The Effect of Board Independence on Firm Performance —New Evidence from Product Market Conditions*

Xiaoyuan Hu[1†], Danmo Lin[2‡] and Onur Kemal Tosun[3§]

Abstract

We study the effect of corporate board independence on firm performance under different product market conditions. Using customer-supplier links to identify exogenous downstream demand shocks, we find that firm performance is positively associated with board independence when the firm-specific product demand drops. The results are stronger for smaller firms and firms with high growth and more volatile stock returns. The findings prevail if the firm faces a medium level of product market competition or a medium level of downstream demand shock. We provide suggestive evidence for the board's monitoring function driving the effectiveness of board independence in bad times of idiosyncratic risks, rather than its advisory function.

Keywords: *Board independence; firm performance; customer-supplier link; downstream demand shocks; product market competition*

JEL Classification: *C33, C36, G30, G32, L14, L22*

*We thank Professor Chris Adcock (the Editor), two anonymous reviewers, Katie Moon, Murillo Campello, Giorgo Sertsios, Gustavo Manso, Vojislav Maksimovic, Ilona Babenko, Sarah Wang, Margarita Tsoutoura, Jian Feng, Constantinos Antoniou, and participants at the University of Warwick Seminar, 2018 Financial Management European Conference, 2018 Financial Management Asia-Pacific Conference, 30th Asian Finance Association Annual Meeting 2018, 2018 Financial Management Annual Meeting, and IFABS 2018 Chile Conference for their comments and support. All remaining errors are ours. Declarations of interest: none.

†Cornerstone Research. 1000 El Camino Real, Suite 250, Menlo Park, CA 94025-4327, United States. Email: xhu@cornerstone.com

‡Finance Group at Warwick Business School, University of Warwick, Coventry CV4 7AL, United Kingdom. Email: danmo.lin@wbs.ac.uk

§(corresponding author) Accounting and Finance Group at Cardiff Business School, Cardiff University, Cardiff CF10 3AT, United Kingdom. Email: TosunO@cardiff.ac.uk.

1. Introduction

It is essential for firms to have a well-structured board in order to operate successfully. An article in The Wall Street Journal (February 26, 2018) states:

"[T]he decline of [General Electric Co.] has prompted investors and analysts to question the board's oversight... GE will overhaul its board, removing several of the struggling conglomerate's longest-serving members and nominating three outsiders, including an accounting expert and former top executives... [GE's new CEO and Chairman] Mr. Flannery has said he wants executives and directors to debate and challenge his decisions as part of their regular governance of the company..."

The literature on corporate governance has examined the relationship between board independence and firm performance extensively. However, the findings from previous studies vary from board independence having a positive effect on performance (e.g., Knyazeva et al., 2013; Liu et al., 2015; Appel et al., 2016) to board independence having a negative effect (e.g., Holmstrom and Kaplan, 2003; Bhagat and Bolton, 2008; Cavaco et al., 2017) to statistically insignificant or dependent correlations between the two (e.g., Bhagat and Black, 2002; Hermalin and Weisbach, 2003; Fields and Keys, 2003; Wintoki et al., 2012; Kanatas and Qi, 2012). Unlike any of these studies, we focus on a setting with various product market conditions to provide clarifications on the relationship from a new perspective. Specifically, we examine whether the association of board independence with firm performance depends on product market demands. To do so, we compare the relation between board independence and firm performance (1) when firm-specific product market demands drop unexpectedly versus (2) during periods of time with non-changing or improving product market demands.[1]

Product market dynamics are shown to be crucial in determining firm performance. Such dynamics include product market competition (e.g., Chhaochharia et al., 2016; Dasgupta et al., 2018; Singla and Singh, 2019), export market entry (e.g., Fabling and Sanderson, 2013), product innovation (e.g., Tung, 2012; Lu and Wang, 2018), product portfolios and the diversification (e.g., Hitt et al., 1997; Randall and Ulrich, 2001; Rothaermel et al., 2006), markets' perception on product quality (e.g., Bardos et al., 2020), demand uncertainty (e.g., Allen et al., 2015), among others. Product market demand, with its first order importance, made it to the list more than a hundred years ago in the classic models of Cournot or Bertrand competition, if not earlier. Among the different kinds of product market dynamics, the literature on corporate governance has mainly focused on the dynamics of product market competition (e.g., Giroud and Mueller, 2011; Dasgupta et al., 2018), probably because competition is regarded

[1]Board independence is important and relevant to study firms' responses when demand conditions deteriorate. For example, compared to the other provisions of Sarbanes–Oxley Act (SOX) of 2002, board independence is directly associated with the main structure of the board that is primarily responsible to ensure good corporate governance in firms. Moreover, the regulation of board independence is the most adopted rule in other countries to improve corporate governance overall.

exogenous to firms or the result of market equilibrium. These studies find evidence that market competition and corporate governance work as substitutes in mitigating managerial agency problems. Although some similarity can be drawn between increased product market competition and reduced product demand, it is not obvious or correct to assume that a worsening demand condition should have the same impact on the effectiveness of corporate governance as a more fierce competition.

In this paper, we investigate the overlooked angle of product market demand condition in the study of corporate governance, and examine whether any association between board independence and firm performance is stronger or weaker during demand downturns. We argue that from a theory perspective it is unclear how product market conditions influence the need and effectiveness of outside directors considering monitoring and advisory functions.[2] First, changing product market conditions can affect the need for monitoring by outside directors. On the one hand, a negative demand shock can shift the potential outcomes of any managerial decisions downwards, from potential gains to potential loses defined by a reference point. Prospect theory, proposed in Kahneman and Tversky (1979), suggests that individuals have tendencies toward risk aversion when facing gains and toward risk seeking when facing losses.[3] The resulting misalignment of managerial incentives on picking risky projects and shareholder values can increase the need for monitoring from independent directors. Meanwhile, the deterioration of product market conditions can lead to lower firm profits. Consequently, the value of managerial efforts to bring down production costs may fall, leading to managers shirking at their jobs (Raith, 2003), intensifying agency problems, and making monitoring more important. On the other hand, reduced demand creates less room for managers to consume private benefits, making self-dealing (Djankov et al., 2008) or tunnelling (Johnson et al., 2000) more difficult. The pressure to survive can also motivate managers to work harder (Schmidt, 1997). Both effects can reduce the need for board monitoring. Second, regarding the advisory function, expert advice from outside directors with management and financing expertise in the event of product market disruptions may help firms recover from adverse shocks along the supply chain (e.g., Fich, 2005). However, it is also plausible that reduced demand restricts the set of corporate strategies that outside directors can provide their advice on, and thus dampening the advisory roles of outside directors. Given the ambiguity of theory predictions, whether board independence should be more or less effective during demand downturn remains an empirical question.

We show, as our main result, that board independence is positively associated with firm performance after a negative downstream demand shock. The effect is statistically and economically significant, and it is much stronger

[2]See, for example, Weisbach (1988), Harris and Raviv (2008), Brickley et al. (1994), Adams and Ferreira (2007), Knyazeva et al. (2013), Klein (1998), Faleye et al. (2011), and Baldenius et al. (2014) for general discussions on the two main role of outside directors.

[3]Under prospect theory, people underweight the outcome that are merely probably in comparison with the outcome that are obtained with certainty, contributing to the risk aversion in choices involving sure gains and to risk seeking in choices involving sure losses. In addition, an individual is more sensitive to loses than to gains due to loss aversion.

than when the demand does not decline. Controlling for firm characteristics and fixed effects, a one-standard deviation increase in lagged board independence is associated with an additional 0.77% increase in Return on Assets (ROA) after negative demand shocks, as compared to other times. The magnitude is approximately 31% of the sample mean of ROA. The same shift in board structure is associated with a 3.3% increase in Return on Equity (ROE) compared to the sample mean of 3.8%, and a 1.0% increase in sales growth compared to the sample mean of 0.08%. In the absence of negative demand shocks, we do not find such a positive link between board independence and firm performance.

To address the empirical challenge that product demand and firm performance may be simultaneously determined, we exploit exogenous downstream demand shocks in the context of supplier-customer links. The idea is that a supplier firm faces an exogenous demand shock when its customer firms' downstream demand falls. To implement this idea, we start with a comprehensive sample of 3,440 supplier-customer-year observations with available financial and board information during the period 1997–2016, using data from Compustat Customer Segment Files, Compustat, and BoardEx. We then use the input-output table from the Bureau of Economic Analysis (BEA) to find all the downstream industries of a customer company's industry, and construct a weighted average demand of those industries. For a supplier firm in a given year, if its customer firms' downstream demand is less than what the industry and year fixed effects predict, then it is classified as a declining time in the product market for the supplier firm. By using the customer firms as the intermediators between the supplier firms and the downstream industries, we ensure that our demand shocks to the supplier firms are exogenous. In addition, unlike the economy-wide shocks (such as recession years defined by the National Bureau of Economic Research (NBER)) or industry-specific demand shocks used in the literature (e.g., Mitchell and Mulherin, 1996; Fresard, 2010; Benmelech and Bergman, 2011), our focus on firm-specific demand shocks gives us more variations on product market conditions across different firm-year observations. Moreover, our measure of the demand shock captures idiosyncratic risks better: firms in the same industry can be subject to different product demand conditions, while firms in different industries can face the same demand conditions.

We employ two identification methods to mitigate the endogeneity concern associated with board independence in our setting. First, we adopt an instrumental variables (IV) approach following Duchin et al. (2010), and use a firm's non-compliance status of a fully independent audit committee in 2000 as an instrument variable for board independence. We try to address the concerns raised regarding this approach (e.g., Atanasov and Black, 2017) by focusing on a smaller sample of firms with similar board independence ex-ante. Second, we use director deaths and retirement as exogenous shocks to board composition (as in e.g., Fracassi and Tate, 2012; Chang and Wu, 2021) and estimate a Difference-in-difference-in-differences (DDD) model. Similar results to main findings provide

evidence for causal relation between higher board independence and firm performance during deteriorated market conditions.

We then explore the key channel(s) through which board independence is linked to performance when downstream demand drops. We examine the board's advising function through board connection to related firms, and via providing wisdom and guidance in gaining new customers and the board's monitoring functions through mitigating managerial entrenchment and agency problems. We obtain the following results. First, board connection to the customer company's industry does not explain the performance improvement associated with higher board independence in bad times. Second, the positive effect of board independence on sales growth is not driven by business expansion to new customers, but by increasing sales growth to existing customers who are unaffected by the shock. Third, the effectiveness of board independence on improving firm performance is most significant for firms with high levels of free cash flows, lagged discretionary accruals, and G-index, all of which are related to a higher degree of agency problems. We interpret the first and second findings as insufficient evidence that a board's advisory function drives our main result, and the third one as suggestive evidence for a board's effective monitoring in bad times being the main channel. We also study whether corporate investment and innovation could be other channels leading to improved firm performance, and we obtain no significant evidence supporting this claim.

We examine further how the positive effect of board independence in bad times differs across firms. We find that the effect on the supplier firms is stronger when their customer companies are less resilient to demand shocks and more likely to pass the shocks onto the suppliers. In addition, we find that the effect is stronger when a firm is small, experiences a high growth rate, and operates with high risk, all of which are related to a more constrained environment. Interestingly, the benefit of having an independent board during negative demand shocks is largest when the firm faces a medium level of product market competition. This hump-shaped effect of competition is consistent with predictions of existing theoretical models. When competition among supplier firms decreases from the medium to the low level, the bargaining power of a particular supplier firm against its customers becomes stronger (e.g., Scherer and Ross, 1990; Holmstrom and Roberts, 1998). Therefore, the supplier firm's performance is less vulnerable to its customers' demand shock, which makes the board independence less effective. When competition increases from a medium level to a high level, fierce competition may act as a substitute for corporate governance in improving performance (e.g., Schmidt, 1997; Raith, 2003) and thus board independence is not perceived as effective. Overall, results from these sub-sample analyses are consistent with the idea that outside board members play an active role with their monitoring duties to improve firm performance while product market conditions deteriorate. We also conduct a battery of further analyses, including a dynamic GMM regression analysis, a test on excess firm performance, a cross-sectional logistics test, exclusion of the

crisis period, examination of the top three industries in the sample, the effect of CNDS through control variables, alternative measures of board structure, CEO skills, and information acquisition cost.

Our paper contributes to several strands of literature. First, it speaks to the debate in literature on when outside directors matter and why (e.g., Duchin et al., 2010; Faleye et al., 2011; Fracassi and Tate, 2012; Francis et al., 2012; Knyazeva et al., 2013; Liu et al., 2015; Lu and Wang, 2015; Lu and Wang, 2018; Singla and Singh, 2019). We push this research forward by providing evidence that board independence enhances performance when product market demand declines unexpectedly, during which monitoring may become more critical than advising.

Second, our findings also contribute to the recent literature that examines how customer-supplier relationships impact suppliers regarding their corporate policies (e.g., Kale and Shahrur, 2007; Banerjee et al., 2008; Dass et al., 2014; Itzkowitz, 2013; Wang, 2012; Johnson et al., 2015; Campello and Gao, 2017) and on their performance and valuation (e.g., Bhattacharyya and Nain, 2011; Patatoukas, 2011; Cen et al., 2015; Irvine et al., 2015; Dhaliwal et al., 2016; Intintoli et al., 2017). We use the finding from this literature that idiosyncratic shocks propagate in supplier-customer networks (e.g., Cohen and Frazzini, 2008; Barrot and Sauvagnat, 2016) to construct our measure of product market conditions via the customer-supplier link. Our study adds to this literature by showing the impact of the supplier firms' product market condition through the customer-supplier link is affected by board independence, a potential channel overlooked by this literature.

Third, our study relates to the existing work on the importance of corporate governance in different economic conditions. Li and Li (2016) find that strong corporate governance increases the cost of equity during economic busts, due to the valuable divestiture options held by firms with strong governance. Francis et al. (2012) show that the positive impact of outside financial experts on firm performance is more significant than that of strong independence during financial crisis. Han et al. (2016) show the firms with powerful CEOs perform worse in industrial downturns because of the change in the quality of information needed for the CEOs to make efficient decisions. The novelty of our study is that we focus on the role of board structure during various firm-specific product market conditions and we find, on the contrary, that board independence is more important when firms face negative idiosyncratic risks.

Fourth, this study contributes to our understanding of the interaction between market competition and corporate governance. We uncover two interesting non-linearities: the effect of board independence is observed mainly when (1) the idiosyncratic risk is at a medium level of severity; or/and for (2) the subsample of firm with medium levels of industry product market competition as measured by the Herfindahl Hirschman Index (HHI). The second non-linearity is a combination of the substitution effect between the product market competition and board independence in disciplining managers and improving operating performance (as in e.g., Giroud and Mueller, 2010;

Chhaochharia et al., 2016) in a highly competitive market, and a strong bargaining power of a supplier firm against its customer when the supplier is a powerful market player.

There are a few possible practical implications of our study. Firstly, firms can rely on the findings of our study while restructuring their boards. Provided the positive association of board independence to firm performance in bad times, they may consider hiring more outsiders as directors when product market conditions deteriorate, especially if the firm operates in an industry with a medium level of competition. Moreover, following a negative shock, the monitoring role of the board seems to be, on average, more critical than the advisory role. Thus, a board can put more emphasis on its monitoring function when demand drops.

The paper proceeds as follows. Section 2 describes our data collection procedure and the construction of the main variables. Section 3 specifies our regression methodology, reports the main results. Section 4 discusses causal inferences of the identified effect of board independence. Section 5 explores the main channel for the key findings. Section 6 includes further analyses and robustness tests. Section 7 concludes.

2. Data

2.1. Sample construction

Our sample consists of US public firms during the period 1997–2016 with available information on firms' relationships with US public customer companies, financial data from Compustat, and board data from the Institutional Shareholder Services (ISS) database (formerly RiskMetrics).

Following previous literature (e.g., Cohen and Frazzini, 2008; Cen et al., 2017), we identify supplier-customer links using Compustat Customer Segment Files. Since 1976, the Statement of Financial Accounting Standards No. 14 (SFAS 14) of the Financial Accounting Standard Board (FASB) has required firms to report principal customers representing over 10% of total sales. It is difficult if not impossible to supplement the data on customers contributing to less than 10% of suppliers sales, so our study captures the most important downstream demand shocks to the suppliers but by no means we can give a complete description of the supplier's demand condition. In 1997, SFAS 14 was superseded by FAS 131. As a result of the change in disclosure rules, some firms restated their segment information, but the requirement to report the principal customers remained intact for public companies under SEC Regulation S-K Item 101. We restrict our sample to the post-1997 period to mitigate potential biases introduced by the 1997 change in disclosure requirements.[4] In each year, firms are required to report the names of their principal customers and the amount of sales to each of them. Customer names are mapped to Compustat

[4]The downstream demand conditions that are transmitted from the principal customers to the dependent suppliers are arguably most relevant to identify the negative demand shocks to the supplier firms. Our main results are robust to the exclusion of voluntarily reported customers below the 10% sales threshold.

Gvkey identifiers through a text algorithm combined with manual checks. This procedure allows us to identify whether the customer is also listed in Compustat, and to track changes in sales to different customers.[5]

In our sample, we retain all supplier-customer pairs where both parties are US public firms over the period 1997–2016. Our main sample consists of 3440 supplier-customer pair-year observations with available financial data and board data. There are 565 unique supplier firms and 453 unique customer firms. Some suppliers supply to more than one customer and some customers source from more than one supplier. The median customer in our sample has 12 suppliers. The median supplier in our sample only supplies to two customers.[6] In one-tenth of the supplier-customer pair sample, supplier firms are the only source for their customer companies, whereas customer companies are the only buyer for their suppliers in one-third of the sample. In robustness analyses, we restrict our sample to supplier-customer pairs in which the customer purchases the largest share of a firm's output among all the firm's customer companies. This allows us to uniquely identify observations by supplier firm and year, and thus mitigates potential noises from suppliers' outside options.

According to the 49-industry classification defined by Fama and French (1997), supplier firms in our sample mainly belong to the following sectors: Electronic Equipment sector (15.4%), Pharmaceutical Products (12.9%), Petroleum and Natural Gas (7.5%), Business Services (6.0%) and Computer Software (5.5%). In addition, customer firms generally operate in the following sectors: Retail (21.0%), Wholesale (15.1%), Communication (8.8%), Electronic Equipment (8.5%) and Petroleum and Natural Gas (7.1%). In our regression analyses, we use 4-digit SIC industry classifications to compute customer companies' downstream industry demand.

2.2. Variable descriptions

2.2.1. Product market conditions

One of our key independent variables is *CNDS*, which captures exogenous variations of a supplier firm's product market conditions by its customers' downstream demand. The idea is that a supplier firm faces a negative shock when its customer companies' downstream demand is reduced. Specifically, we use the following four steps to construct this variable with Figure 1 provided as an illustration.

[Insert Figure 1 here.]

[5] We thank Lauren Cohen for sharing the correspondences between customer names and the CRSP Permno identifiers they used in Cohen and Frazzini (2008), and we thank Ling Cen for sharing the link table of principal customers and dependent suppliers (described in e.g., Cen et al., 2017 and Cen et al., 2018).

[6] One potential reason why suppliers are generally smaller than customers in our sample is that supplier-customer links are reported by suppliers. The Compustat Customer Segment Files do not include links in which the supplier is very large in size but supplies to customers below the 10% threshold.

Step I: Identify a supplier firm's customer companies using the Compustat Customer Segment Files. For example, *Supplier 1* supplies to *Customer A* in Figure 1.

Step II: Map a given customer firm's industry to its downstream industries using the input-output table from the BEA. We first use the input-output table from the U.S. Department of Commerce's BEA to identify downstream industries that consist of publicly listed companies. Then we use the 2002 standard input-output tables, following Moon and Phillips (2021). The raw data are at the commodity-code level. We aggregate these data to the NAICS-code level using correspondence tables from the BEA. Industry is defined by NAICS codes in the BEA data. In addition, we account for three broadly-defined downstream sectors: the government sector, the private sector and the foreign sector. We identify these sectors using other databases from the BEA. In Figure 1, *Customer A*'s industry supplies to 10 NAICS industries that consist of publicly listed companies (*Industry 1* to *Industry 10*), the *Government* sector, the *Private* sector, and the *Foreign* sector.

Step III: Obtain the weighted average downstream demand for each customer firm's industry. To do so, we first calculate the demand for each downstream industry in any given year.[7] Then, for each customer NAICS industry, we compute a weighted average value of that industry's downstream industry demand.[8] The weights are equal to the share of total output value from the NAICS industry given in the BEA's input-output table. In Figure 1, we compute weighted average downstream demand for *Customer A*'s NAICS industry.

Step IV: Calculate the detrended percentage change in a given customer firm's downstream industry demand. To detrend, we regress the weighted average value of downstream industry demand on industry and year fixed effects, and we take the residuals from the regression. The residual represents the detrended percentage change in downstream industry demand. Then we match these data to each customer company's 4-digit SIC industry using correspondences between NAICS codes and SIC codes. We assign one to the indicator for the customer's negative demand shock (*CNDS*) if the detrended percentage change is negative, and zero otherwise. In Figure 1, *Supplier 1* will have a $CNDS = 1$ if the detrended percentage change in *Customer A*'s downstream industry demand is negative.[9]

Using CNDS as a measure for product market conditions has two clear advantages compared to some other candidates in the literature. First, it is arguably exogenous to the supplier firm. By using the output from the downstream of a firm's customer companies, this measure mitigates the concern that changes in supplier firm

[7]The demand for the public industries is measured by the quantity indices for gross output by industry from the BEA. In addition, we use the BEA's government expenditures and investment indices, personal consumption and investment indices, and exports and imports indices to account for downstream demand from government, private, and foreign sectors that are not covered by the quantity indices.

[8]We thank Katie Moon for generously sharing the data of unanticipated demand shocks at the 3-digit NAICS code level, with details explained in Moon and Phillips (2021).

[9]Figure A.1 in the Appendix provides insight on the magnitude and distribution of detrended percentage change in downstream demand.

performance may simultaneously affect the demand for customer companies' products.[10] One concern is that supplier firms may be able to avoid demand shocks by acquiring or renegotiating with customers. However, supplier firms in our sample are on average much smaller in firm size than their customers, so it is less likely that they have the capacity to acquire or bargain against their customers.

Second, unlike industry-level proxies for product market conditions, our measure of demand shock captures firm-level variations in product market conditions and it is uniquely defined by customer-supplier links. The following two aspects illustrate the uniqueness of our measure. First, supplier firms that belong to different industries may be subject to the same demand shock if they supply to the same customer. For example, consider the customer-supplier links between Intel Corporation and its suppliers. Intel experienced a sudden reduction in demand from its downstream industries in 2003. At the same time, both LightPath Technologies Inc. and CollabRx Inc. supplied to Intel. LightPath Technologies Inc. is a leading manufacturer of optical instruments. CollabRx Inc. is a company that offers cloud-based data services. These two supplier firms are from two different industries, but they are subject to the same demand shock originated from Intel. Second, supplier firms operating in the same industry that supply to different customers may be affected differently. For instance, consider Perceptron Inc., which is a manufacturer of optical instruments. Perceptron is in the same industry as LightPath Technologies Inc., but it supplied to Ford Motor Corporation instead of Intel in 2003. Unlike Intel, Ford did not face a sudden deterioration of demand in 2003. Thus, unlike LightPath, Perceptron did not experience a negative demand shock.

Furthermore, to address the concern that board independence may change at the same time around the demand shock, we compare the change in board independence around the demand shock with the change in board independence based on the full sample. We found that the mean value of annual absolute percentage change in board independence based on the full sample (8.5%) is close to the mean value based on the subsample around the demand shock, i.e., from one year prior to the demand shock through one year after the demand shock (8.3%). The distribution of the annual absolute percentage change in board independence based on the full sample is also similar to the distribution around the demand shock.

2.2.2. Dependent variables

We focus on three main measures for firm performance: *ROA* is net income divided by total assets; *ROE* is income before extraordinary items divided by total common equity; and *Sales Growth* is annual sales growth rate (%)

[10] See Maksimovic and Phillips (2001) and Moon and Phillips (2021) for further discussion on this measure. In our sample, CNDS has a correlation of 0.48 with a measure constructed based on the output from the downstream of a firm itself, thus captures different variations in a firm's demand conditions than a direct shock measure such as the one used in Li et al., 2019.

times 100 divided by total assets. These measures capture different aspects of firm performance.[11] Return on assets accounts for all expenses and income, and it captures the general profitability of a firm relative to its total assets. Alternatively, return on equity measures the profitability relative to total common equity. Sales growth assesses sales performance and growth potential. *Tobin's Q* (computed as market-to-book ratio) and *Earnings Ratio* (computed as EBITDA divided by total assets) are used in robustness checks.

2.2.3. Board structure and control variables

In our main analysis, board structure is measured by board independence, defined as the fraction of outside directors on the board. We also consider the independence of key committees as alternative measures of board structure.

We control for a group of firm characteristics[12] that may affect firm performance, including firm size (*Total Assets*); the fraction of capital expenditures among total assets (*Growth*); the fraction of cash among total assets (*Cash Ratio*); total liabilities divided by total assets (*Leverage*); and the standard deviations of daily stock returns (*Stock Volatility*). In addition, we include product market competition[13] and board characteristics[14] as measures for other governance mechanisms. We control for the Herfindahl-Hirschman Index of sales for firms in a 4-digit SIC industry that supply to the same customer firm (*SHHI*), the number of directors on the board (*Board Size*), the percentage of common shares held by board members (*Board Ownership*), whether more than half of the directors on the board sits on more than two outside firms' boards (*Busy Board*), and whether the CEO is the chair of the board (*CEO Duality*). In untabulated tables, our results are robust to using additional control variables for CEO compensation, e.g., total CEO pay and CEO delta.

All continuous variables are winsorized at the 1% level. Detailed definitions are presented in Table A.I of the Appendix. Table I presents summary statistics for supplier firms while Table IA.I in the Internet Appendix gives statistics for customer firms in the sample. Compared to the median customer firm, the median supplier firm is much smaller, maintains a lower leverage ratio, and is similar in terms of board independence and board size. In an untabulated analysis, we show that the median supplier firm in our sample has a similar firm size to the median out-of-sample Compustat firm.

[11] In an untabulated table, we find low pairwise correlations among these measures, which confirms that these measures contain different information.

[12] The literature on firm performance suggests that larger growth firms with high leverage and cash ratio have access to more resources (e.g., cash) to help them operate better and improve firm performance while high levels of volatility, growth and leverage increase firm risk and probability of financial distress, affecting firm performance negatively (e.g., Bhagat and Bolton, 2008; Lefort and Urzúa, 2008; Liu et al., 2015; Wintoki et al., 2012; Tosun, 2021).

[13] A group of existing studies shows that product market competition can influence firm performance because it drives down product prices and profits, but also motivates managers to improve productivity in order to avoid liquidation or steal demand from rivals (e.g., Schmidt, 1997; Raith, 2003; Giroud and Mueller, 2010).

[14] The corporate governance literature documents the effects of board size, composition, director incentives, and busy directors on corporate monitoring effectiveness in various ways (e.g., Yermack, 1996; Hermalin and Weisbach, 1998; Ferris et al., 2003).

[Insert Table I here.]

3. Empirical methodology and main results

3.1. Univariate analysis

As an initial step, we examine how firm performance is linked to different levels of demand conditions for firms with the high versus low board independence. We select the observations with the highest or the lowest quartiles of board independence, and then within each of these two groups, we calculate the average values of ROA, ROE, and sales growth for each deciles of demand shocks. Figure A.2 in the Appendix show the distribution of firm performance over the deciles of demand conditions, for firms with high board independence in Panel A and low board independence in Pane B. Interestingly, Panel A shows that firms with high board independence perform better when they are hit by more severe product market demand shock. The positive association between board independence and firm performance weakens as the product market condition improves. On the contrary, in Panel B, ROA, ROE, and sales growth fluctuate around similar levels throughout different product market conditions when board independence is in the lowest quartile. This implies that the relatively high firm performance during negative demand condition is evident only when board independence is high, and this relation does not hold fully for firms with lower board independence.

Overall, this exercise provides some evidence that firms may benefit from more independent board structure in adverse product market conditions. However, this analysis does not allow us to control for firm characteristics and unobserved heterogeneity that may affect firm performance, so we conduct regression analyses in later sections to draw further inferences on the relation between firm performance and board structure.

3.2. Main regression analysis

We examine the relation between a supplier firm's board independence and firm performance when it experiences a negative demand shock through the supplier-customer relationship, versus when such a negative shock is absent. We use the following regression specification on all of our supplier-customer-year observations:[15]

$$\begin{aligned} \textit{Supplier Firm Performance}_{ict} = {} & \alpha_t + \beta_{ic} + \gamma_1 \textit{CNDS}_{ict-1} + \gamma_2 \textit{Board Independence}_{it-1} \\ & + \gamma_3 \textit{CNDS}_{ict-1} \times \textit{Board Independence}_{it-1} + \delta \textit{Controls}_{it-1} + \varepsilon_{ict}, \end{aligned} \tag{1}$$

where i indexes supplier firm, c indexes customer firm, and t indexes year. $CNDS_{ict-1}$ is an indicator that equals one if the customer company c of the supplier firm i experienced a negative downstream demand shock in the

[15] Some supplier firms in our sample have multiple customers in a given year. We pool the data across customers for a given supplier and estimate the average effect of board independence on supplier firm performance.

previous year, i.e., when the annual detrended percentage change in the customer company's downstream industry demand was negative; $Board\ Independence_{it-1}$ is the fraction of outside directors on the board of supplier firm i in the previous year; $Controls_{it-1}$ is a vector of control variables for supplier firm i in the previous year; α_t and β_{ic} are year and supplier-customer pair fixed effects that account for unobserved heterogeneity across time and supplier-customer pairs. In order to mitigate the concern that firm performance, board independence and other firm characteristics may be simultaneously determined, we lag right-hand-side variables by one year. The main variable of interest is γ_3, which is the interaction term between negative demand shock and board independence.[16]

Table II presents the results for ROA, ROE, and sales growth. They support the idea that higher firm performance is associated with higher board independence when the product market shrinks, as compared to other times. In all specifications, the coefficient estimates for lagged demand shock alone are negative and significant. These results suggest that, without considering the effect of board independence, a negative demand shock leads to worse firm performance. This finding validates our measure of product market conditions. After a demand shock, an average firm experiences a drop in ROA, ROE and sales growth by 2.8%, 14%, and 3.7% respectively. In addition, the coefficient estimates for lagged board independence are negative and in general insignificant, which suggests that board independence does not contribute to better performance in the absence of demand shocks. This is in line with the literature suggesting "no relation" between performance and board independence. Importantly, the coefficient estimates for interaction between demand shock and board independence are positive and significant at 1%–5% levels in all specifications. These findings indicate that board independence alleviates the decline in firm performance due to negative demand shocks. As a result, firms with a more independent board outperform firms with a less independent board in the event of a negative demand shock. The results are also economically significant. A one-standard-deviation increase in lagged board independence is associated with a 0.77% increase in ROA after negative demand shocks ($= 0.053 \times 0.146$), which is approximately 31% of the sample mean of ROA (0.025). The same change in board independence is associated with a 3.3% increase in ROE ($= 0.223 \times 0.146$), which is approximately 86% of the sample mean of ROE (0.038). The associated increase in sales growth is 1.0%, compared with its sample mean of 0.8%. Consider the interpretation of the magnitude with an average firm that has nine board members, and seven of them are independent directors. Switching one of the non-independent directors to independent would be associated with a 0.6% increase in ROA ($= 0.053 \times (8/9 - 7/9)$) when the firm faces an adverse demand shock. In untabulated robustness checks, we also control for lagged dependent variables, as well as, for CEO pay-for-performance sensitivity (CEO delta), risk-taking incentives (CEO vega), and CEO pay

[16] Since we focus on demand shocks that affect supplier firms through affecting customer firms, clustering standard errors at the supplier-customer pair level may address potential spatial correlations across observations. In untabulated robustness checks, we cluster standard errors at the supplier-customer pair level and obtain similar results.

structure (ratio of performance-based pay to total CEO pay). We obtain robust results.

[Insert Table II here.]

There are various ways through which independent board members improve firm performance during a negative shock. They can monitor managers closely during bad times to see if they make decisions to gain private benefits —for example, to commit a fire sale of the assets. They can also advise on how to expand the firm's customer base and how to differentiate its products from competitors, or they can make decisions on whether to consider a potential acquisition offer, or hire a manager who has more expertise in marketing. In Section 5.1. and Section 5.2., we provide more direct evidence on the mechanism.

4. Attempts for causal inferences

4.1. An instrumental variable approach

It is very challenging to have a bullet-proof empirical design to claim causality when it comes to the relation between governance and firm performance. Thus, without making any strong claims, we attempt to address the issue that board independence and firm performance may be simultaneously determined, and use a similar instrumental variable approach to Duchin et al. (2010). Specifically, we exploit an exogenous change in board structure brought by the regulatory requirement of a fully independent audit committee. Since December 1999, there has been a series of regulatory changes, including the SEC rules concerning NYSE and NASDAQ listings and SOX. These new rules on governance structure require corporate audit committees to consist of entirely outside directors.[17] As a result, non-compliant firms were forced to increase the percentage of outside directors on their audit committee. This leads to an exogenous increase in audit committee independence. Firms that did not need to comply with the requirement of audit committee full independence prior to 2000 should have a strong governance structure. Hence, it is more likely that those firms already satisfied the requirement on board independence from 2003, and they did not need to comply with that rule. Thus, we can use audit committee full independence as an instrument for board independence. Moreover, it is unlikely that the percentage of outside members in the audit committee affects the performance of the entire firm directly. Hence, we believe that the exclusion restriction for this instrument is likely to be satisfied.

To construct our instrumental variables, we first construct an indicator for non-complaint firms, i.e., an indicator that equals one if a firm did not have a fully independent audit committee in 2000, which is defined in the same way as in Duchin et al. (2010). We take into consideration the concerns raised in Atanasov and Black (2017)

[17] See Duchin et al. (2010) for a detailed description of these regulations.

and Phillips and Sertsios (2016) regarding the DMO instrumental variable model, and we incorporate applicable suggestions in our model.[18] First, we add a separate first stage regression model to estimate the instrumented value for the interaction between demand shock and board independence, similar to Atanasov and Black (2017). Second, following Atanasov and Black (2017), we estimate the regressions over the "common support" of the data, i.e., a subsample in which compliant firms and non-complaint firms have overlapping values of board independence. This restricts our sample to firms with board independence ranging between 40% and 80% in 2000. Finally, to address the possibility that our results could be driven by time-variant unobserved heterogeneity in firm characteristics following the audit committee regulatory changes, we use as instruments the interaction of the indicator for non-complaint firms in 2000 with demand shock and also the interaction between the indicator for non-complaint firms and time-varying firm characteristics, following the approach used by Phillips and Sertsios (2016).[19]

We estimate the following panel regressions: In the first stage, we conduct two regressions. First, we regress board independence on the interaction of an indicator for non-complaint firms with our demand shock indicator, the interaction of the indicator for non-complaint firms with time-varying firm characteristics, the demand shock indicator, and the control variables used in our main analysis. Second, we regress the interaction term between the demand shock indicator and board independence on the same set of explanatory variables. In the second stage, we regress firm performance on a demand shock indicator, the instrumented board independence, the instrumented interaction term between the demand shock indicator and board independence, and control variables. Similar to our previous analyses, we include year fixed effects and supplier-customer pair fixed effects in both stages.

Columns 1 to 2 of Table III present the first-stage results. For both first-stage models, the interaction of the indicator for non-complaint firms with *Growth* is the strongest instrument, which has a positive and significant coefficient estimate. To illustrate the intuition for this result, consider the board independence first stage. The positive coefficient suggests that, while firms that did not comply with the requirement of a fully independent audit committee tend to have a lower level of board independence, this effect is moderated if a firm has a higher growth rate.[20] Columns 3 to 5 summarize the second-stage results. In all specifications, the coefficient estimates

[18] See Atanasov and Black (2017) and Phillips and Sertsios (2016) for a detailed description of these concerns.

[19] Since the non-complaint status in 2000 is time-invariant for each firm and we control for supplier-customer pair fixed effects, we do not include this instrument in our analysis, similar to Phillips and Sertsios (2016). Furthermore, the interactions of the indicator for non-complaint firms with time-varying firm characteristics likely satisfy the exclusion restriction, as the non-complaint status in 2000 is time-invariant and unlikely to have a direct effect on yearly firm characteristics once controlling for year fixed effects. Following Duchin et al. (2010), our sample period for the IV analysis is 2000–2005. Our the initial sample has 808 observations. Following the suggestion in Atanasov and Black (2017) to limit firms to those with board independence in the "common support range" for reasonable overlap between treated and control firms on all covariates, our sample reduces to 441 observations. The common support of board independence in our sample is between 40% and 80% in 2000.

[20] In an untabulated table, we use the indicator for non-complaint firms and its interaction with the demand shock indicator as instruments, i.e., using a similar specification as in Atanasov and Black (2017) without addressing the time-varying unobserved heterogeneity concern raised by Phillips and Sertsios (2016). We find that the coefficient on the indicator for non-complaint firms is negative for the board independence first stage. This result is consistent with the idea that non-compliant companies may not have a strong governance structure

for interaction terms remain consistently positive and significant. For the average firm, a one-standard-deviation increase in lagged instrumented board independence is associated with a 1.1% jump in ROA after negative demand shocks ($= 0.141 \times 0.08$, which is the sample standard deviation of instrumented board independence). Moreover, the increase in ROE and sales growth is 3.7% ($= 0.463 \times 0.08$) and 1.2% respectively, subsequent to negative demand shocks.

[Insert Table III here.]

Our instrument set is not subject to the issues of weak instruments, under-identification, or over-identification. To address these issues, we first conduct Cragg-Donald's Wald F-test for weak instruments and find that our instrument passes the weak instrument test at the 5% significance level (according to the Stock-Yogo critical F-statistic value of 5.45). Second, we perform Anderson's canonical correlation *Chi*-square test for under-identification and find that the *Chi*-square value is statistically significant at the 1% level, which suggests that canonical correlation is different from zero and under-identification is not an issue in our analyses. Finally, we obtain insignificant Hansen J statistics which suggests that the null hypothesis that over-identification restrictions are valid cannot be rejected and that our instrument set is appropriate.

4.2. A difference-in-difference-in-differences (DDD) approach

As another attempt to check the causal link between board independence and firm performance under negative demand shock, we consider a possible exogenous shock to board composition that we can use in a difference-in-differences setting. Inspired by Fracassi and Tate (2012) and Chang and Wu (2021), we use director deaths and retirements as unanticipated events for boards of directors. Relying on data from BoardEx, we identify the occasions satisfying two conditions: (1) a member of the board dies and/or retires from the director position, and (2) the event leads to an exogenous increase in board independence. A director death/retirement by itself may not necessarily impact the board composition if the same position is filled by a director of the same type. Having both conditions ensures the exogeneity and the realization of board independence change. We implement an event study where we focus on +/- 3-year period around each event, following Fracassi and Tate (2012) and Chang and Wu (2021). We define *Post* as a dummy variable that equals one for the 3-year post-event period for an increase in board independence due to a director death or retirement in a particular firm, and zero for no such changes in the same 3-year pre-event period. Then, we construct a triple difference (DDD) model where the main explanatory variable, i.e., *CNDS* $\times$ *Board Independence* $\times$ *Post*, proxies for board independence increase due to director death/retirement during a negative demand shock. The estimation of the coefficient on this variable helps

and, hence, it is more likely that they also have fewer outside members in the board. We also find robust second-stage results.

to capture the casual relation between higher board independence due to an exogenous shock and firm performance during deteriorated market conditions. The full model specification is the following:

$$\begin{aligned} \textit{Supplier Firm Performance}_{ict} = {} & \alpha_t + \beta_{ic} + \gamma_1 \textit{CNDS}_{ict-1} \times \textit{Board Independence}_{it-1} \times \textit{Post}_{it-1} \\ & + \gamma_2 \textit{CNDS}_{ict-1} \times \textit{Board Independence}_{it-1} + \gamma_3 \textit{CNDS}_{ict-1} \times \textit{Post}_{it-1} \\ & + \gamma_4 \textit{Board Independence}_{it-1} \times \textit{Post}_{it-1} + \gamma_5 \textit{Board Independence}_{it-1} \\ & + \gamma_6 \textit{CNDS}_{ict-1} + \delta \textit{Controls}_{it-1} + \varepsilon_{ict} \end{aligned} \tag{2}$$

where i indexes supplier firm, t indexes year; α_t and β_{ic} are year and supplier-customer pair fixed effects. *Post* is not included in the model separately as it is subsumed by the year fixed effects.

Table IV gives the results. Statistically significant and positive results for the triple interaction term support our original findings. Particularly, during a negative demand shock an exogenous increase in board independence due to director death/retirement by one standard deviation leads to a jump in ROA by about 3.75% (= 0.247 $\times$ 0.152). Firms also perform better under same conditions in terms of ROE and sales growth. Specifically, ROE and sales growth increase by 10.50% and 1.06%, respectively, due to a jump in board independence by 15.20% in negative demand conditions. Overall, this exercise through director death/retirement as an exogenous shock to board composition provides suggestive findings for a causal relation between higher board independence and improved firm performance under deteriorated product market conditions.

[Insert Table IV here.]

5. The possible channel(s)

We further investigate which of the two main roles of the board (advisory and monitoring, see e.g., Hermalin and Weisbach, 1988; Harris and Raviv, 2008) explains the effectiveness of board independence on firm performance under deteriorating product market conditions. Distinguishing these two channels completely is impossible, and hence our analyses only provide suggestive evidence pointing to the more likely force behind the main result. In addition, we also study whether corporate investment and innovation could lead to improved firm performance.

5.1. Possible channel I: advisory role of the board

5.1.1. Evidence from board connections

We argue that if the board's advising function becomes more important after negative demand shocks, then we should expect the supplier firms with outside directors that are connected to the customer firm's industry to experience a more positive impact from board independence. A strand of literature examines the benefit of having

connected directors. Cai and Sevilir (2012) and Intintoli et al. (2015) suggest that connected directors may provide superior information on customer industry conditions and help a supplier firm to increase sales to new or existing customers. In addition, connected directors may offer advice on strategic reactions to downstream demand shocks.

We split the sample between supplier firms with and without board connections. Specifically, a board connection is identified as whether an outside director of a supplier firm is also a board member of a company in the customer's industry. Table V presents the results from the subsample tests. In Panel A, the customer's industry is defined by 2-digit SIC codes.[21] In all specifications, the coefficient estimates for the interaction term are significant and positive for the no-connection group. Particularly, a one-standard-deviation increase in lagged board independence for an average firm without board connection is associated with a 0.7%, 3.7% and 1.2% increase in ROA, ROE and sales growth respectively, after negative demand shocks. The estimates are insignificant for the subsample of firms with board connections. The results remain similar when we consider a broader classification of the customer's industry defined by Fama and French (1997) 10-industry classifications in Panel B. Thus, there is no statistically significant evidence that connected outside directors are related to high firm performance after negative demand shocks.

[Insert Table V here.]

5.1.2. Evidence from sales growth decomposition

Next, we consider the possibility that an indirect effect of the board's advising could be captured by increasing sales to new customers when demand drops exogenously. We decompose sales growth into growth of sales to the affected customer, growth of sales to other pre-existing customers, and growth of sales to new customers. We obtain the data on sales to a given customer from Compustat Customer Segment Files. For sales to other pre-existing customers and new customers, we account for not only the major customers identified in Compustat Customer Segment Files, but also other small customers by subtracting sales to a given customer from total sales.

Table VI reports the results. In column 1, the dependent variable is the growth of sales to a given customer. Based on the full sample, the coefficient estimate for interaction term is insignificant. This implies that board independence does not help a supplier firm to boost sales to the customer that was hit by a negative demand shock. In column 2, the dependent variable is replaced with the growth of sales to other pre-existing customers. The coefficient estimate for interaction term becomes positive and significant at the 5% level. A one-standard-deviation increase in lagged board independence for an average firm is associated with a 4.1% increase in sales growth to other pre-existing customers after negative demand shocks. This magnitude is larger than the one for

[21] To obtain sufficient number of board connections, we use 2-digit SIC codes instead of more detailed-level industry classifications.

the total sales growth in our main analysis. In column 3, the dependent variable is replaced with the growth of sales to new customers. The coefficient estimate for interaction term is insignificant. These findings indicate that the positive association of board independence to performance during negative demand shocks is mainly driven by increasing sales to pre-existing customers instead of new customers. As a robustness check, we restrict our sample to suppliers and their largest customers (columns 4–6) in order to mitigate potential noises from pooling the data across customers. The results are even stronger.

[Insert Table VI here.]

Overall, the results in Table VI suggest that our main finding on sales growth is primarily driven by increasing sales to pre-existing customers that are less affected by demand shocks. We regard this as additional evidence against advisory function being more important in bad times as the rationale for our main finding.

5.2. Possible channel II: monitoring role of the board

Board independence can be effective in curtailing managers' pursuit of private benefits and encouraging efforts through monitoring (e.g., Wintoki et al., 2012; Knyazeva et al., 2013). However, whether monitoring is the channel through which board independence is positively associated with firm performance in our setting is not obvious. We explore this possibility and investigate whether firms with a greater need for monitoring the management perform better when they have higher board independence in troubled times. We proxy the need for monitoring by high levels of free cash flows, lagged discretionary accruals, and G-index. High levels of free cash flows are associated with managerial agency problems (Jensen, 1986). High lagged discretionary accruals are associated with earnings management (e.g., Dechow et al., 1995). Lastly, high G-index indicates weak shareholders' rights (Gompers et al., 2003). Results for these analyses are given in Table VII.

[Insert Table VII here.]

In Panel A, ROA, ROE and sales growth increase by 1.4% ($= 0.098 \times 0.146$), 4.8%, and 1.9%, respectively, for the firms with more serious free cash flow issues when firms increase board independence by one standard deviation after negative demand shock. These estimates are more profound than our main results in Table II, and they support the idea that board independence is related to high firm performance in troubled times more likely through the monitoring channel. Likewise in Panels B and C, board independence is associated with higher performance for firms with more serious earnings management issues or weaker shareholders' rights when those firms encounter a negative demand shock in the product market. In general, our results from these analyses imply

that the link between high firm performance and the board in challenging business conditions may be explained through strong monitoring.

It remains possible that firm performance is driven through increased scrutiny or monitoring of the firm by market participants during the negative demand shock. The management may be more motivated to drive performance gains when the external scrutiny increases during downstream demand shocks, for example through institutional investors or analysts. We explore this possibility and use the number of blockholders and the residual analyst coverage (Hong et al., 2000) that is measured using the residual from a regression of Log(1+N) on log(market value). Regression 1 of Panels A and B of Table IA.II in the Internet Appendix indicates no statistical significance regarding any effect of external scrutiny on firm performance during downstream demand shocks. However Regression 2 of both panels of Table IA.II shows that such external monitoring or scrutiny complements board independence in driving the higher firm performance during negative demand shocks. We interpret this result as an evidence for the complementary effect of external scrutiny on internal monitoring regarding firm performance improvement (Misangyi and Acharya, 2014).

According to Wintoki and Xi (2019), while both inside and outside directors can contribute to monitoring and advising the managers, outside directors are especially beneficial for monitoring given their independence and inside directors are especially beneficial given their knowledge of the firm and industry and their closeness to the CEO. Thus, our finding that the monitoring of independent directors drives the result is not surprising. One possible explanation for the monitoring function of the outside directors to be effective in our setting can be related to the prospect theory, which was proposed in Kahneman and Tversky (1979). It suggests that individuals have tendencies towards risk aversion when facing gains, and towards risk seeking when facing losses, relative to the *reference point*.[22] Another possible explanation is that the deteriorating demand condition leads to lower profits, which reduces the value of managerial efforts of lowering costs or raising demand. This causes managers to shirk and the agency problem to be more severe (e.g., Nickell, 1996).

5.3. Other possible channels: corporate investments and innovation

Aside of the advisory and monitoring roles of the board, there might be few alternative mechanisms that can explain the observed relationship between board independence and firm performance under lower product market

[22]Prospect theory has been used to explain investor behavior (e.g., Odean, 1998; Kyle et al., 2006), organizational behavior (e.g., Shimizu, 2007), and corporate decisions (e.g., Bromiley, 1991; Wen, 2010), among others. An exogenous drop in firm-specific product market demand creates a downward shift of potential outcomes for any given decisions of managers. For example, exercising a growth option may lead to lower uncertain outcomes after the shock, comparing with normal times. As a result, the managers experience a downward jump on her/his possible future payoff, from above the manager-specific reference point to below the reference point. Such a change can trigger managers' tendencies towards risk seeking according to the prospect theory. The incentive for the managers to seek risky projects when facing losses can be misaligned with value maximization of shareholders, making the agency problem worse. Monitoring by outside directors can thus act as the effective channel mitigating this problem and leading to better firm performance. We provide limited further evidence in Table IA.III that our documented link is indeed stronger for firms with managers who are more likely to seek risk.

demand conditions, e.g., through corporate investments and innovation. To address this further, we follow Chen et al. (2007), Lu and Wang (2015), and Liu et al. (2015), and construct the following variables: *Growth* as capital expenditures; *RnD* as R&D expenses; *Growth&RnD* as capital expenditures plus R&D expenses; *Asset Growth* as the change in total assets from last year. All these measures are scaled by total assets. In the main model, we replace firm performance with these measures of investment and innovation individually to examine if board independence and negative demand shock can explain them as potential channels.

Statistically insignificant results in Table VIII indicate that corporate investments and innovation are not sufficient enough to explain the proposed relation because board independence during negative demand shock cannot influence these policies in the first place. Although theoretically plausible, we cannot find empirical evidence for them being the channels.

[Insert Table VIII here.]

6. Further analysis

6.1. Refinement of the sample: unique supplier-year observations

To mitigate potential noises from pooling the data across customers for a single supplier in a given year, we consider two alternative specifications that allow us to uniquely identify observations by supplier firm and year. First, we retain only supplier-customer pairs in which the customer purchases the largest share of a firm's output among all the firm's customer companies. We call such a customer "the largest customer" for that supplier. We then estimate a supplier firm-year panel regression as shown in Equation (3):

$$\begin{aligned} \textit{Supplier Firm Performance}_{it} = \zeta_t + \eta_i + \theta_1 \textit{CNDS}_{it-1} + \theta_2 \textit{Board Independence}_{it-1} \\ + \theta_3 \textit{CNDS}_{it-1} \times \textit{Board Independence}_{it-1} + \lambda \textit{Controls}_{it-1} + e_{it}, \end{aligned} \tag{3}$$

where i indexes supplier firm, t indexes year and ζ_t and η_i are year and supplier firm fixed effects. The results are similar to our main findings and they are reported in Table A.II in the Appendix.

Second, we use a weighted average measure for negative downstream demand shocks. For a given supplier firm, we compute the weighted average annual detrended percentage change in the firm's customer companies' downstream demand. The weight equals to the share of supplier firm's output to a given customer among all sample customers. We then define the new supplier-year level CNDS in a similar way to our original CNDS. Using Equation (3) as our regression model, we again obtain robust results, which are given in Table A.II in the Appendix.

6.2. Alternative measures of firm performance

We consider various proxies for the key variables in our main analysis. We find robust results using Tobin's Q and earnings ratio as alternative measures for firm performance. Table A.III in the Appendix shows that, when firms face negative demand shocks, a one-standard-deviation increase in lagged board independence is associated with a 10.9% increase in Tobin's Q ($= 0.748 \times 0.146$), and it is a 0.5% increase for the earnings ratio ($= 0.034 \times 0.146$). In both specifications, the estimates for interaction terms are statistically significant at the 1% level.

6.3. Non-coopted board independence

We consider a refined measure of traditional board independence, which is *Non-Coopted Board Independence*, following Coles et al. (2014). *Non-Coopted Board Independence* is defined as the fraction of outside directors on the board who were appointed before the current CEO assumed office, so it takes into account the CEO's influence over board directors. Coles et al. (2014) suggest that co-opted directors, who are appointed after the CEO assumed office, may tend to assign their allegiance to the CEO regardless of whether they are classified as independent using traditional measures. As a robustness check, we replace board independence with this refined measure. Table A.IV in the Appendix shows that the coefficient estimates on interaction between CNDS and non-coopted board independence are statistically significant for all three performance measures. These results are consistent with our main findings.

6.4. Impact of female directors

The literature documents the importance of female directors on the board and their potential impact on firm policies and performance (e.g., Adams and Ferreira, 2009; Miller and del Carmen Triana, 2009; Levi et al., 2014; Tosun et al., 2022). To investigate this further, we construct *Female Board of Directors* as the fraction of female directors on the board, and *Female Board Independence* as the fraction of female outside directors on the board. We replace *Board Independence* variable with these new measures and rerun our main analyses. Table A.V in the Appendix provides statistically insignificant results for new interaction variables, i.e., *CNDS* $\times$ *Female Board of Directors* and *CNDS* $\times$ *Female Board Independence*. These findings indicate that our original results are not driven by the presence of female directors on the board.

6.5. Demand shock severity

We explore how the relation between board independence and firm performance depends on the level of exogenous change in downstream demand via a quartile analysis. Conditional on negative demand shocks, we separate the sample into four groups depending on the shock severity. In particular, we assign the indicator for bottom-quartile

demand shock equals one if, conditional on a negative demand shock (i.e., $CNDS = 1$), the annual detrended percentage change in customer companies' downstream industry demand is less than the 25th percentile. This indicator equals zero if there is no negative demand shock (i.e., $CNDS = 0$). The indicators for second-quartile, third-quartile, and top-quartile demand shocks are constructed similarly. The bottom quartile captures the most severe demand shocks and the top quartile captures the least severe demand shocks. We restrict the sample to firms that have both one and zero values for demand shocks within a given quartile in different years. In other words, we exclude the firms that face same quartile of demand shocks or never experience a demand shock during the sample period. This ensures that our results are not driven by cross-sectional variations in demand shocks. In addition, this analysis helps to alleviate the endogeneity concern that supplier firms anticipating constant changes or no change in downstream demand may develop different firm and board characteristics.

The results for conditional quartile analysis are presented in Table A.VI. We find that our main results are most evident when demand shocks are within the medium quartiles —i.e., when the change in customers' downstream demand lies between the 25th and the 75th percentile. Two potential reasons may explain the results. On the one hand, an extremely negative demand shock may have such severe consequences on firm operations that they cannot be recovered by board monitoring or advising. On the other hand, a mildly negative shock may limit the role of outside directors. Under such relatively easy business conditions, a firm's operations may provide moderate performance even without board guidance or monitoring. Hence, board structure may not have a significant association with firm performance.

6.6. Customer resilience

To further explore the level of demand shocks, we examine how our main findings depend on customer companies' resilience to shocks. Certain customers may be able to absorb changes in downstream demand and avoid passing demand shocks onto their suppliers. Other customers may be less capable of doing so and thus their suppliers may face more severe disturbances in demand. We use subsample analysis on our main regression depending on the customer firms' own resilience to their downstream demand change. We argue that customer firms' governance issues, proxied by high levels of free cash flow and high lagged discretionary accruals, may lead to inefficient corporate decisions in the event of demand shocks and higher likelihood of passing the shocks onto their suppliers. High levels of free cash flows are associated with managerial agency problems (Jensen, 1986), and high lagged discretionary accruals are signs for earnings management (e.g., Dechow et al., 1995).

Results in Table A.VII show that our main findings are most pronounced when customers are less resilient to demand shocks, i.e., when shocks are more likely to be passed onto supplier firms. In Panel A, for the subsample

of firms with customers having higher free cash flows, supplier ROA, ROE and sales growth increase by 1.4%(= 0.097×0.146), 4.2%, and 1.4%, respectively, when supplier firms increase board independence by one standard deviation after negative demand shock. The estimates for interaction terms are significantly positive for firms with customers having higher free cash flows and are insignificant for firms with customers having lower free cash flows. In Panel B, board independence is associated with higher performance for firms with customers having higher lagged discretionary accruals.

6.7. Constrained environment

We examine whether board independence is more valuable to the firms that potentially operate in a constrained environment. Firms that are smaller in size, higher in growth rate, and higher in firm risk may face greater constraints in financing and human resources, and thus, they may be less capable of making efficient corporate decisions and recovering from negative demand shocks. Hence, those firms may benefit to a greater extent from having independent boards that can monitor managers and guide them to overcome adverse situations.

Table A.VIII reports our panel regression results from subsample tests on firm size, growth and risk. In Panel A, we compare small firms (bottom-quartile total assets) to large firms (top-quartile total assets). The estimates for interaction between demand shocks and board independence remain significantly positive across different measures for firm performance while results for large firms are insignificant. Particularly, those estimates for smaller firms are larger in magnitude than the ones based on full-sample analysis, indicating the positive effect of board independence on firm performance after demand shocks is more evident in small firms. In Panel B, we examine high-growth and low-growth firms using subsamples by top-quartile and bottom-quartile capital expenditures scaled by total assets, respectively. The estimates for interaction terms are significantly positive for high-growth firms and are insignificant for low-growth firms. In Panel C, we perform subsample tests on high-risk and low-risk firms using top-quartile and bottom-quartile stock volatility, respectively. We find that the main results are more pronounced in high-risk firms than low-risk firms. These estimates are all significant at the 1% level. Overall, these results in Table A.VIII provide evidence that board independence is associated with even higher firm performance when companies are more constrained and have smaller size, higher growth rate, and higher risk via more volatile stock return.

6.8. Cross sectional variation: product market competition

To test whether the relation between board independence and firm performance depends on product market competition, we split the supplier firms into three groups based on levels of product market competition measured by the Herfindahl Hirschman Index (HHI): top-quartile (high), second and third quartiles (medium), and bottom-quartile

(low). We consider two ways to define product markets, and report the results in Table A.IX in the Appendix. In Panel A, competition is defined as the HHI of sales for firms in a 4-digit SIC industry that supply to the same customer firm. In Panel B, competition is defined as the HHI of sales for firms in a 4-digit SIC industry. Competition is measured in a finer way in Panel A where product markets are defined by not only industries but also customers. Shaked and Sutton (1987) find that industries are naturally segmented if consumers differ in their preferred choice of product. Firms may invest in relationship-specific assets and tailor products to their customers' needs. In addition, customers may also invest in specific relationships —for example, through training suppliers or production processes (Cen et al., 2015) or training suppliers.

In Panel A and Panel B of Table A.IX, we find that the medium-competition group consistently demonstrates a significantly positive relationship between firm performance and the interaction between demand shocks and board independence. However, we do not find such a significant relationship for the high- or low-competition group. Furthermore, the magnitude of the coefficient estimate for the interaction term is largest when firms belong to the medium-competition group.[23] Particularly in Panel A, a one-standard-deviation increase in lagged board independence for an average firm in the medium-competition group is associated with a 2.8% increase in ROA after negative demand shocks. The magnitude for the high-competition group is only 0.5%, and statistically insignificant, and it is 1.0% for the low-competition group.[24] Similar patterns follow for ROE and sales growth.

A combination of two reasons may explain these results. At one extreme, fierce competition may discipline managers and substitute the need for monitoring by corporate governance mechanisms. Thus, our results are less evident for the high-competition group.[25] At the other extreme, the low-competition group in our sample consists of firms that are the only, or are among few, observed suppliers for their customer company. According to existing studies, these supplier firms may have larger bargaining power over their customers. Scherer and Ross (1990) argue that more concentrated suppliers may have greater seller power over their customers. Holmstrom and Roberts (1998) suggest that the presence of many alternative suppliers allows the customer to make a credible threat to withhold future business from its existing suppliers. Consistent with these studies, supplier firms in the low-competition group may be able to bargain for favorable seller terms when their customers experience a reduction in demand which can avoid a reduction in firm performance. Subsequently, the role of board independence in relation

[23] As a robustness check, we use the text-based network (TNIC) industry concentration by Hoberg and Phillips (2016) as an alternative measure for product market competition and find consistent results.

[24] In Panel A, the medium-competition group has the least number of observations because the distribution of *SHHI* is highly skewed. In one-third of our sample, *SHHI* equals one (i.e., there is only one supplier firm that supplies to a customer within the supplier's industry). The low-competition group consists of all these firms.

[25] This is consistent with the findings of Giroud and Mueller (2010) and Chhaochharia et al. (2016). Both studies examine regulations that alter corporate governance strength and show that the effect of those regulatory changes on firm performance is less pronounced when firms face a higher level of competition. Our results complement their findings by showing that board governance is less effective in highly competitive product markets.

to firm performance should be less pronounced for the low-competition group in our analysis.

6.9. Other analyses

Dynamic GMM regression analysis As a further attempt to examine the association between board independence and firm performance under negative demand shock, we consider a GMM regression analysis following Blundell and Bond (2000) and Wintoki et al. (2012). The estimation procedure for a GMM estimator consists of the following two steps. First, we construct a first-difference form of the dynamic model to eliminate potential biases that may arise from time-invariant unobserved heterogeneity. Second, we use deeper lags of ROA, ROE, Sales Growth, CNDS and Board Independence interaction, and all other control variables as instruments for the current changes (first-differences) in these variables to account for potential simultaneity. Because these deeper lags are too far to explain the current ROA, ROE and Sales Growth, the exclusion restriction is satisfied. In the GMM regression model, we regress each performance measure on the main explanatory variables and controls, as well as multi-year lagged variables of that specific performance measure. Table IA.IV in the Internet Appendix presents the results from the dynamic GMM regressions, which are consistent with our main regression result.[26]

Excess firm performance Using a similar approach to Faleye et al. (2011), we investigate the relation between excess firm performance and board independence during demand shocks. This alternative approach helps us understand whether outside directors contribute to exceptional firm performance when product market conditions deteriorate. Specifically, we perform two stages of regressions. First, we predict regular performance as a function of economic determinants of firm performance. Second, we regress the residuals from the first stage regression as the excess performance on board independence, demand shock, and their interaction. As an alternative dependent variable, we also use a dummy that is equal to one if the first stage residuals are positive, and zero otherwise. Both stages of regressions include year fixed effects and supplier-customer pair fixed effects. Table IA.V in the Internet Appendix shows an increase in board independence is associated with economically significant increase in excess of firm performance on average after negative demand shocks, and the board independence is associated with a higher probability of achieving positive excess performance during customers' downstream demand shock. These results are consistent with our main findings, and they indicate that a higher fraction of outside directors is associated with higher excess firm performance in the event of a negative downstream demand shock.

[26]We conduct a set of tests to verify the validity of our GMM estimation statistically. First, the AR(1) and AR(2) tests for the first- and second-order serial correlations in the first-differenced residuals confirm the validity of the exogeneity assumptions. Next, the Hansen test for over-identifying restrictions indicates that our specification is not over-identified. Lastly, we confirm the validity of the assumption that any correlation between our endogenous variables and the unobserved (fixed) effects is constant over time through the difference-in-Hansen test.

Cross-sectional logistics test We perform a cross-sectional logistics test as a robustness check to the panel regressions in our main analysis. The test helps to mitigate potential biases due to time-series correlation for a given variable. For each supplier firm, we compute two mean values of ROA: across all years with and without a negative downstream demand shock. We then take the difference between these two mean values for a given firm to be the dependent variable. We repeat the same exercise for ROE and sales growth. The independent variable of interest is the mean value of board independence across the years only when a firm faces negative demand shocks. The mean values of control variables are also included. We conduct logistic regression analysis and report estimates as odds ratios along with standard errors of betas in Table IA.VI in the Internet Appendix. We find that the odds ratios on the mean values of board independence are above positive one in all specifications. These results suggest that cross-sectional differences in board independence explain corporate performance when firms face negative demand shocks, and are consistent with our main findings.

Excluding crisis period Although we study the board independence-firm performance nexus during firm-specific demand shocks, it remains plausible the documented positive link is driven by the effectiveness of board independence during financial crisis. As a robustness test, we exclude observations in the years of 2008 and 2009 from the sample (about 6.8% of the sample) and run the main regression. Statistically significant and robust results in Table IA.VII in the Internet Appendix suggest that crisis setting does not drive our original findings.

Top three industries in the sample The top three industries by their numbers of observations in the sample are electronics (15.39%), pharmaceuticals (12.88%), and petroleum and natural gas (7.48%). Recall we focus on the supplier firms' performance and characteristics in our regression analyses, using the customer-supplier relationship to identify the propagation of demand shocks from downstream customers. Running the main regression of Equation (1) on these three industries separately, we show in Table IA.VIII of the Internet Appendix that our main findings hold in all three industries, and with similar economic and statistical significance. [27]

The effect of CNDS through control variables Demand shocks can affect our control variables, and our main finding may simply reflect the effect of demand shock on firm performance through its influence on the control variables. For example, some firms may choose to downsize their assets after a negative downstream demand shock. Thus, including a number of time-varying control variables while excluding their interactions with the

[27] One big potential difference for supplier firms in these three industries is their innovativeness or the riskiness of their cash flows: the electronics and pharmaceutical suppliers are more likely to be high-tech firms or firms with riskier cash flows than petroleum and gas suppliers. If alleviating managerial conservatism in risk-taking exacerbated by negative demand shocks is the main drive for our documented positive link of board independence on firm performance at such time, then we may expect the link to vary among the three industries. We regard it as suggestive evidence that combating managerial conservatism (as in e.g., Lu and Wang, 2018) is not the main force behind the positive effect of board independence in our setting.

demand shocks may bias the estimate of interest.[28] In order to address this potential bias, we interact all control variables with the demand shock indicator for our main regression. Coefficient estimates in Table IA.IX in the Internet Appendix confirm the robustness of our main findings.

Key committee full independence We consider key committee full independence as an alternative measure for the board structure. Key committees assume different responsibilities in the area of corporate governance. For example, the nominating committee evaluates and nominates the board of directors, whilst the compensation committee determines executive compensation packages. Both of these committees play important roles in facilitating the board's monitoring duty, although their members do not necessarily overlap with the board directors. To check whether these committees' full independence matter in our setting, we replace Board Independence in Equation (1) by dummy variables representing full independence in the nominating and compensation committees. Reported in Table IA.X in the Internet Appendix, we find that firms with a fully independent nominating committee achieve a better firm performance than their counterparts subsequent to negative demand shocks on average. The compensation committee's full independence has a similar effect on the firm's performance. We interpret these findings as evidence of robustness of our main findings, and as a further indication that the boards' monitoring mechanism benefits firms when facing product market disruptions.

CEO skills It is plausible that our main results in Table II are driven by skilled CEOs rather than board independence, given that firms with more skilled CEOs can be associated with higher board independence. CEOs with a higher level of managerial skills understand the product market dynamics better, and thus might be able to navigate the firms through product demand shocks or recover quickly from the shocks. To test whether it is the case in our setting, we replace board independence in our main regression of Equation (1) by the *CEO generalist ability index*, as an proxy for CEO skills following Custódio et al. (2013). Table IA.XI in the Internet Appendix provides evidence that skilled CEOs alone do not drive the improvement of firm performance during negative demand shocks.

Informational acquisition cost Duchin et al. (2010) find that the effectiveness of outside directors on firm performance depends on the cost of acquiring information about the firm. Using their measure of *information cost index*[29] to proxy for such information acquisition cost, Table IA.XII of the Internet Appendix suggests that

[28] See Angrist and Pischke (2009) and Roberts and Whited (2012) for more details on the issue of bad controls.

[29] It combines the number of analysts, the dispersion of analyst forecasts, and analyst forecast error by taking the average of a firm's percentile ranking in the sample according to each measure. The reverse ranking is used for the number of analysts. Finally, the index is scaled to range from zero to one.

our documented positive effect of board independence on firm performance during negative demand shocks is robust after controlling for the information environment specific to a firm at any given time. It implies that the change in the information environment as a result of idiosyncratic negative demand shocks does not explain our main result.

7. Conclusion

This paper examines the relation between board independence and firm performance under various product market conditions. We utilize customer-supplier links to capture firm-specific exogenous demand shocks coming from downstream firms, and find board independence is related to high firm performance during bad times relative to other demand conditions. Methods of IV and difference-in-difference-in-differences (DDD) are employed as our attempts to establish the causality of our documented link between board independence and firm performance. The positive association we find between board independence and firm performance during negative demand shocks is robust to a few different models such as dynamic GMM, and the use of alternative performance measures or board independence measures. We also show that the main results are not driven by skilled CEOs, or female directors, or the financial crisis, or changes in the information acquisition cost, among other things.

Furthermore, we find that the main result is primarily driven by firms with more serious free cash flows or earnings management issues, or weaker shareholders rights, or having CEOs with long tenure or low salary-to-stock ratio, but not driven by firms that have independent directors with connection to customer industries, or the expansion of sales to new customers. This suggestive evidence is consistent with the board's monitoring role driving the main result. Meanwhile, the positive association of board independence in deteriorating product market conditions is more pronounced for smaller firms and firms with high growth or high stock price volatility, or for medium levels of demand shocks, or when customers are less resilient and more likely to pass the shocks onto their suppliers. In addition, our main findings are most striking for firms operating in industries with a medium level of competition, which indicates a complementary relation between competition and board independence when the product market is less competitive, and a substitutive relation when it is more competitive.

This study contributes to the corporate governance literature by providing new evidence for the importance of board independence from the perspective of product markets. We believe that this study can help provide further clarification for the literature regarding when we expect board independence matters for firm performance. The findings may offer guidance for firms on their governance decisions and help them to be proactive so that they can operate successfully when a negative shock hits their businesses.

Our study is limited to investigating firm performance-board independence nexus under firm-specific product

market demand conditions, which differ from industry competition. Further examination on the role of board independence in other related product market dynamics such as entry and exit, or horizontal/vertical/conglomerate mergers can provide more insights in this research area. A cross-country analysis that incorporates cultural aspects and institutional differences has the potential to advance our understanding on when and whether the board roles of monitoring and advising are important.

References

Adams, R. B., and D. Ferreira. 2007. A theory of friendly boards. *The Journal of Finance* 62:217–250.

Adams, R. B., and D. Ferreira. 2009. Women in the boardroom and their impact on governance and performance. *Journal of financial economics* 94:291–309.

Allen, F., E. Carletti, and R. Marquez. 2015. Stakeholder governance, competition, and firm value. *Review of Finance* 19:1315–1346.

Angrist, J. D., and J.-S. Pischke. 2009. *Mostly harmless econometrics: An empiricist's companion*. Princeton University Press.

Appel, I. R., T. A. Gormley, and D. B. Keim. 2016. Passive investors, not passive owners. *Journal of Financial Economics* 121:111–141.

Atanasov, V. A., and B. S. Black. 2017. The trouble with instruments: Re-Examining shock-based IV designs. ECGI - Finance Working Paper; Northwestern Law & Econ Research Paper 16-01; Northwestern Public Law Research Paper No. 15-26, Available at SSRN 2417689.

Baldenius, T., N. Melumad, and X. Meng. 2014. Board composition and CEO power. *Journal of Financial Economics* 112:53–68.

Banerjee, S., S. Dasgupta, and Y. Kim. 2008. Buyer–supplier relationships and the stakeholder theory of capital structure. *the Journal of finance* 63:2507–2552.

Bardos, K. S., M. Ertugrul, and L. S. Gao. 2020. Corporate social responsibility, product market perception, and firm value. *Journal of Corporate Finance* 62:101588.

Barrot, J.-N., and J. Sauvagnat. 2016. Input specificity and the propagation of idiosyncratic shocks in production networks. *Quarterly Journal of Economics* 131:1543–1592.

Benmelech, E., and N. K. Bergman. 2011. Bankruptcy and the collateral channel. *The Journal of Finance* 66:337–378.

Bhagat, S., and B. Black. 2002. The non-correlation between board independence and long-term firm performance. *Journal of Corporate Law* 27:231–273.

Bhagat, S., and B. Bolton. 2008. Corporate governance and firm performance. *Journal of Corporate Finance* 14:257–273.

Bhattacharyya, S., and A. Nain. 2011. Horizontal acquisitions and buying power: A product market analysis. *Journal of Financial Economics* 99:97–115.

Blundell, R., and S. Bond. 2000. GMM estimation with persistent panel data: an application to production functions. *Econometric reviews* 19:321–340.

Brickley, J. A., J. L. Coles, and R. L. Terry. 1994. Outside directors and the adoption of poison pills. *Journal of Financial Economics* 35:371–390.

Bromiley, P. 1991. Testing a causal model of corporate risk taking and performance. *Academy of Management journal* 34:37–59.

Cai, Y., and M. Sevilir. 2012. Board connections and M&A transactions. *Journal of Financial Economics* 103:327–349.

Campello, M., and J. Gao. 2017. Customer concentration and loan contract terms. *Journal of Financial Economics* 123:108–136.

Cavaco, S., P. Crifo, A. Rebérioux, and G. Roudaut. 2017. Independent directors: Less informed but better selected than affiliated board members? *Journal of Corporate Finance* 43:106–121.

Cen, L., F. Chen, Y. Hou, and G. D. Richardson. 2018. Strategic disclosures of litigation loss contingencies when customer-supplier relationships are at risk. *The Accounting Review* 93:137–159.

Cen, L., S. Dasgupta, and R. Sen. 2015. Discipline or disruption? Stakeholder relationships and the effect of takeover threat. *Management science* 62:2820–2841.

Cen, L., E. L. Maydew, L. Zhang, and L. Zuo. 2017. Customer–supplier relationships and corporate tax avoidance. *Journal of Financial Economics* 123:377–394.

Chang, C.-H., and Q. Wu. 2021. Board networks and corporate innovation. *Management Science* 67:3618–3654.

Chen, Q., I. Goldstein, and W. Jiang. 2007. Price informativeness and investment sensitivity to stock price. *The Review of Financial Studies* 20:619–650.

Chhaochharia, V., Y. Grinstein, G. Grullon, and R. Michaely. 2016. Product market competition and internal governance: Evidence from the Sarbanes–Oxley Act. *Management Science* 63:1405–1424.

Cohen, L., and A. Frazzini. 2008. Economic links and predictable returns. *Journal of Finance* 63:1977–2011.

Coles, J. L., N. D. Daniel, and L. Naveen. 2014. Co-opted boards. *Review of Financial Studies* 27:1751–1796.

Custódio, C., M. A. Ferreira, and P. Matos. 2013. Generalists versus specialists: Lifetime work experience and chief executive officer pay. *Journal of Financial Economics* 108:471–492.

Dasgupta, S., X. Li, and A. Y. Wang. 2018. Product market competition shocks, firm performance, and forced CEO turnover. *The Review of Financial Studies* 31:4187–4231.

Dass, N., J. R. Kale, and V. Nanda. 2014. Trade credit, relationship-specific investment, and product market power. *Review of Finance* 19:1867–1923.

Dechow, P. M., R. G. Sloan, and A. P. Sweeney. 1995. Detecting earnings management. *Accounting Review* pp. 193–225.

Dhaliwal, D., J. S. Judd, M. Serfling, and S. Shaikh. 2016. Customer concentration risk and the cost of equity capital. *Journal of Accounting and Economics* 61:23–48.

Djankov, S., R. La Porta, F. Lopez-de Silanes, and A. Shleifer. 2008. The law and economics of self-dealing. *Journal of financial economics* 88:430–465.

Duchin, R., J. G. Matsusaka, and O. Ozbas. 2010. When are outside directors effective? *Journal of Financial Economics* 96:195–214.

Fabling, R., and L. Sanderson. 2013. Exporting and firm performance: Market entry, investment and expansion. *Journal of International Economics* 89:422–431.

Faleye, O., R. Hoitash, and U. Hoitash. 2011. The costs of intense board monitoring. *Journal of Financial Economics* 101:160–181.

Fama, E. F., and K. R. French. 1997. Industry costs of equity. *Journal of Financial Economics* 43:153–193.

Ferris, S. P., M. Jagannathan, and A. C. Pritchard. 2003. Too busy to mind the business? Monitoring by directors with multiple board appointments. *Journal of Finance* 58:1087–1111.

Fich, E. M. 2005. Are some outside directors better than others? Evidence from director appointments by Fortune 1000 firms. *Journal of Business* 78:1943–1972.

Fields, M. A., and P. Y. Keys. 2003. The emergence of corporate governance from Wall St. to Main St.: Outside directors, board diversity, earnings management, and managerial incentives to bear risk. *Financial Review* 38:1–24.

Fracassi, C., and G. Tate. 2012. External networking and internal firm governance. *The Journal of finance* 67:153–194.

Francis, B. B., I. Hasan, and Q. Wu. 2012. Do corporate boards matter during the current financial crisis? *Review of Financial Economics* 21:39–52.

Fresard, L. 2010. Financial strength and product market behavior: The real effects of corporate cash holdings. *The Journal of finance* 65:1097–1122.

Giroud, X., and H. M. Mueller. 2010. Does corporate governance matter in competitive industries? *Journal of Financial Economics* 95:312–331.

Giroud, X., and H. M. Mueller. 2011. Corporate governance, product market competition, and equity prices. *The Journal of Finance* 66:563–600.

Gompers, P., J. Ishii, and A. Metrick. 2003. Corporate governance and equity prices. *The quarterly journal of economics* 118:107–156.

Han, S., V. K. Nanda, and S. Silveri. 2016. CEO power and firm performance under pressure. *Financial Management* 45:369–400.

Harris, M., and A. Raviv. 2008. A theory of board control and size. *Review of Financial Studies* 21:1797.

Harris, M., and Y. Weiss. 1984. Job matching with finite horizon and risk aversion. *Journal of Political Economy* 92:758–779.

Hermalin, B. E., and M. S. Weisbach. 1988. The determinants of board composition. *RAND Journal of Economics* pp. 589–606.

Hermalin, B. E., and M. S. Weisbach. 1998. Endogenously chosen boards of directors and their monitoring of the CEO. *American Economic Review* pp. 96–118.

Hermalin, B. E., and M. S. Weisbach. 2003. Boards of directors as an endogenously determined institution: A survey of the economic literature. *Economic Policy Review* 9:7–26.

Hitt, M. A., R. E. Hoskisson, and H. Kim. 1997. International diversification: Effects on innovation and firm performance in product-diversified firms. *Academy of Management journal* 40:767–798.

Hoberg, G., and G. Phillips. 2016. Text-based network industries and endogenous product differentiation. *Journal of Political Economy* 124:1423–1465.

Holmstrom, B., and S. N. Kaplan. 2003. The state of US corporate governance: What's right and what's wrong? *Journal of Applied Corporate Finance* 15:8–20.

Holmstrom, B., and J. Roberts. 1998. The boundaries of the firm revisited. *Journal of Economic Perspectives* 12:73–94.

Hong, H., T. Lim, and J. C. Stein. 2000. Bad news travels slowly: Size, analyst coverage, and the profitability of momentum strategies. *Journal of Finance* 55:265–295.

Intintoli, V., K. M. Kahle, and W. Zhao. 2015. Board connectedness and board effectiveness. Working Paper, Available at SSRN 2578716.

Intintoli, V. J., M. Serfling, and S. Shaikh. 2017. CEO turnovers and disruptions in customer–supplier relationships. *Journal of Financial and Quantitative Analysis* 52:2565–2610.

Irvine, P. J., S. S. Park, and Ç. Yıldızhan. 2015. Customer-base concentration, profitability, and the relationship life cycle. *The Accounting Review* 91:883–906.

Itzkowitz, J. 2013. Customers and cash: How relationships affect suppliers' cash holdings. *Journal of Corporate Finance* 19:159–180.

Jensen, M. C. 1986. Agency costs of free cash flow, corporate finance, and takeovers. *The American economic review* 76:323–329.

Johnson, S., R. La Porta, F. Lopez-de Silanes, and A. Shleifer. 2000. Tunneling. *American economic review* 90:22–27.

Johnson, W. C., J. M. Karpoff, and S. Yi. 2015. The bonding hypothesis of takeover defenses: Evidence from IPO firms. *Journal of Financial Economics* 117:307–332.

Kahneman, D., and A. Tversky. 1979. Prospect theory: An analysis of decision under risk. *Econometrica* 47:363–391.

Kale, J. R., and H. Shahrur. 2007. Corporate capital structure and the characteristics of suppliers and customers. *Journal of Financial Economics* 83:321–365.

Kanatas, G., and J. Qi. 2012. Competition and managerial incentives: board independence, information and predation. *The Journal of Industrial Economics* 60:136–161.

Klein, A. 1998. Firm performance and board committee structure. *Journal of Law and Economics* 41:275–304.

Knyazeva, A., D. Knyazeva, and R. W. Masulis. 2013. The supply of corporate directors and board independence. *The Review of Financial Studies* 26:1561–1605.

Kyle, A. S., H. Ou-Yang, and W. Xiong. 2006. Prospect theory and liquidation decisions. *Journal of Economic Theory* 129:273–288.

Lefort, F., and F. Urzúa. 2008. Board independence, firm performance and ownership concentration: Evidence from Chile. *Journal of Business Research* 61:615–622.

Levi, M., K. Li, and F. Zhang. 2014. Director gender and mergers and acquisitions. *Journal of Corporate Finance* 28:185–200.

Li, D., and E. X. Li. 2016. Corporate Governance and Costs of Equity: Theory and Evidence. *Management Science* .

Li, M., Y. Lu, and G. M. Phillips. 2019. CEOs and the product market: When are powerful CEOs beneficial? *Journal of Financial and Quantitative Analysis* .

Liu, Y., M. K. Miletkov, Z. Wei, and T. Yang. 2015. Board independence and firm performance in China. *Journal of corporate Finance* 30:223–244.

Lu, J., and W. Wang. 2015. Board independence and corporate investments. *Review of Financial Economics* 24:52–64.

Lu, J., and W. Wang. 2018. Managerial conservatism, board independence and corporate innovation. *Journal of Corporate Finance* 48:1–16.

Maksimovic, V., and G. Phillips. 2001. The market for corporate assets: Who engages in mergers and asset sales and are there efficiency gains? *Journal of Finance* 56:2019–2065.

Milidonis, A., and K. Stathopoulos. 2014. Managerial incentives, risk aversion, and debt. *Journal of Financial and Quantitative Analysis* 49:453–481.

Miller, T., and M. del Carmen Triana. 2009. Demographic diversity in the boardroom: Mediators of the board diversity–firm performance relationship. *Journal of Management studies* 46:755–786.

Misangyi, V. F., and A. G. Acharya. 2014. Substitutes or complements? A configurational examination of corporate governance mechanisms. *Academy of Management Journal* 57:1681–1705.

Mitchell, M. L., and J. H. Mulherin. 1996. The impact of industry shocks on takeover and restructuring activity. *Journal of financial economics* 41:193–229.

Moon, S. K., and G. M. Phillips. 2021. Outsourcing through purchase contracts and firm capital structure. *Management Science* 67:363–387.

Nickell, S. J. 1996. Competition and corporate performance. *Journal of political economy* 104:724–746.

Odean, T. 1998. Are investors reluctant to realize their losses? *The Journal of finance* 53:1775–1798.

Patatoukas, P. N. 2011. Customer-base concentration: Implications for firm performance and capital markets: 2011 american accounting association competitive manuscript award winner. *The Accounting Review* 87:363–392.

Phillips, G. M., and G. Sertsios. 2016. Financing and New Product Decisions of Private and Publicly Traded Firms. *Review of Financial Studies* 30:1744–1789.

Raith, M. 2003. Competition, risk and managerial incentives. *American Economic Review* 93:1425–1436.

Randall, T., and K. Ulrich. 2001. Product variety, supply chain structure, and firm performance: Analysis of the US bicycle industry. *Management Science* 47:1588–1604.

Roberts, M. R., and T. M. Whited. 2012. Endogeneity in empirical corporate finance. Simon School Working Paper No. FR 11-29, Available at SSRN 1748604.

Rothaermel, F. T., M. A. Hitt, and L. A. Jobe. 2006. Balancing vertical integration and strategic outsourcing: effects on product portfolio, product success, and firm performance. *Strategic management journal* 27:1033–1056.

Scherer, F. M., and D. Ross. 1990. *Industrial market structure and economic performance*. Houghton-Mifflin, Boston.

Schmidt, K. M. 1997. Managerial incentives and product market competition. *Review of Economic Studies* 64:191–213.

Shaked, A., and J. Sutton. 1987. Product differentiation and industrial structure. *Journal of Industrial Economics* pp. 131–146.

Shimizu, K. 2007. Prospect theory, behavioral theory, and the threat-rigidity thesis: Combinative effects on organizational decisions to divest formerly acquired units. *Academy of Management Journal* 50:1495–1514.

Singla, M., and S. Singh. 2019. Board monitoring, product market competition and firm performance. *International Journal of Organizational Analysis* 27:1036–1052.

Tosun, O. K. 2021. Changes in corporate governance: externally dictated vs voluntarily determined. *International Review of Financial Analysis* 73:101608.

Tosun, O. K., I. El Kalak, and H. Robert. 2022. How female directors help firms to attain optimal cash holdings. *International Review of Financial Analysis* 80:102034.

Tung, J. 2012. A study of product innovation on firm performance. *International Journal of Organizational Innovation* 4:84–97.

Wang, J. 2012. Do firms' relationships with principal customers/suppliers affect shareholders' income? *Journal of Corporate Finance* 18:860–878.

Weisbach, M. S. 1988. Outside directors and CEO turnover. *Journal of Financial Economics* 20:431–460.

Wen, Y.-F. 2010. Capital investment decision, corporate governance, and prospect theory. *Procedia-Social and Behavioral Sciences* 5:116–126.

Wintoki, M. B., J. S. Linck, and J. M. Netter. 2012. Endogeneity and the dynamics of internal corporate governance. *Journal of Financial Economics* 105:581–606.

Wintoki, M. B., and Y. Xi. 2019. Friendly directors and the cost of regulatory compliance. *Journal of Corporate Finance* 58:112–141.

Yermack, D. 1996. Higher market valuation of companies with a small board of directors. *Journal of Financial Economics* 40:185–211.

Figure 1: An Example of Supplier-Customer Network

This figure illustrates links between a supplier firm, a customer company, and the customer company's downstream industries. *Supplier 1* supplies to *Customer A*. *Customer A*'s industry supplies to ten industries that consist of publicly listed companies (*Industry 1* to *Industry 10*). In addition to that, *Customer A*'s industry supplies to *Government* sector, *Private* sector, and *Foreign* sector. A negative downstream demand shock hits *Supplier 1* (i.e., *CNDS* equals one) if the detrended percentage change in *Customer A*'s downstream industry demand is negative. Blue color denotes *Customer A*'s downstream industries. Dashed red lines demonstrates how potential demand shocks originated in downstream industries could affect the supplier.

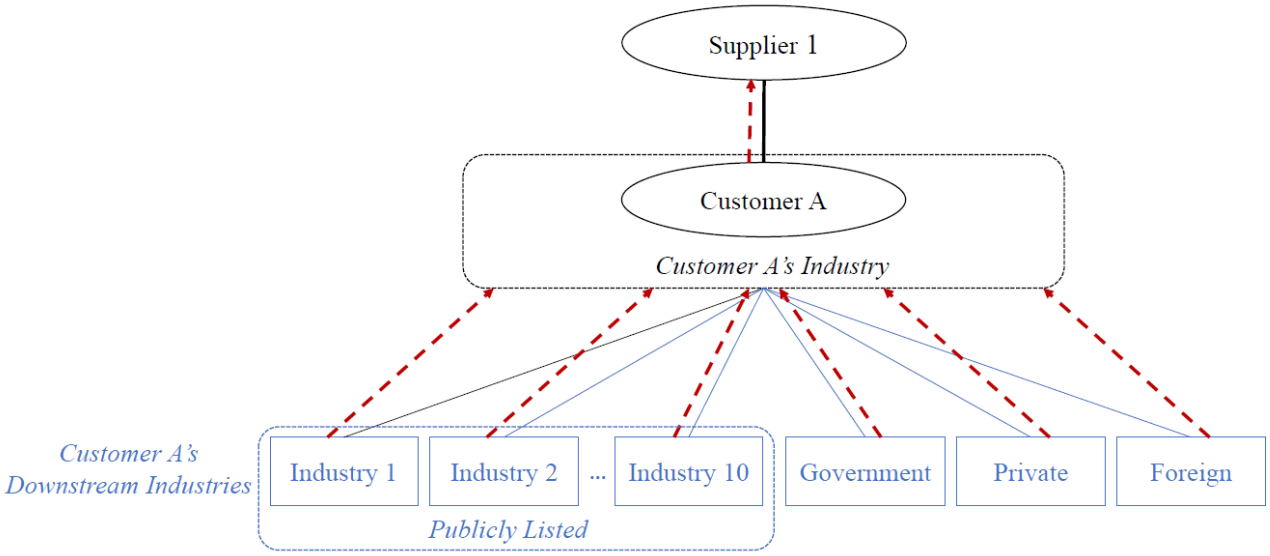


Table I: Summary Statistics

This table reports summary statistics. The sample consists of US public firms during the period 1997–2016 with available financial data, board data, and information on firms' relationships with US public customer companies. Main variables include: *CNDS*, an indicator that is equal to one if a firm experiences a negative downstream demand shock, i.e., when the annual detrended percentage change in a given customer company's downstream industry demand is negative; *Board Independence*, the fraction of outside directors on board; *ROA*, computed as net income divided by total assets; *ROE*, computed as income before extraordinary items divided by total common equity; and *Sales Growth*, computed as annual sales growth rate (%) times 100 divided by total assets. Detailed definitions of all variables are presented in Table A.I. Mean, standard deviation (Std. Dev.), the first quartile ($p25$), median, and the third quartile ($p75$) of the variables are reported.

Panel A: Main Variables

	(1) Mean	(2) Std. Dev.	(3) $p25$	(4) Median	(5) $p75$
CNDS	0.552	0.497	0.000	1.000	1.000
Board Independence	0.733	0.146	0.636	0.769	0.857
ROA	0.025	0.141	0.007	0.047	0.084
ROE	0.038	0.426	0.019	0.099	0.166
Sales Growth	0.008	0.086	-0.001	0.002	0.016

Panel B: Other Firm Characteristics

	(1) Mean	(2) Std. Dev.	(3) $p25$	(4) Median	(5) $p75$
Total Assets (in $ millions)	4461.220	8435.162	548.998	1407.767	4207.400
Leverage	0.450	0.224	0.264	0.453	0.608
Growth	0.049	0.055	0.018	0.031	0.055
Cash Ratio	0.134	0.127	0.040	0.097	0.194
Stock Volatility	0.029	0.014	0.019	0.025	0.035
SHHI	0.731	0.308	0.479	0.904	1.000
Board Size	8.718	2.039	7.000	9.000	10.000
Board Ownership	0.071	0.111	0.013	0.028	0.073
Busy Board	0.019	0.137	0.000	0.000	0.000
CEO Duality	0.384	0.486	0.000	0.000	1.000

Table II: Effect of Board Independence on Firm Performance Upon Demand Shocks

This table reports estimates from regressing firm performance on board independence, downstream demand shock, interaction between the two variables, controls, year fixed effects, and supplier-customer pair fixed effects, for the period 1997–2016. The dependent variables are: *ROA*, computed as net income divided by total assets; *ROE*, computed as income before extraordinary items divided by total common equity; and *Sales Growth*, computed as annual sales growth rate (%) times 100 divided by total assets. *CNDS* is an indicator that is equal to one if a firm experiences a negative downstream demand shock, i.e., when the annual detrended percentage change in a given customer company's downstream industry demand is negative. *Board Independence* is the fraction of outside directors on board. Detailed definitions of other variables are presented in Table A.I. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1) ROA_t	(2) ROE_t	(3) Sales $Growth_t$
$CNDS_{t-1}$	-0.028*	-0.141***	-0.037**
	(0.016)	(0.052)	(0.014)
Board $Independence_{t-1}$	-0.019	-0.001	-0.041
	(0.023)	(0.085)	(0.026)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.053**	0.223***	0.069***
	(0.024)	(0.076)	(0.019)
Log(Total $Assets)_{t-1}$	-0.051***	-0.068**	-0.033***
	(0.007)	(0.028)	(0.008)
$Leverage_{t-1}$	0.074***	-0.087	0.055**
	(0.021)	(0.134)	(0.024)
$Growth_{t-1}$	-0.131**	-0.196	-0.020
	(0.064)	(0.217)	(0.054)
Cash $Ratio_{t-1}$	0.101**	0.049	-0.069*
	(0.043)	(0.104)	(0.040)
Stock $Volatility_{t-1}$	-0.549	-1.022	0.148
	(0.356)	(1.231)	(0.322)
$SHHI_{t-1}$	-0.003	-0.130*	-0.008
	(0.018)	(0.071)	(0.012)
Log(Board $Size)_{t-1}$	0.012	0.044	0.035**
	(0.024)	(0.061)	(0.016)
Board $Ownership_{t-1}$	-0.033	0.037	0.042
	(0.030)	(0.110)	(0.048)
Busy $Board_{t-1}$	-0.012	0.072	0.006*
	(0.011)	(0.060)	(0.004)
CEO $Duality_{t-1}$	0.000	0.009	0.001
	(0.004)	(0.017)	(0.004)
Observations	3440	3440	3440
Adjusted R^2	0.499	0.383	0.194
Year Fixed Effects	Yes	Yes	Yes
Supplier-Customer Pair Fixed Effects	Yes	Yes	Yes

Table III: Instrumental Variable Approach

This table presents robustness checks to Table II using an instrumental variable approach, following Duchin et al. (2010) and using an adjusted methodology suggested by Atanasov and Black (2017) and Phillips and Sertsios (2016). Columns 1–2 report first-stage results from regressing board independence, and the interaction between demand shock and board independence on the interactions of an indicator that is equal to one if the firm did not comply with the regulatory requirement of a fully independent audit committee in 2000 with demand shock, and with a list of time-varying firm characteristics including *log(total asset)*, *leverage*, *Growth*, *stock volatility* and *Cash Ratio*, and the demand shock indicator, control variables, year fixed effects, and supplier-customer pair fixed effects. Columns 3–5 present second-stage results. *Instrumented Board Independence* is the instrumented value of board independence from the first stage. *Instrumented (CNDS × Board Independence)* is the instrumented value of the interaction between demand shock and board independence from the first stage. Detailed definitions of other variables are presented in Table A.I. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	First Stage		Second Stage		
	(1)	(2)	(3)	(4)	(5)
	Board Independence$_t$	CNDS$_t$ × Board Independence$_t$	ROA$_t$	ROE$_t$	Sales Growth$_t$
CNDS$_{t-1}$ × Audit Committee Not Fully Independent in 2000	0.010	-0.110*			
	(0.027)	(0.058)			
Log(Total Assets)$_{t-1}$ × Audit Committee Not Fully Independent in 2000	-0.020**	0.015			
	(0.009)	(0.015)			
Leverage$_{t-1}$ × Audit Committee Not Fully Independent in 2000	0.088	0.025			
	(0.139)	(0.197)			
Growth$_{t-1}$ × Audit Committee Not Fully Independent in 2000	1.701*	-1.510			
	(0.957)	(1.403)			
Stock Volatility$_{t-1}$ × Audit Committee Not Fully Independent in 2000	2.692	-0.203			
	(2.069)	(3.180)			
Cash Ratio$_{t-1}$ × Audit Committee Not Fully Independent in 2000	-0.406	-0.171			
	(0.409)	(0.680)			
CNDS$_{t-1}$	0.045*	0.182**	-0.007	0.026	0.000
	(0.023)	(0.072)	(0.009)	(0.035)	(0.010)
Instrumented Board Independence$_{t-1}$			-0.376***	-1.712***	-0.378**
			(0.106)	(0.458)	(0.183)
Instrumented (CNDS$_{t-1}$ × Board Independence$_{t-1}$)			0.141**	0.463***	0.152**
			(0.059)	(0.150)	(0.074)
Log(Total Assets)$_{t-1}$	0.015	-0.024*	-0.038***	-0.007	-0.038***
	(0.010)	(0.014)	(0.012)	(0.065)	(0.009)
Leverage$_{t-1}$	0.095	0.002	0.055	-0.019	0.178*
	(0.070)	(0.091)	(0.070)	(0.165)	(0.099)
Growth$_{t-1}$	-0.475**	-0.442*	0.058	-0.128	0.043
	(0.201)	(0.237)	(0.134)	(0.317)	(0.178)
Cash Ratio$_{t-1}$	0.110	0.413***	0.132*	-0.176	-0.140***
	(0.102)	(0.152)	(0.069)	(0.227)	(0.050)
Stock Volatility$_{t-1}$	0.504	-4.759***	0.707	3.951	-1.064**
	(0.781)	(1.544)	(0.552)	(2.852)	(0.508)
SHHI$_{t-1}$	0.023	0.047	-0.021	-0.420*	0.061*
	(0.028)	(0.046)	(0.028)	(0.221)	(0.035)
Log(Board Size)$_{t-1}$	0.047	0.112*	0.013	-0.078	0.039
	(0.042)	(0.066)	(0.030)	(0.122)	(0.025)
Board Ownership$_{t-1}$	-0.054	-0.180	0.003	-0.198	0.197
	(0.141)	(0.133)	(0.087)	(0.186)	(0.183)
Busy Board$_{t-1}$	0.002	-0.206***	0.024	0.067***	0.001
	(0.033)	(0.043)	(0.016)	(0.024)	(0.009)
CEO Duality$_{t-1}$	0.046***	0.047*	-0.008	-0.026	0.002
	(0.015)	(0.026)	(0.007)	(0.034)	(0.006)
Observations	441	441	441	441	441
Adjusted R^2	0.280	0.503	0.657	0.421	0.192
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair Fixed Effects	Yes	Yes	Yes	Yes	Yes

Table IV: Difference-in-Difference-in-Difference (DIDID) Approach

This table reports estimates from regressing firm performance on board independence, downstream demand shock, and the indicator for the 3-year post-event period with the increase in board independence due to a director death or retirement, along with the interaction between the three variables, controls, year fixed effects, and supplier-customer pair fixed effects, for the period 1997–2016. The dependent variables are *ROA*, *ROE*, and *Sales Growth*. *CNDS* is an indicator that is equal to one if a firm experiences a negative downstream demand shock, i.e., when the annual detrended percentage change in a given customer company's downstream industry demand is negative. *Board Independence* is the fraction of outside directors on board. *Post* is a dummy variable that equals one for the 3-year post-event period with the increase in board independence due to a director death or retirement in a particular firm, and zero for the same 3-year pre-event period. *CNDS* × *Board Independence* × *Post* is the main explanatory variable. *Post* is not included in the model separately as it is subsumed by the year fixed effects. Detailed definitions of other variables are presented in Table A.I. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1) ROA_t	(2) ROE_t	(3) Sales $Growth_t$
$CNDS_{t-1}$ × Board $Independence_{t-1}$ × Post	0.262**	0.636**	0.071**
	(0.111)	(0.312)	(0.034)
$CNDS_{t-1}$ × Post	-0.205**	-0.409*	-0.036
	(0.092)	(0.240)	(0.028)
Board $Independence_{t-1}$ × Post	-0.035**	-0.137	-0.024***
	(0.015)	(0.113)	(0.009)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	-0.035	-0.292	0.017
	(0.049)	(0.260)	(0.031)
$CNDS_{t-1}$	0.037	0.193	-0.026
	(0.036)	(0.195)	(0.023)
Board $Independence_{t-1}$	0.011	0.406	0.018
	(0.043)	(0.284)	(0.033)
Log(Total $Assets)_{t-1}$	-0.023	0.130	0.001
	(0.025)	(0.180)	(0.018)
$Leverage_{t-1}$	-0.032	-1.009	0.013
	(0.049)	(0.759)	(0.059)
$Growth_{t-1}$	-0.352**	-1.090	0.100
	(0.154)	(0.811)	(0.174)
Cash $Ratio_{t-1}$	0.022	-0.182	-0.038
	(0.075)	(0.330)	(0.049)
Stock $Volatility_{t-1}$	-1.034	6.400	-0.710**
	(0.667)	(4.034)	(0.294)
$SHHI_{t-1}$	0.043	-0.232	-0.050
	(0.045)	(0.258)	(0.037)
Log(Board $Size)_{t-1}$	-0.021	-0.017	-0.042
	(0.031)	(0.242)	(0.030)
Board $Ownership_{t-1}$	-0.045	0.182	-0.093**
	(0.057)	(0.361)	(0.038)
Busy $Board_{t-1}$	0.002	0.191	-0.001
	(0.034)	(0.167)	(0.007)
CEO $Duality_{t-1}$	0.002	0.054	-0.002
	(0.009)	(0.045)	(0.006)
Observations	471	471	471
Adjusted R^2	0.604	0.526	0.377
Year Fixed Effects	Yes	Yes	Yes
Supplier-Customer Pair Fixed Effects	Yes	Yes	Yes

Table V: Is Advising the Main Channel? Evidence from Board Connections

This table presents sub-sample tests of Table II between firms with and without board connection with its customer industry, for the period 1997–2016. A board connection is identified as whether an outside director of a supplier firm is also a board member of a company in the customer's industry. In panel A, customer industry is defined by 2-digit SIC codes. In panel B, customer industry is defined by Fama and French (1997) 10-industry classifications. *CNDS* is an indicator that is equal to one if a firm experiences a negative downstream demand shock, i.e., when the annual detrended percentage change in a given customer company's downstream industry demand is negative. *Board Independence* is the fraction of outside directors on board. Detailed definitions of all variables are presented in Table A.I. All specifications include control variables in Table II except *Busy Board*, year fixed effects, and supplier-customer pair fixed effects. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Connections between Supplier and Customer 2-digit SIC Industries

	ROA_t		ROE_t		Sales $Growth_t$	
	(1) No Connection	(2) Board Connections	(3) No Connection	(4) Board Connections	(5) No Connection	(6) Board Connections
$CNDS_{t-1}$	-0.034**	-0.018	-0.170***	-0.376	-0.046***	-0.107
	(0.017)	(0.043)	(0.052)	(0.240)	(0.015)	(0.121)
Board $Independence_{t-1}$	-0.030	0.009	-0.038	-0.197	-0.060***	-0.160
	(0.024)	(0.051)	(0.078)	(0.364)	(0.019)	(0.163)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.048**	0.015	0.250***	0.506	0.082***	0.127
	(0.023)	(0.057)	(0.075)	(0.337)	(0.019)	(0.147)
Observations	2755	456	2755	456	2755	456
Adjusted R^2	0.574	0.730	0.455	0.346	0.007	0.221
Controls for firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: Connections between Supplier and Customer Fama and French (1997) 10 Industries

	ROA_t		ROE_t		Sales $Growth_t$	
	(1) No Connection	(2) Board Connections	(3) No Connection	(4) Board Connections	(5) No Connection	(6) Board Connections
$CNDS_{t-1}$	-0.036	-0.021	-0.121*	-0.450*	-0.035*	-0.067
	(0.022)	(0.032)	(0.066)	(0.266)	(0.019)	(0.050)
Board $Independence_{t-1}$	-0.033	-0.093**	0.016	-0.473	-0.055**	-0.158
	(0.033)	(0.038)	(0.093)	(0.379)	(0.027)	(0.102)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.055*	0.034	0.194**	0.547	0.071***	0.091
	(0.034)	(0.040)	(0.087)	(0.332)	(0.026)	(0.063)
Observations	2022	1152	2022	1152	2022	1152
Adjusted R^2	0.605	0.551	0.472	0.404	0.014	0.115
Controls for firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes	Yes	Yes	Yes

Table VI: Is Advising the Main Channel? Evidence from Sales Growth Decomposition

This table presents variants to column 3 of Table II. The dependent variables are: *Sales Growth to Given Customer*, defined as annual growth rate of sales to a given customer (%) times 100 divided by total assets, in columns 1 and 4; *Sales Growth to Other Existing Customers*, defined as annual growth rate of sales to other pre-existing customers (%) times 100 divided by total assets, in columns 2 and 5; and *Sales Growth to New Customers*, defined as annual growth rate of sales to new customers (%) times 100 divided by total assets, in columns 3 and 6. *CNDS* is an indicator that is equal to one if a firm experiences a negative downstream demand shock. *Board Independence* is the fraction of outside directors on board. Detailed definitions of other variables are presented in Table A.I. Columns 4–6 report results for the sub-sample of customer-supplier pairs in which customers purchase the largest share of firms' output among all sample customer companies. All specifications include control variables in Table II, year fixed effects, and supplier-customer pair fixed effects, for the period 1997–2016. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Full Sample			Largest Customer Subsample		
	(1)	(2)	(3)	(4)	(5)	(6)
	Sales Growth to Given Customer$_t$	Sales Growth to Other Existing Customers$_t$	Sales Growth to New Customers$_t$	Sales Growth to Given Customer$_t$	Sales Growth to Other Existing Customers$_t$	Sales Growth to New Customers$_t$
CNDS$_{t-1}$	0.004	-0.181*	0.067	-0.029	-0.241*	0.004
	(0.101)	(0.108)	(0.088)	(0.043)	(0.143)	(0.020)
Board Independence$_{t-1}$	-0.057	-0.313*	0.444	-0.053	-0.552	0.015
	(0.171)	(0.186)	(0.381)	(0.049)	(0.440)	(0.028)
CNDS$_{t-1}$ × Board Independence$_{t-1}$	0.013	0.283*	-0.059	0.041	0.468**	0.010
	(0.140)	(0.148)	(0.104)	(0.054)	(0.234)	(0.026)
Observations	2799	1715	2795	1606	557	1606
Adjusted R^2	0.068	0.101	0.122	0.108	0.111	0.066
Controls for firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes	Yes	Yes	Yes

Table VII: The Channel of Impact: Monitoring

This table presents sub-sample tests of Table II. Panel A reports results for firms with top-quartile and bottom-quartile free cash flows (*FCF*). Panel B presents results for firms with top-quartile and bottom-quartile lagged discretionary accruals (*LDA*). Panel C presents results for firms with top-quartile and bottom-quartile G-Index. All for the period 1997–2016. Definitions of all variables are presented in Table A.I. All specifications include controls in Table II, year fixed effects, and supplier-customer pair fixed effects. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Top-quartile Free Cash Flows vs. Bottom-quartile Free Cash Flows

	ROA_t		ROE_t		Sales $Growth_t$	
	(1) High FCF	(2) Low FCF	(3) High FCF	(4) Low FCF	(5) High FCF	(6) Low FCF
$CNDS_{t-1}$	-0.074**	0.056	-0.236**	-0.391	-0.094**	0.035
	(0.038)	(0.072)	(0.116)	(0.259)	(0.045)	(0.042)
Board $Independence_{t-1}$	0.033	0.061	0.250*	0.297	-0.049	0.060
	(0.053)	(0.078)	(0.144)	(0.384)	(0.042)	(0.067)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.098**	-0.023	0.329**	0.653	0.127**	-0.052
	(0.048)	(0.112)	(0.154)	(0.408)	(0.057)	(0.055)
Observations	660	629	660	629	660	629
Adjusted R^2	0.461	0.539	0.633	0.446	0.288	0.290
Controls and Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: Top-quartile Lagged Discretionary Accruals vs. Bottom-quartile Lagged Discretionary Accruals

	ROA_t		ROE_t		Sales $Growth_t$	
	(1) High LDA	(2) Low LDA	(3) High LDA	(4) Low LDA	(5) High LDA	(6) Low LDA
$CNDS_{t-1}$	-0.038*	0.011	-0.091**	-0.524	-0.071*	-0.033
	(0.020)	(0.059)	(0.044)	(0.392)	(0.037)	(0.057)
Board $Independence_{t-1}$	-0.064**	0.091	-0.171***	0.111	-0.106*	-0.084
	(0.026)	(0.112)	(0.062)	(0.620)	(0.061)	(0.061)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.076***	0.001	0.159**	0.699	0.087*	0.108
	(0.028)	(0.084)	(0.062)	(0.518)	(0.048)	(0.068)
Observations	726	683	726	683	726	683
Adjusted R^2	0.611	0.700	0.605	0.445	0.317	-0.037
Controls and Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes	Yes	Yes	Yes

Panel C: Top-quartile G-Index vs. Bottom-quartile G-Index

	ROA_t		ROE_t		Sales $Growth_t$	
	(1) High G-Index	(2) Low G-Index	(3) High G-Index	(4) Low G-Index	(5) High G-Index	(6) Low G-Index
$CNDS_{t-1}$	-0.084**	0.025	-0.302**	-0.194	-0.041*	-0.011
	(0.039)	(0.042)	(0.140)	(0.158)	(0.024)	(0.062)
Board $Independence_{t-1}$	-0.090**	0.115*	-0.231	0.190	-0.008	-0.010
	(0.035)	(0.062)	(0.201)	(0.186)	(0.019)	(0.052)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.114*	-0.028	0.428**	0.179	0.055*	0.011
	(0.060)	(0.067)	(0.215)	(0.230)	(0.033)	(0.081)
Observations	624	640	624	640	625	640
Adjusted R^2	0.597	0.630	0.332	0.589	0.219	0.522
Controls and Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes	Yes	Yes	Yes

Table VIII: Other Possible Channels: Corporate Investments and Innovation

This table reports estimates from regressing corporate investments and innovation on board independence, downstream demand shock, along with the interaction between the two variables, controls, year fixed effects, and supplier-customer pair fixed effects, for the period 1997–2016. Following Chen et al. (2007), Lu and Wang (2015), and Liu et al. (2015), corporate investments and innovation are proxied by: *Growth* as capital expenditures; *RnD* as R&D expenses; *Growth&RnD* as capital expenditures plus R&D expenses; *Asset Growth* as the change in total assets from last year. All these measures are scaled by total assets. *CNDS* is an indicator that is equal to one if a firm experiences a negative downstream demand shock, i.e., when the annual detrended percentage change in a given customer company's downstream industry demand is negative. *Board Independence* is the fraction of outside directors on board. *CNDS* $\times$ *Board Independence* is the main explanatory variable. To control particularly corporate investments and innovation, the model also includes: *Cash Flow* as the sum of net income before extraordinary items, depreciation and amortization expenses, and R&D expenses, scaled by total assets; *InvAssets* as inverse of total assets; *Tangibility* as net property, plant and equipment, scaled by total assets; *Earnings Ratio* as EBITDA scaled by total assets; *Tobin's Q* as market value of total assets to book value of total assets, where the market value of assets is computed as stock price at the end of fiscal year multiplied by the number of common shares outstanding, plus book value of total assets, then minus book value of stockholders' equity. Detailed definitions of other variables are presented in Table A.I. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1) Growth_t	(2) $\text{Growth\&RnD}_t$	(3) RnD_t	(4) Asset Growth_t
CNDS_{t-1}	-0.013	-0.013*	0.005	0.049
	(0.009)	(0.008)	(0.005)	(0.036)
$\text{Board Independence}_{t-1}$	-0.014	-0.010	-0.003	0.103**
	(0.009)	(0.012)	(0.008)	(0.049)
$\text{CNDS}_{t-1} \times \text{Board Independence}_{t-1}$	0.018	0.012	-0.010	-0.037
	(0.010)	(0.010)	(0.007)	(0.049)
Observations	3498	3498	3505	3505
Adjusted R^2	0.774	0.751	0.824	0.321
for firm characteristics	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Supplier-Customer Pair Fixed Effects	Yes	Yes	Yes	Yes

Appendix: Additional Figures and Tables

Figure A.1: Distribution of Change in the Detrended Customer's Downstream Demand

This figure shows the distribution of the detrended change of downstream demand of a customer firm. When this change is negative, *CNDS* = 1. Otherwise, *CNDS* = 0.

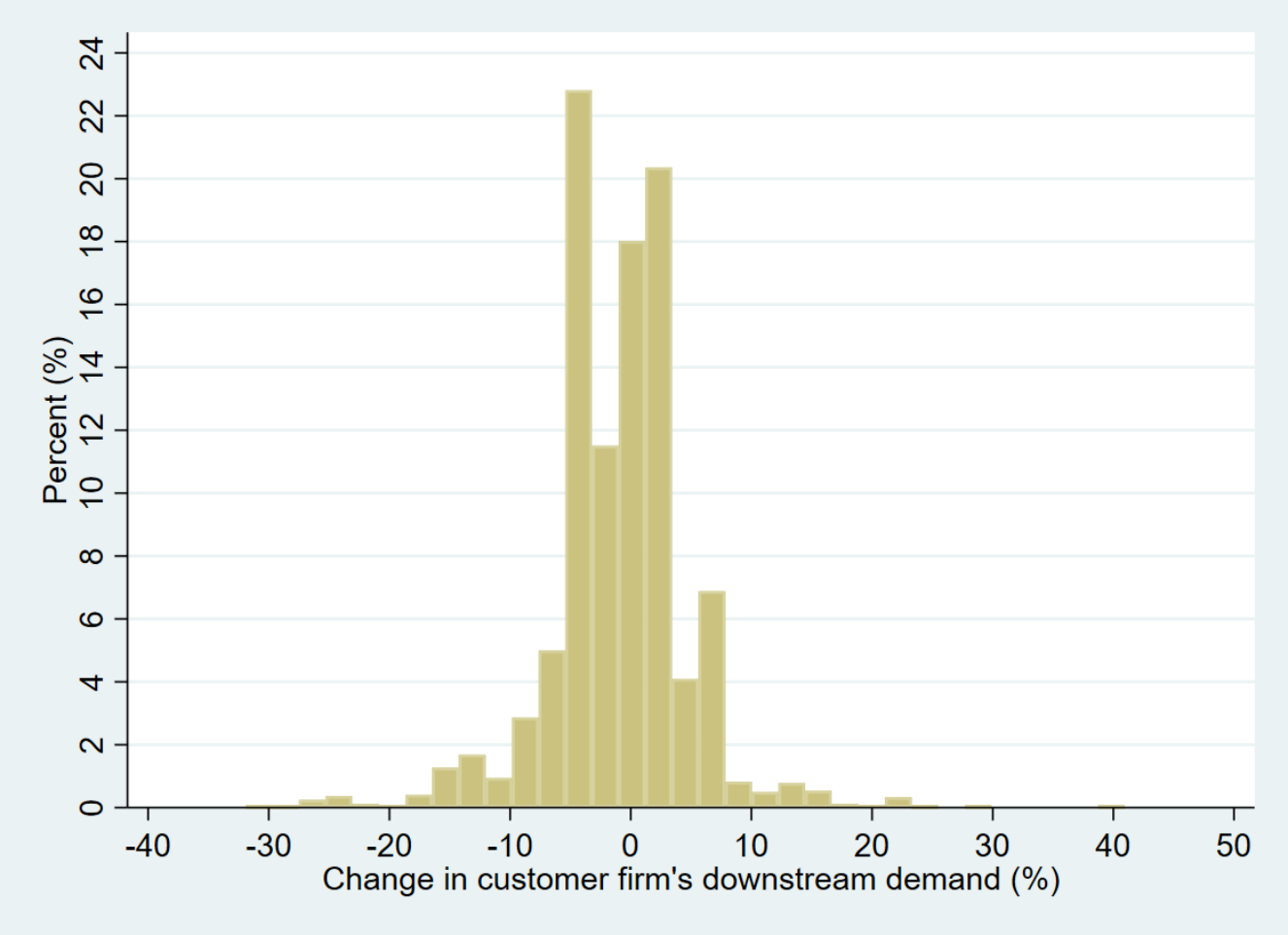
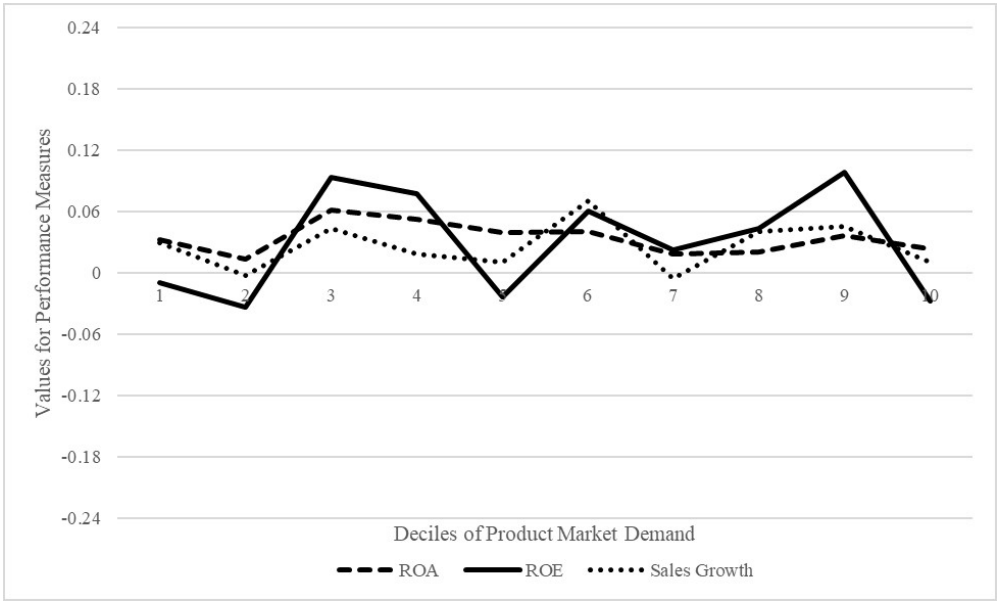
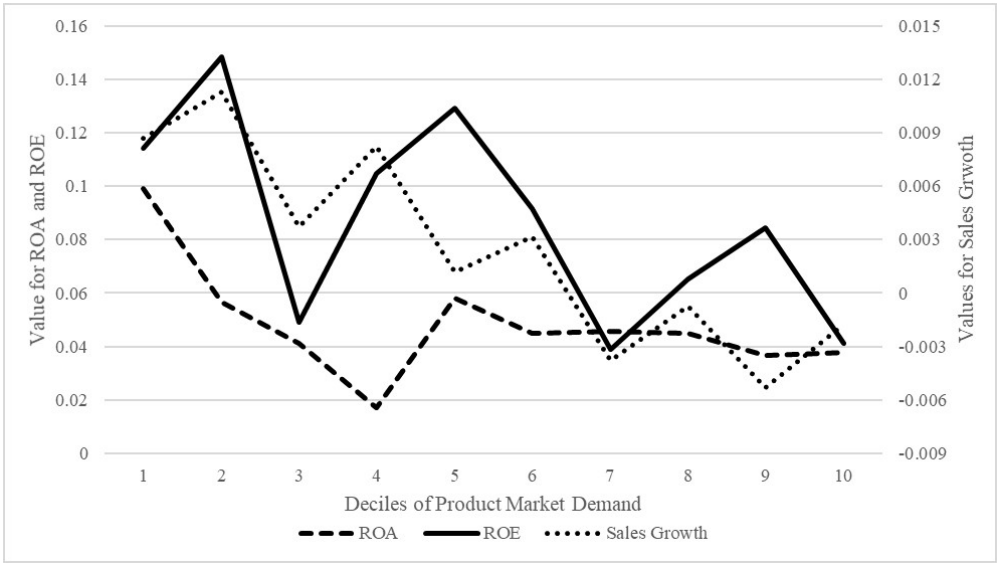


Figure A.2: Firm Performance Distribution across Different Demand Conditions

This figure shows the distribution of firm performance across deciles of product market demand conditions for firms with low and high board independence separately. Firm performance is measured by *ROA*, *ROE*, and *Sales Growth*. Low (high) deciles of demand conditions represent more negative (positive) shock in product market. Panel A (B) gives the distribution for firm with lowest (highest) quartile of board independence. The sample period is 1997–2016.



Panel A: Firms with low board independence



Panel B: Firms with high board independence

Table A.I: Variable Definitions

Variables	Definitions
Panel A: Downstream Demand Shocks (Source: BEA)	
CNDS	Indicator=1 if a firm's given customer company's downstream industry has a negative demand shock in a given year, defined as $CDownDemand < 0$, where *CDownDemand* is annual detrended percentage change in the customer's downstream industry demand, which is the residual from regressing the customer's downstream industry demand on industry and year fixed effects, calculated following Maksimovic and Phillips (2001) and Moon and Phillips (2021). Specifically, downstream industry demand condition is measured by the quantity indexes for gross output by industry from the US Department of Commerce's Bureau of Economic Analysis (BEA). For government, private and foreign sectors demand, we use government expenditures and investment indexes, personal consumption and investment indexes, and exports and imports indexes. Then the downstream industry demand is matched to each customer's industry via the input-output use table from the BEA. To detrend, we regress the raw downstream industry demand on industry and year fixed effects and then take the residuals from the regression.
Panel B: Board Independence and Governance (Source: ISS)	
Board Independence	Fraction of outside directors on the board.
Compensation Full Independence	Indicator that is equal to one if all board members on compensation committee are independent directors.
Female Board Independence	The fraction of female outside directors on the board.
Female Board of Directors	The fraction of female directors on the board.
Non-Coopted Board Independence	Fraction of outside directors on the board who were appointed before the current CEO assumes office (source: Coles et al., 2014).
Nominating Full Independence	Indicator that is equal to one if all board members on nominating committee are independent directors.
Panel C: Operating Performance (Source: Compustat)	
Earnings Ratio	EBITDA divided by total assets.
ROA	Net income divided by total assets.
ROE	Income before extraordinary items divided by total common equity.
Sales Growth	Annual sales growth rate (%) times 100 divided by total assets.
Tobin's Q	Market value of total assets to book value of total assets, where the market value of assets is computed as stock price at the end of fiscal year multiplied by the number of common shares outstanding, plus book value of total assets, then minus book value of stockholders' equity.
Panel D: Other Firm Characteristics	
Asset Growth	Change in total assets from last year divided by total assets.
Board Size	The number of directors on the board (source: ISS; same below).
Board Ownership	Percentage of common shares held by board members.
Busy Board	Indicator that is equal to one if more than half of the directors on the board sit on more than two other outside firms' boards in a given year.

Cash Ratio	Cash divided by total assets.
CEO Duality	Indicator that is equal to one if the CEO also holds the position of chairman of the board.
CEO Tenure	Fiscal year minus the year current CEO began service.
CEO Generalist Ability Index	An index of CEO skills based on principal components analysis to five proxies of general managerial ability based on a CEO past work experience, following Custódio et al. (2013). Higher values indicate higher levels of CEO skills.
CEO salary/stock ratio	The ratio of CEO salary (in $) and stock holdings (in $).
FCF	Free cash flows, computed as (operating income before depreciation − taxes expenses − interest expenses − dividends − capital expenditures)/total assets.
Growth	Capital expenditures divided by total assets.
G-Index	Governance Index to proxy for the level of shareholder rights, where higher values indicate weaker rights, following Gompers et al. (2003).
HHI	Measure for product market competition, computed as the Herfindahl-Hirschman Index of sales for firms in a 4-digit SIC industry.
Info Cost Index	Same as in Duchin et al. (2010).
LDA	Lagged discretionary accruals, where discretionary accruals is the predicted residuals from regressing total accruals on ΔREV, PPE, and a constant, following Dechow et al. (1995). ΔREV is computed as (change in revenue from previous year − change in net receivables from previous year)/total assets in previous year. PPE is gross property, plant, and equipment scaled by total assets in previous year.
Leverage	Total liabilities divided by total assets.
RAC	Residual analyst coverage, measured using the residual from a regression of log(1+N) on log(market value), where N is the amount of analysts issuing one-quarter ahead earnings forecasts in quarter t–1 for firm i, following the procedure in Hong et al. (2000).
RnD	R&D expenses divided by total assets.
SHHI	Measure for product market competition, computed as the Herfindahl-Hirschman Index of sales for firms in a 4-digit SIC industry that supply to a same customer firm, calculated using data from Compustat Customer Segment Files.
Stock Volatility	Standard deviations of daily stock returns in a given year, calculated using CRSP data.
Total Assets	Book value of total assets (in $ millions).
#BH	Number of blockholders who own at least five percent of the firm's shares (source: Thomson Reuters).

Table A.II: Largest Customer Sub-sample and Weighted Average Demand Shock

This table presents robustness checks to Table II where observations are uniquely identified by supplier firm-year combinations for the period 1997–2016. Columns 1–3 report results for the sub-sample of customer-supplier pairs in which customers purchase the largest share of firms' output among all sample customers. In columns 4–6, *Average CNDS* is an indicator that is equal to one if the weighted average detrended percentage change in customer's downstream demand is negative across sample customers of a given firm. The weight equals to the share of a firm's output to a given customer among all sample customers. Definitions of all variables are presented in Table A.I. All specifications include control variables, year fixed effects, and supplier firm fixed effects. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Largest Customer Subsample			Weighted Average Demand Shock		
	(1)	(2)	(3)	(4)	(5)	(6)
	ROA_t	ROE_t	Sales $Growth_t$	ROA_t	ROE_t	Sales $Growth_t$
$CNDS_{t-1}$	-0.028	-0.207***	-0.035			
	(0.022)	(0.080)	(0.024)			
Board $Independence_{t-1}$	-0.019	-0.126	-0.047	-0.008	0.000	-0.031
	(0.027)	(0.109)	(0.029)	(0.023)	(0.076)	(0.024)
$CNDS_{t-1} \times$ Board $Independence_{t-1}$	0.041	0.264**	0.059*			
	(0.028)	(0.110)	(0.031)			
Average $CNDS_{t-1}$				-0.013	-0.121**	-0.033**
				(0.018)	(0.055)	(0.016)
Average $CNDS_{t-1} \times$ Board $Independence_{t-1}$				0.017	0.202**	0.059***
				(0.026)	(0.082)	(0.022)
Log(Total $Assets)_{t-1}$	-0.037***	-0.073*	-0.023***	-0.040***	-0.037	-0.025***
	(0.007)	(0.041)	(0.007)	(0.008)	(0.027)	(0.008)
$Leverage_{t-1}$	0.087***	0.049	0.062*	-0.021	-0.048	-0.010
	(0.025)	(0.213)	(0.034)	(0.025)	(0.135)	(0.024)
$Growth_{t-1}$	-0.056	0.016	-0.012	0.023	0.181	-0.045
	(0.077)	(0.310)	(0.056)	(0.077)	(0.255)	(0.051)
Cash $Ratio_{t-1}$	0.085**	0.093	-0.058	0.071*	0.104	-0.050
	(0.039)	(0.107)	(0.041)	(0.043)	(0.107)	(0.036)
Stock $Volatility_{t-1}$	-0.784*	-2.145	-0.077	-1.421***	-2.038	0.059
	(0.442)	(1.984)	(0.392)	(0.394)	(1.292)	(0.278)
$SHHI_{t-1}$	-0.006	-0.192*	0.003	0.007	-0.034	0.007
	(0.028)	(0.102)	(0.019)	(0.017)	(0.057)	(0.012)
Log(Board $Size)_{t-1}$	-0.019	0.060	0.018	-0.028	-0.043	0.015
	(0.018)	(0.073)	(0.016)	(0.020)	(0.061)	(0.015)
Board $Ownership_{t-1}$	-0.018	0.061	0.013	0.034	0.021	0.060
	(0.041)	(0.173)	(0.049)	(0.030)	(0.101)	(0.046)
Busy $Board_{t-1}$	-0.022	0.087	0.005	-0.007	0.086	0.008
	(0.016)	(0.090)	(0.004)	(0.014)	(0.072)	(0.005)
CEO $Duality_{t-1}$	-0.004	-0.012	-0.005	-0.006	0.008	0.002
	(0.006)	(0.025)	(0.005)	(0.006)	(0.022)	(0.006)
Observations	1859	1859	1859	2641	2641	2641
Adjusted R^2	0.556	0.407	0.066	0.413	0.343	0.171
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Supplier Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Table A.III: Different Performance Measures: Tobin's Q and Earings Ratio

This table presents robustness checks to Table II using alternative performance measures for the period 1997–2016. The dependent variables are: *Tobin's Q*, computed as market-to-book ratio, in column 1; and *Earnings Ratio*, computed as EBITDA divided by total assets, in column 2. *CNDS* is an indicator that is equal to one if a firm experiences a negative downstream demand shock, i.e., when the annual detrended percentage change in a given customer company's downstream industry demand is negative. *Board Independence* is the fraction of outside directors on board. Detailed definitions of other variables are presented in Table A.I. All specifications include control variables in Table II, year fixed effects, and supplier-customer pair fixed effects. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1) Tobin's Q_t	(2) Earnings $Ratio_t$
$CNDS_{t-1}$	-0.607***	-0.021*
	(0.200)	(0.011)
Board $Independence_{t-1}$	-0.510**	0.002
	(0.252)	(0.015)
$CNDS_{t-1} \times$ Board $Independence_{t-1}$	0.748***	0.034**
	(0.244)	(0.015)
$Log(Total\ Assets)_{t-1}$	-0.633***	-0.026***
	(0.080)	(0.005)
$Leverage_{t-1}$	0.104	0.062***
	(0.222)	(0.015)
$Growth_{t-1}$	-0.272	-0.061
	(0.568)	(0.049)
Cash $Ratio_{t-1}$	0.729***	0.018
	(0.254)	(0.018)
Stock $Volatility_{t-1}$	7.790***	-0.792***
	(2.632)	(0.184)
$SHHI_{t-1}$	0.324**	0.003
	(0.136)	(0.011)
$Log(Board\ Size)_{t-1}$	-0.599**	-0.027**
	(0.241)	(0.013)
Board $Ownership_{t-1}$	0.177	-0.061**
	(0.370)	(0.024)
Busy $Board_{t-1}$	-0.155**	-0.011
	(0.076)	(0.008)
CEO $Duality_{t-1}$	-0.029	0.001
	(0.049)	(0.003)
Observations	3440	3440
Adjusted R^2	0.708	0.732
Year Fixed Effects	Yes	Yes
Supplier-Customer Pair Fixed Effects	Yes	Yes

Table A.IV: Non-Coopted Board Independence

This table presents robustness checks to the main results by replacing *Board Independence* with *Non-Coopted Board Independence* following Coles et al. (2014), for the period 1997–2016. *CNDS* is an indicator that is equal to one if a firm experiences a negative downstream demand shock, i.e., when the annual detrended percentage change in a given customer company's downstream industry demand is negative. *Non-Coopted Board Independence* is the fraction of outside directors on the board who were appointed before the current CEO assumes office. All specifications include control variables in the main regression models, year fixed effects, and supplier-customer pair fixed effects. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1) ROA_t	(2) ROE_t	(3) Sales $Growth_t$
$CNDS_{t-1}$	-0.015	-0.059*	-0.013**
	(0.010)	(0.033)	(0.006)
Board $Independence_{t-1}$	-0.016	-0.078	0.022**
	(0.014)	(0.065)	(0.011)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.034*	0.167***	0.050***
	(0.018)	(0.062)	(0.016)
Log(Total $Assets)_{t-1}$	-0.051***	-0.081*	-0.042***
	(0.009)	(0.044)	(0.013)
$Leverage_{t-1}$	0.084***	-0.065	0.070**
	(0.027)	(0.193)	(0.033)
$Growth_{t-1}$	-0.150*	-0.096	-0.158**
	(0.082)	(0.293)	(0.078)
Cash $Ratio_{t-1}$	0.041	-0.041	-0.112**
	(0.040)	(0.134)	(0.055)
Stock $Volatility_{t-1}$	-0.369	-2.079	0.105
	(0.395)	(1.645)	(0.339)
$SHHI_{t-1}$	0.029	-0.191*	0.002
	(0.018)	(0.111)	(0.013)
Log(Board $Size)_{t-1}$	-0.004	-0.061	0.026
	(0.020)	(0.071)	(0.019)
Board $Ownership_{t-1}$	-0.044	0.125	0.094
	(0.037)	(0.216)	(0.086)
Busy $Board_{t-1}$	-0.017	0.073	0.012**
	(0.014)	(0.078)	(0.005)
CEO $Duality_{t-1}$	0.001	0.014	-0.004
	(0.005)	(0.026)	(0.006)
Observations	2234	2234	2234
Adjusted R^2	0.620	0.385	0.054
Year Fixed Effects	Yes	Yes	Yes
Supplier-Customer Pair Fixed Effects	Yes	Yes	Yes

Table A.V: Female Directors on the Board

This table presents robustness checks to the main results by replacing *Board Independence* with proxies for female board representation. Particularly, the model includes: *Female Board of Directors* as the fraction of female directors on the board; and *Female Board Independence* as the fraction of female outside directors on the board. *CNDS* is an indicator that is equal to one if a firm experiences a negative downstream demand shock, i.e., when the annual detrended percentage change in a given customer company's downstream industry demand is negative. *CNDS* × *Female Board of Directors* and *CNDS* × *Female Board Independence* are the main explanatory variables. Detailed definitions of other variables are presented in Table A.I, and regressions are for the period 1997–2016. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Female Board of Directors			Female Board Independence		
	(1)	(2)	(3)	(4)	(5)	(6)
	ROA_t	ROE_t	Sales $Growth_t$	ROA_t	ROE_t	Sales $Growth_t$
$CNDS_{t-1}$	0.019	0.008	0.005	0.020	0.015	0.006
	(0.014)	(0.024)	(0.012)	(0.013)	(0.024)	(0.011)
Female board of $directors_{t-1}$	0.066	0.310*	-0.017			
	(0.056)	(0.168)	(0.074)			
$CNDS_{t-1}$ × Female board of $directors_{t-1}$	-0.077	0.107	0.075			
	(0.057)	(0.191)	(0.077)			
Female board $independence_{t-1}$				0.045	0.210	-0.008
				(0.036)	(0.123)	(0.051)
$CNDS_{t-1}$ × Female board $independence_{t-1}$				-0.070	0.032	0.053
				(0.043)	(0.164)	(0.057)
Log(Total $Assets)_{t-1}$	-0.051***	-0.066*	-0.033**	-0.050***	-0.065*	-0.033**
	(0.010)	(0.032)	(0.014)	(0.010)	(0.033)	(0.014)
$Leverage_{t-1}$	0.071**	-0.080	0.057	0.070**	-0.083	0.057
	(0.031)	(0.127)	(0.047)	(0.031)	(0.126)	(0.047)
$Growth_{t-1}$	-0.123	-0.152	-0.011	-0.125	-0.149	-0.010
	(0.091)	(0.227)	(0.058)	(0.090)	(0.228)	(0.058)
Cash $Ratio_{t-1}$	0.094*	0.029	-0.068	0.094*	0.031	-0.068
	(0.052)	(0.089)	(0.047)	(0.052)	(0.090)	(0.048)
Stock $Volatility_{t-1}$	-0.703	-1.556	0.136	-0.707	-1.508	0.143
	(0.551)	(1.589)	(0.341)	(0.552)	(1.573)	(0.343)
$SHHI_{t-1}$	-0.005	-0.142	-0.010	-0.005	-0.141	-0.011
	(0.017)	(0.090)	(0.014)	(0.017)	(0.091)	(0.014)
Log(Board $Size)_{t-1}$	0.011	0.041	0.035	0.011	0.041	0.035
	(0.038)	(0.080)	(0.027)	(0.038)	(0.080)	(0.027)
Board $Ownership_{t-1}$	-0.031	0.028	0.048	-0.029	0.028	0.047
	(0.030)	(0.101)	(0.075)	(0.030)	(0.098)	(0.074)
Busy $Board_{t-1}$	-0.013	0.073	0.005	-0.013	0.071	0.005
	(0.012)	(0.065)	(0.005)	(0.012)	(0.064)	(0.005)
CEO $Duality_{t-1}$	0.000	0.008	-0.000	0.001	0.009	-0.000
	(0.005)	(0.027)	(0.007)	(0.005)	(0.027)	(0.007)
Observations	3435	3435	3435	3433	3433	3433
Adjusted R^2	0.504	0.387	0.192	0.504	0.386	0.192
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Supplier Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Table A.VI: Shock severity: CNDS Quartile Analysis

This table presents variants to Table II. Columns 1–3 of panel A present results for bottom-quartile demand shocks conditional on negative demand shocks. *CNDS Quartile* is an indicator that is equal to one if, conditional on a negative demand shock (*CNDS*=1), the annual detrended percentage change in a given customer company's downstream industry demand is less than the 25th percentile, and equalling zero if there is no negative demand shock (*CNDS*=0). *CNDS* is an indicator that is equal to one when the detrended change in downstream demand is negative. *CNDS Quartile* in other columns are constructed via the same method. In other words, the bottom quartile captures the most severe demand shocks and the top quartile captures the least severe demand shocks. The sample is restricted to firms that have both one and zero values of *CNDS Quartile* in different years. *Board Independence* is the fraction of outside directors on board. All specifications include controls, year fixed effects, and supplier-customer pair fixed effects, and for the period 1997–2016. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Bottom and Second Quartile Demand Shocks Conditional on Negative Demand Shocks

	Bottom Quartile			Second Quartile		
	(1)	(2)	(3)	(4)	(5)	(6)
	ROA_t	ROE_t	Sales $Growth_t$	ROA_t	ROE_t	Sales $Growth_t$
CNDS $Quartile_{t-1}$	0.056	0.168	-0.049	-0.078***	-0.175**	-0.030*
	(0.057)	(0.169)	(0.045)	(0.025)	(0.086)	(0.018)
Board $Independence_{t-1}$	-0.092	-0.208	-0.036	-0.028	-0.219	-0.048
	(0.087)	(0.271)	(0.065)	(0.029)	(0.153)	(0.048)
CNDS $Quartile_{t-1}$ × Board $Independence_{t-1}$	-0.027	-0.031	0.092	0.083***	0.222*	0.039*
	(0.079)	(0.224)	(0.063)	(0.031)	(0.122)	(0.022)
Observations	500	500	500	649	649	649
Adjusted R^2	0.489	0.413	0.122	0.622	0.539	0.239
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: Third and Top Quartile Demand Shocks Conditional on Negative Demand Shocks

	Third Quartile			Top Quartile		
	(1)	(2)	(3)	(4)	(5)	(6)
	ROA_t	ROE_t	Sales $Growth_t$	ROA_t	ROE_t	Sales $Growth_t$
CNDS $Quartile_{t-1}$	-0.102*	-0.220*	-0.048*	0.002	-0.102	-0.022
	(0.061)	(0.124)	(0.029)	(0.025)	(0.074)	(0.028)
Board $Independence_{t-1}$	0.018	0.066	-0.024	0.039	0.166	0.046
	(0.061)	(0.123)	(0.045)	(0.037)	(0.126)	(0.048)
CNDS $Quartile_{t-1}$ × Board $Independence_{t-1}$	0.136*	0.294*	0.060*	0.012	0.131	0.038
	(0.077)	(0.160)	(0.036)	(0.031)	(0.085)	(0.036)
Observations	770	770	770	740	740	740
Adjusted R^2	0.272	0.457	0.057	0.666	0.585	0.217
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Table A.VII: Customer Resilience

This table presents sub-sample tests of Table II. The two panels report results for firms with top-quartile and bottom-quartile customers' free cash flows (*FCF*) and customers' lagged discretionary accruals (*LDA*). Definitions of all variables are presented in Table A.I. All specifications include controls in Table II, year fixed effects, and supplier-customer pair fixed effects, and for the period 1997–2016. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Top-quartile Customer Free Cash Flows vs. Bottom-quartile Customer Free Cash Flows

	ROA_t		ROE_t		Sales $Growth_t$	
	(1) High FCF	(2) Low FCF	(3) High FCF	(4) Low FCF	(5) High FCF	(6) Low FCF
$CNDS_{t-1}$	-0.083**	-0.016	-0.225**	-0.119	-0.065*	-0.005
	(0.034)	(0.036)	(0.104)	(0.092)	(0.038)	(0.035)
Board $Independence_{t-1}$	-0.050	-0.018	-0.024	0.070	-0.021	0.013
	(0.042)	(0.063)	(0.133)	(0.202)	(0.039)	(0.049)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.097**	0.029	0.289**	0.110	0.098**	0.013
	(0.045)	(0.052)	(0.145)	(0.142)	(0.049)	(0.039)
Observations	668	931	668	931	668	931
Adjusted R^2	0.757	0.522	0.483	0.348	0.163	0.149
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: Top-quartile vs. Bottom-quartile Customer Lagged Discretionary Accruals

	ROA_t		ROE_t		Sales $Growth_t$	
	(1) High LDA	(2) Low LDA	(3) High LDA	(4) Low LDA	(5) High LDA	(6) Low LDA
$CNDS_{t-1}$	-0.021	-0.112	-0.146**	-0.311	-0.026	0.030
	(0.026)	(0.069)	(0.065)	(0.225)	(0.024)	(0.029)
Board $Independence_{t-1}$	-0.042	-0.105	-0.038	-0.110	-0.033	-0.051
	(0.047)	(0.100)	(0.110)	(0.405)	(0.043)	(0.043)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.067**	0.148	0.275***	0.316	0.065**	-0.036
	(0.034)	(0.096)	(0.101)	(0.302)	(0.030)	(0.037)
Observations	708	649	708	649	708	649
Adjusted R^2	0.390	0.666	0.366	0.566	0.293	0.130
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes	Yes	Yes	Yes

Table A.VIII: Firm Heterogeneity: Constrained Environment

This table presents sub-sample tests of Table II. The three panels report sub-sample results for small firms (bottom-quartile total assets) vs. large firms (top-quartile total assets), firms with top-quartile growth vs. bottom-quartile growth, and high risk (top-quartile stock volatility) vs. low risk firms (bottom-quartile stock volatility). Detailed definitions of all variables are presented in Table A.I. All specifications include control variables in Table II, year fixed effects, and supplier-customer pair fixed effects, and for the period 1997–2016. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Bottom-quartile Firm Size vs. Top-quartile Firm Size

	ROA_t		ROE_t		Sales $Growth_t$	
	(1) Small Firm	(2) Large Firm	(3) Small Firm	(4) Large Firm	(5) Small Firm	(6) Large Firm
$CNDS_{t-1}$	-0.088*	-0.030	-0.316***	-0.029	-0.095*	-0.002
	(0.052)	(0.027)	(0.121)	(0.124)	(0.053)	(0.002)
Board $Independence_{t-1}$	-0.020	0.007	-0.048	0.097	-0.055	-0.004*
	(0.085)	(0.023)	(0.230)	(0.146)	(0.079)	(0.003)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.172*	0.056	0.584***	0.045	0.236***	0.004
	(0.101)	(0.039)	(0.216)	(0.144)	(0.078)	(0.002)
Observations	785	882	785	882	785	882
Adjusted R^2	0.457	0.589	0.335	0.344	0.234	0.319
Controls and Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: Top-quartile Growth vs. Bottom-quartile Growth

	ROA_t		ROE_t		Sales $Growth_t$	
	(1) High Growth	(2) Low Growth	(3) High Growth	(4) Low Growth	(5) High Growth	(6) Low Growth
$CNDS_{t-1}$	-0.070	0.031	-0.314*	0.037	-0.050*	-0.008
	(0.044)	(0.033)	(0.177)	(0.068)	(0.028)	(0.041)
Board $Independence_{t-1}$	-0.070	0.008	0.159	-0.020	-0.042*	0.030
	(0.049)	(0.063)	(0.197)	(0.130)	(0.024)	(0.048)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.132**	-0.028	0.433*	0.023	0.063*	0.014
	(0.064)	(0.040)	(0.257)	(0.094)	(0.037)	(0.051)
Observations	711	762	653	732	653	732
Adjusted R^2	0.688	0.693	0.454	0.448	0.269	0.389
Controls and Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes	Yes	Yes	Yes

Panel C: Top-quartile Risk (Stock Volatility) vs. Bottom-quartile Risk (Stock Volatility)

	ROA_t		ROE_t		Sales $Growth_t$	
	(1) High Risk	(2) Low Risk	(3) High Risk	(4) Low Risk	(5) High Risk	(6) Low Risk
$CNDS_{t-1}$	-0.146*	0.011	-0.375*	-0.257	-0.150*	-0.003
	(0.080)	(0.019)	(0.225)	(0.170)	(0.077)	(0.012)
Board $Independence_{t-1}$	-0.063	-0.012	0.503*	-0.170	-0.072	0.012
	(0.108)	(0.024)	(0.299)	(0.230)	(0.101)	(0.013)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.345**	-0.016	0.698*	0.340	0.342***	0.004
	(0.161)	(0.024)	(0.404)	(0.234)	(0.125)	(0.015)
Observations	643	833	643	833	643	833
Adjusted R^2	0.421	0.607	0.290	0.504	0.143	0.324
Controls and Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes	Yes	Yes	Yes

Table A.IX: The Impact of Product Market Competition

This table presents sub-sample tests of Table II. Columns 1, 4, 7 of panel A report sub-sample results for high product market competition (*SHHI* belongs to the bottom quartile, where *SHHI* is defined as the Herfindahl-Hirschman Index of sales for firms in a 4-digit SIC industry that supply to a same customer firm). Columns 2, 5, 8 of panel A present sub-sample results for medium product market competition. (*SHHI* is in between the bottom quartile and the top quartile). Columns 3, 6, 9 of panel B report sub-sample results for low product market competition (*SHHI* belongs to the top quartile). In panel B, the measure for competition is replaced with the Herfindahl-Hirschman Index of sales for firms in a 4-digit SIC industry (*HHI*). Detailed definitions of other variables are presented in Table A.I. All specifications include control variables in Table II, year fixed effects, and supplier-customer pair fixed effects, and for the period 1997–2016. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Competition between Firms Supplying to the Same Customer

	ROA_t			ROE_t			Sales $Growth_t$		
	(1) Low SHHI	(2) Mid SHHI	(3) High SHHI	(4) Low SHHI	(5) Mid SHHI	(6) High SHHI	(7) Low SHHI	(8) Mid SHHI	(9) High SHHI
$CNDS_{t-1}$	-0.019	-0.147***	-0.047**	-0.094	-0.495***	-0.140*	-0.013	-0.035	-0.020
	(0.022)	(0.055)	(0.023)	(0.111)	(0.144)	(0.084)	(0.012)	(0.026)	(0.031)
Board $Independence_{t-1}$	-0.033	-0.044	-0.074**	0.161	-0.230	-0.180	-0.016	-0.106**	-0.012
	(0.030)	(0.063)	(0.033)	(0.173)	(0.226)	(0.124)	(0.017)	(0.041)	(0.046)
$CNDS_{t-1} \times$ Board $Independence_{t-1}$	0.034	0.193**	0.073**	0.233	0.592***	0.194*	0.031*	0.063*	0.042
	(0.033)	(0.086)	(0.030)	(0.173)	(0.210)	(0.109)	(0.017)	(0.038)	(0.039)
Observations	1106	702	1301	1106	702	1301	1042	667	1214
Adjusted R^2	0.722	0.367	0.512	0.468	0.484	0.313	0.294	0.093	0.094
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: Competition between Firms in the Same Industry

	ROA_t			ROE_t			Sales $Growth_t$		
	(1) Low HHI	(2) Mid HHI	(3) High HHI	(4) Low HHI	(5) Mid HHI	(6) High HHI	(7) Low HHI	(8) Mid HHI	(9) High HHI
$CNDS_{t-1}$	-0.026	-0.079***	0.019	-0.198	-0.167***	-0.138	0.006	-0.054**	0.006
	(0.069)	(0.024)	(0.027)	(0.203)	(0.061)	(0.116)	(0.028)	(0.026)	(0.034)
Board $Independence_{t-1}$	0.038	-0.093***	-0.004	0.266	0.059	-0.482**	-0.006	-0.083**	0.021
	(0.070)	(0.034)	(0.041)	(0.314)	(0.092)	(0.218)	(0.030)	(0.035)	(0.032)
$CNDS_{t-1} \times$ Board $Independence_{t-1}$	0.119	0.105***	-0.002	0.398	0.240***	0.223	0.032	0.083**	0.005
	(0.137)	(0.033)	(0.032)	(0.337)	(0.087)	(0.156)	(0.055)	(0.033)	(0.036)
Observations	770	1647	793	770	1647	793	741	1545	722
Adjusted R^2	0.415	0.633	0.487	0.441	0.361	0.408	0.011	0.199	0.542
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Internet Appendix: Additional Tables

Table IA.I: Summary Statistics of Customer Firms

This table reports summary statistics for customer firms. The sample consists of US public firms during the period 1997–2016 with available financial data, board data, and information on firms' relationships with US public customer companies. All variables are computed using characteristics of customer companies. Main variables include: *ROA*, computed as net income divided by total assets; *ROE*, computed as income before extraordinary items divided by total common equity; and *Sales Growth*, computed as annual sales growth rate (%) times 100 divided by total assets. Mean, standard deviation (Std. Dev.), the first quartile ($p25$), median, and the third quartile ($p75$) of the variables are reported.

	(1) Mean	(2) Std. Dev.	(3) $p25$	(4) Median	(5) $p75$
ROA	0.034	0.080	0.030	0.032	0.048
ROE	0.113	0.275	0.079	0.154	0.211
Sales Growth	0.001	0.041	0.000	0.000	0.000
Total Assets (in $ millions)	45194.215	74924.329	13879.752	37860.894	53534.000
Leverage	0.651	0.164	0.557	0.696	0.766
Growth	0.039	0.028	0.022	0.038	0.042
Cash Ratio	0.069	0.059	0.040	0.057	0.079
Stock Volatility	0.022	0.012	0.014	0.019	0.026
Board Independence	0.761	0.141	0.667	0.800	0.889
Board Size	10.881	2.073	10.000	11.000	12.000
Observations	3972				

Table IA.II: External Scrutiny: Residual Analyst Coverage and Number of Blockholders

Panel A reports results for firms with top-quartile and bottom-quartile residual analyst coverage (*RAC*) for the period 1997–2016. Panel B presents results for firms with top-quartile and bottom-quartile number of blockholders (*#BH*). Regression 1 in both panels presents sub-sample tests of Table II excluding *Board Independence* and *CNDS* × *Board Independence*. Regression 2 in both panels presents sub-sample tests of Table II. Definitions of all variables are presented in Table A.I. All specifications include controls in Table II, year fixed effects, and supplier-customer pair fixed effects. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Top-quartile Residual Analyst Coverage vs. Bottom-quartile Residual Analyst Coverage

	ROA_t		ROE_t		Sales $Growth_t$	
	(1) High RAC	(2) Low RAC	(3) High RAC	(4) Low RAC	(5) High RAC	(6) Low RAC
Regression 1: CNDS, Controls, Year FE, and Supplier-Customer Pair FE Included as Independent Variables						
$CNDS_{t-1}$	0.024	-0.005	0.075	-0.012	-0.000	-0.001
	(0.015)	(0.007)	(0.078)	(0.016)	(0.004)	(0.011)
Adjusted R^2	0.669	0.701	0.407	0.540	0.776	0.306
Regression 2: Board Independence and CNDS × Board Independence Also Included as Independent Variables						
$CNDS_{t-1}$	-0.158***	-0.008	-0.784***	-0.088	-0.032**	0.032
	(0.049)	(0.026)	(0.218)	(0.071)	(0.015)	(0.066)
$Board\ Independence_{t-1}$	0.102**	-0.094***	0.103	-0.143	0.012	0.054
	(0.047)	(0.034)	(0.273)	(0.100)	(0.022)	(0.083)
$CNDS_{t-1} \times Board\ Independence_{t-1}$	0.258***	0.004	1.229***	0.103	0.038*	-0.045
	(0.078)	(0.038)	(0.383)	(0.101)	(0.021)	(0.082)
Adjusted R^2	0.688	0.708	0.428	0.540	0.775	0.305
Observations	662	644	662	644	662	644
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: Top-quartile Number of Blockholders vs. Bottom-quartile Number of Blockholders

	ROA_t		ROE_t		Sales $Growth_t$	
	(1) High #BH	(2) Low #BH	(3) High #BH	(4) Low #BH	(5) High #BH	(6) Low #BH
Regression 1: CNDS, Controls, Year FE, and Supplier-Customer Pair FE Included as Independent Variables						
$CNDS_{t-1}$	0.008	-0.005	0.031	-0.001	0.004	-0.003
	(0.015)	(0.007)	(0.032)	(0.023)	(0.007)	(0.009)
Adjusted R^2	0.467	0.755	0.331	0.556	0.243	0.258
Regression 2: Board Independence and CNDS × Board Independence Also Included as Independent Variables						
$CNDS_{t-1}$	-0.119*	0.020	-0.302*	0.008	-0.053*	-0.051
	(0.066)	(0.029)	(0.154)	(0.087)	(0.031)	(0.036)
$Board\ Independence_{t-1}$	-0.058	-0.028	-0.016	-0.038	-0.001	-0.063
	(0.086)	(0.027)	(0.159)	(0.111)	(0.055)	(0.063)
$CNDS_{t-1} \times Board\ Independence_{t-1}$	0.164*	-0.035	0.450**	-0.012	0.072*	0.068
	(0.092)	(0.037)	(0.202)	(0.110)	(0.042)	(0.042)
Adjusted R^2	0.465	0.756	0.333	0.554	0.236	0.259
Observations	718	644	718	644	718	644
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes	Yes	Yes	Yes

Table IA.III: Analyses on CEO Risk Aversion/Seeking

This table reports estimates from regressing firm performance on board independence, downstream demand shock, along with the interaction between the two variables, controls, year fixed effects, and supplier-customer pair fixed effects. The sample period is 1997–2016. The analyses use subsample analysis regarding CEO tenure and CEO salary/stock ratio, both are related to the risk aversion of managers (e.g., Harris and Weiss, 1984; Hermalin and Weisbach, 1998; Milidonis and Stathopoulos, 2014). In Panel A, the sample is split according to whether the CEO tenure length is longer or shorter than the sample median. In Panel B, observation are split into those with CEOs having salary-to-stock ratio below or above the sample median. *CNDS* is an indicator that is equal to one if a firm experiences a negative downstream demand shock. *Board Independence* is the fraction of outside directors on board. *CNDS* × *Board Independence* is the main explanatory variable. Detailed definitions of all variables are presented in Table A.I. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Subsample comparison by CEO Tenure

	ROA_t		ROE_t		Sales $Growth_t$	
	(1) Long Tenure	(2) Short Tenure	(3) Long Tenure	(4) Short Tenure	(5) Long Tenure	(6) Short Tenure
$CNDS_{t-1}$	-0.060**	-0.032	-0.285***	-0.070	-0.051**	-0.016
	(0.027)	(0.023)	(0.096)	(0.074)	(0.024)	(0.016)
Board $Independence_{t-1}$	0.052	-0.080***	-0.002	-0.077	-0.019	-0.037*
	(0.045)	(0.026)	(0.161)	(0.105)	(0.043)	(0.020)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.111**	0.072**	0.466***	0.153	0.100***	0.049**
	(0.047)	(0.033)	(0.149)	(0.101)	(0.034)	(0.023)
Observations	1689	1523	1689	1523	1689	1523
Adjusted R^2	0.464	0.597	0.369	0.509	0.314	0.028
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: Subsample comparison by Salary/stock ratio of CEO

	ROA_t		ROE_t		Sales $Growth_t$	
	(1) low ratio	(2) high ratio	(3) low ratio	(4) high ratio	(5) low ratio	(6) high ratio
$CNDS_{t-1}$	-0.122**	-0.062	-0.606*	-0.381	-0.020	0.000
	(0.060)	(0.053)	(0.358)	(0.243)	(0.024)	(0.027)
Board $Independence_{t-1}$	-0.150**	-0.023	0.066	-0.435	-0.068*	-0.033
	(0.068)	(0.053)	(0.456)	(0.387)	(0.037)	(0.032)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.156**	0.043	0.909**	0.436	0.056**	0.011
	(0.074)	(0.066)	(0.455)	(0.291)	(0.028)	(0.036)
Observations	870	822	814	749	849	800
Adjusted R^2	0.102	0.112	0.429	0.341	-0.034	0.125
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes	Yes	Yes	Yes

Table IA.IV: Estimates from Dynamic GMM Regression Model Regarding Endogeneity Issue

This table presents robustness checks to Table II using dynamic GMM regressions of firm performance on *CNDS* × *Board Independence*. The lags of *ROA*, *ROE*, *Sales Growth*, *CNDS*, *Board Independence*, *CNDS* × *Board Independence*, and control variables are included as a part of the dynamic GMM model for the period 1997–2016. Variable definitions are available in Table A.I. Observations are at the firm-year level. Standard errors (in parentheses) are robust and adjusted for clustering within firm. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively. AR(1) and AR(2) are the tests for the first- and second-order serial correlations in the first-differenced residuals, under the null of no serial correlation. The Hansen test of over-identification is under the null that all instruments are valid. The Diff-in-Hansen test of exogeneity is under the null that instruments used for the equations in levels are exogenous.

	(1) ROA_t	(2) ROE_t	(3) Sales $Growth_t$
$CNDS_{t-1}$	-0.326**	-0.462**	-0.100*
	(0.148)	(0.217)	(0.055)
Board $Independence_{t-1}$	-0.598***	-0.860***	-0.117
	(0.189)	(0.313)	(0.082)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.491**	0.640**	0.130*
	(0.199)	(0.283)	(0.067)
Log(Total $Assets)_{t-1}$	-0.002	0.0150	-0.019*
	(0.033)	(0.042)	(0.011)
$Leverage_{t-1}$	0.141	-0.010	-0.008
	(0.099)	(0.221)	(0.043)
$Growth_{t-1}$	0.252	0.409	-0.118
	(0.404)	(0.529)	(0.115)
Cash $Ratio_{t-1}$	0.317*	0.172	-0.002
	(0.174)	(0.223)	(0.056)
Stock $Volatility_{t-1}$	0.832	-3.654	-0.572
	(1.383)	(2.568)	(0.646)
$SHHI_{t-1}$	0.050	-0.100	0.012
	(0.077)	(0.123)	(0.026)
Log(Board $Size)_{t-1}$	0.117	-0.059	0.047
	(0.088)	(0.132)	(0.031)
Board $Ownership_{t-1}$	-0.251	-0.418	0.025
	(0.181)	(0.369)	(0.104)
Busy $Board_{t-1}$	0.002	-0.013	0.025
	(0.040)	(0.090)	(0.021)
CEO $Duality_{t-1}$	0.006	-0.051	0.005
	(0.025)	(0.042)	(0.012)
ROA_{t-1}	0.183		
	(0.174)		
ROA_{t-2}	0.097		
	(0.142)		
ROA_{t-3}	0.114**		
	(0.048)		
ROE_{t-1}		-0.165	
		(0.140)	
Sales $Growth_{t-1}$			-0.158
			(0.105)
Sales $Growth_{t-2}$			0.088
			(0.106)
Lagging Period for Instruments	4 to 12 years	3 to 12 years	5 to 12 years
Observations	2176	3982	2878
Year Dummies	Yes	Yes	Yes
AR(1) Test (p-value)	0.015	0.024	0.089
AR(2) Test (p-value)	0.101	0.104	0.295
Hansen Over-Identification (p-value)	0.336	0.33	0.192
Diff-in-Hansen Exogeneity Test (p-value)	0.251	0.119	0.261

Table IA.V: Excess Firm Performance

This table presents robustness checks to Table II using a similar approach to Faleye et al. (2011) for the period 1997–2016. Panel A reports results from regressing firm performance on control variables. Panel B presents results from regressing excess firm performance on an indicator for demand shock, the fraction of outside directors, and the interaction term. Dependent variables in columns 1, 3, and 5 are actual residuals from panel A regressions. Dependent variables in columns 2, 4, and 6 are indicators that is equal to one if actual residuals are positive. Detailed definitions of all variables are presented in Table A.I. All specifications include year fixed effects and supplier-customer pair fixed effects. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Baseline Regressions

	(1) ROA_t	(2) ROE_t	(3) Sales $Growth_t$
$Log(Total\ Assets)_{t-1}$	-0.052***	-0.070***	-0.034***
	(0.007)	(0.026)	(0.008)
$Leverage_{t-1}$	0.059***	-0.094	0.042*
	(0.020)	(0.123)	(0.022)
$Growth_{t-1}$	-0.100*	-0.113	-0.017
	(0.060)	(0.199)	(0.049)
$Cash\ Ratio_{t-1}$	0.098**	0.055	-0.061*
	(0.040)	(0.097)	(0.037)
$Stock\ Volatility_{t-1}$	-0.553	-1.235	0.118
	(0.337)	(1.157)	(0.313)
$SHHI_{t-1}$	-0.004	-0.118*	-0.008
	(0.016)	(0.065)	(0.011)
$Log(Board\ Size)_{t-1}$	0.016	0.054	0.039**
	(0.022)	(0.057)	(0.015)
$Board\ Ownership_{t-1}$	-0.038	-0.008	0.031
	(0.025)	(0.095)	(0.044)
$Busy\ Board_{t-1}$	-0.012	0.061	0.006*
	(0.011)	(0.055)	(0.003)
$CEO\ Duality_{t-1}$	0.001	0.007	-0.000
	(0.004)	(0.017)	(0.004)
Constant	0.365***	0.606***	0.166***
	(0.059)	(0.188)	(0.049)
Observations	3744	3744	3744
Adjusted R^2	0.500	0.387	0.190
Year FE	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes

Panel B: Excess Firm Performance

	(1) Excess ROA_t	(2) Dummy=1 if Excess $ROA_t > 0$	(3) Excess ROE_t	(4) Dummy=1 if Excess $ROE_t > 0$	(5) Excess Sales $Growth_t$	(6) Dummy=1 if Excess Sales $Growth_t > 0$
$CNDS_{t-1}$	-0.021	-0.252**	-0.097**	-0.177	-0.032***	-0.336***
	(0.014)	(0.123)	(0.042)	(0.117)	(0.012)	(0.115)
$Board\ Independence_{t-1}$	-0.018	0.232	0.039	0.342**	-0.026	-0.385**
	(0.019)	(0.153)	(0.062)	(0.152)	(0.018)	(0.152)
$CNDS_{t-1} \times Board\ Independence_{t-1}$	0.035*	0.321**	0.148***	0.271*	0.054***	0.534***
	(0.019)	(0.163)	(0.057)	(0.156)	(0.015)	(0.151)
Observations	3440	3440	3440	3440	3440	3440
Adjusted R^2	0.031	0.117	0.033	0.162	0.055	0.208
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes	Yes	Yes	Yes

Table IA.VI: Cross-Sectional Logistics Approach

This table presents robustness checks to Table II using an cross-sectional logistics approach for the period 1997–2016. In column 1, the dependent variable is an indicator that is equal to one if $\Delta Mean(ROA)$ is greater than zero. $\Delta Mean(ROA)$ is calculated as $Mean(ROA, CNDS = 1)$ minus $Mean(ROA, CNDS = 0)$, where $Mean(ROA, CNDS = 1)$ is the mean value of *ROA* for a given firm across all years when the firm faces negative downstream demand shocks (when *CNDS* equals one), and $Mean(ROA, CNDS = 0)$ is the mean value of *ROA* for a given firm across all years when that firm does not face negative downstream demand shocks (when *CNDS* equals zero). The remaining dependent variables are constructed via the same method. $Mean(Board\ Independence)$ is the mean value of the fraction of outside directors on the board for a given firm across all years when that firm faces negative downstream demand shocks (when *CNDS* equals one). All specifications include mean values of control variables in Table II as well as the mean value of CEO tenure. Detailed definitions of other variables are presented in Table A.I. Exponential coefficient estimates (odds ratios) are reported. Standard errors of beta reported in parentheses are clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1) Dummy=1 if ΔMean(ROA) > 0	(2) Dummy=1 if ΔMean(ROE) > 0	(3) Dummy=1 if ΔMean(Sales Growth) > 0
Mean(Board Independence)	3.589*	3.613*	4.504**
	(2.702)	(2.818)	(3.387)
Mean(Total Assets)	1.000	1.000	1.000
	(0.000)	(0.000)	(0.000)
Mean(Leverage)	1.767	0.491	1.701
	(0.770)	(0.217)	(0.759)
Mean(Log(Growth))	1.077	1.325***	1.114
	(0.104)	(0.130)	(0.110)
Mean(Cash)	0.179*	4.590*	0.281
	(0.182)	(4.248)	(0.284)
Mean(Log(Stock Volatility))	1.514*	1.674**	0.871
	(0.372)	(0.421)	(0.212)
Mean(SHHI)	0.863	1.449	1.348
	(0.244)	(0.419)	(0.381)
Mean(Log(Board Size))	1.225	2.840**	0.871
	(0.518)	(1.208)	(0.362)
Mean(Board Ownership)	0.903	0.394	1.042
	(0.805)	(0.350)	(0.920)
Mean(Busy Board)	0.949	0.420	1.970
	(0.913)	(0.404)	(1.828)
Mean(CEO Duality)	1.056	1.023	0.895
	(0.231)	(0.227)	(0.196)
Mean(CEO Tenure)	1.016	1.021	0.982
	(0.014)	(0.014)	(0.013)
Observations	722	713	709
Pseudo R^2	0.020	0.028	0.017

Table IA.VII: Exclusion of Financial Crisis Period

This table reports estimates from regressing firm performance on board independence, downstream demand shock, along with the interaction between the two variables, controls, year fixed effects, and supplier-customer pair fixed effects. The sample period is 1997–2016, excluding observations of the years 2008 and 2009, i.e., the period for the Financial Crisis. The dependent variables are *ROA*, *ROE*, and *Sales Growth*. *CNDS* is an indicator that is equal to one if a firm experiences a negative downstream demand shock, i.e., when the annual detrended percentage change in a given customer company's downstream industry demand is negative. *Board Independence* is the fraction of outside directors on board. *CNDS* × *Board Independence* is the main explanatory variable. Detailed definitions of other variables are presented in Table A.I. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1) ROA_t	(2) ROE_t	(3) Sales $Growth_t$
$CNDS_{t-1}$	-0.029*	-0.135***	-0.036**
	(0.015)	(0.052)	(0.016)
Board $Independence_{t-1}$	-0.026	0.022	-0.035
	(0.023)	(0.093)	(0.029)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.046**	0.211***	0.054***
	(0.021)	(0.076)	(0.021)
Log(Total $Assets)_{t-1}$	-0.051***	-0.047*	-0.030***
	(0.007)	(0.026)	(0.008)
$Leverage_{t-1}$	0.072***	-0.140	0.018
	(0.025)	(0.156)	(0.020)
$Growth_{t-1}$	-0.212***	-0.199	-0.024
	(0.068)	(0.227)	(0.064)
Cash $Ratio_{t-1}$	0.056*	-0.026	-0.078*
	(0.034)	(0.103)	(0.044)
Stock $Volatility_{t-1}$	-1.125***	-0.549	-0.075
	(0.396)	(1.180)	(0.339)
$SHHI_{t-1}$	0.009	-0.019	-0.003
	(0.016)	(0.050)	(0.013)
Log(Board $Size)_{t-1}$	0.021	0.056	0.037**
	(0.021)	(0.059)	(0.016)
Board $Ownership_{t-1}$	-0.036	0.124	0.068
	(0.025)	(0.119)	(0.055)
Busy $Board_{t-1}$	-0.002	0.106	0.005
	(0.010)	(0.068)	(0.004)
CEO $Duality_{t-1}$	0.003	0.022	0.002
	(0.005)	(0.017)	(0.005)
Observations	2817	2817	2817
Adjusted R^2	0.545	0.425	0.363
Year Fixed Effects	Yes	Yes	Yes
Supplier-Customer Pair Fixed Effects	Yes	Yes	Yes

Table IA.VIII: Analysis with Three Largest Industry Sectors in the Sample

This table reports estimates from regressing firm performance on board independence, downstream demand shock, along with the interaction between the two variables, controls, year fixed effects, and supplier-customer pair fixed effects, for the period 1997–2016. In panels A to C, the analysis is repeated for each of the three largest industry sectors in the sample, i.e., electronics, pharmaceutical, and petroleum & gas. The dependent variables are *ROA*, *ROE*, and *Sales Growth*. *CNDS* is an indicator that is equal to one if a firm experiences a negative downstream demand shock, i.e., when the annual detrended percentage change in a given customer company's downstream industry demand is negative. *Board Independence* is the fraction of outside directors on board. *CNDS* × *Board Independence* is the main explanatory variable. Detailed definitions of other variables are presented in Table A.I. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Electronics

	(1) ROA_t	(2) ROE_t	(3) Sales $Growth_t$
$CNDS_{t-1}$	-0.211*	-0.298	-0.096*
	(0.113)	(0.197)	(0.056)
Board $Independence_{t-1}$	-0.142	-0.069	0.030
	(0.146)	(0.273)	(0.066)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.323*	0.600**	0.167**
	(0.183)	(0.280)	(0.081)
Observations	319	319	319
Adjusted R^2	0.224	0.278	0.615
Controls and Year FE	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes

Panel B: Pharmaceutical

	(1) ROA_t	(2) ROE_t	(3) Sales $Growth_t$
$CNDS_{t-1}$	-0.021	-0.184	-0.117*
	(0.041)	(0.141)	(0.065)
Board $Independence_{t-1}$	0.032	-0.338	-0.084
	(0.051)	(0.303)	(0.098)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.034	0.425*	0.147*
	(0.051)	(0.249)	(0.085)
Observations	490	490	490
Adjusted R^2	0.837	0.455	0.024
Controls and Year FE	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes

Panel C: Petroleum and Natural Gas

	(1) ROA_t	(2) ROE_t	(3) Sales $Growth_t$
$CNDS_{t-1}$	-0.099	-1.336	-0.129***
	(0.085)	(0.819)	(0.041)
Board $Independence_{t-1}$	0.031	0.074	-0.130***
	(0.056)	(0.442)	(0.042)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.275**	1.903*	0.129**
	(0.113)	(1.137)	(0.056)
Observations	298	251	298
Adjusted R^2	0.565	0.529	0.179
Controls and Year FE	Yes	Yes	Yes
Supplier-Customer Pair FE	Yes	Yes	Yes

Table IA.IX: Interacting Demand Shock with Control Variables

This table reports robustness checks to the main results in Table II by interacting demand shock with all controls, for the period 1997–2016. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1) ROA_t	(2) ROE_t	(3) Sales $Growth_t$
$CNDS_{t-1}$	0.081	0.074	-0.032
	(0.064)	(0.153)	(0.042)
Board $Independence_{t-1}$	-0.034	-0.042	-0.042*
	(0.026)	(0.094)	(0.024)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.085**	0.272***	0.072***
	(0.041)	(0.094)	(0.024)
Log(Total $Assets)_{t-1}$	-0.056***	-0.060**	-0.036***
	(0.008)	(0.029)	(0.010)
$Leverage_{t-1}$	0.099***	-0.092	0.060**
	(0.028)	(0.174)	(0.025)
$Growth_{t-1}$	-0.128*	0.016	-0.061
	(0.076)	(0.223)	(0.072)
Cash $Ratio_{t-1}$	0.115**	0.051	-0.065
	(0.052)	(0.130)	(0.047)
Stock $Volatility_{t-1}$	-0.417	-1.427	0.045
	(0.417)	(1.282)	(0.304)
$SHHI_{t-1}$	0.000	-0.096	-0.005
	(0.018)	(0.073)	(0.013)
Log(Board $Size)_{t-1}$	0.053	0.064	0.047**
	(0.033)	(0.069)	(0.020)
Board $Ownership_{t-1}$	-0.041	0.055	0.041
	(0.029)	(0.111)	(0.049)
Busy $Board_{t-1}$	-0.017	0.220*	0.006
	(0.015)	(0.113)	(0.006)
CEO $Duality_{t-1}$	-0.007	0.022	-0.007
	(0.006)	(0.022)	(0.006)
$CNDS_{t-1}$ × Log(Total $Assets)_{t-1}$	0.008**	-0.015	0.005
	(0.004)	(0.015)	(0.005)
$CNDS_{t-1}$ × $Leverage_{t-1}$	-0.049	0.001	-0.013
	(0.034)	(0.132)	(0.024)
$CNDS_{t-1}$ × $Growth_{t-1}$	-0.009	-0.361	0.068
	(0.098)	(0.227)	(0.064)
$CNDS_{t-1}$ × Cash $Ratio_{t-1}$	-0.015	0.011	-0.004
	(0.050)	(0.150)	(0.043)
$CNDS_{t-1}$ × Stock $Volatility_{t-1}$	-0.166	0.950	0.269
	(0.432)	(1.473)	(0.424)
$CNDS_{t-1}$ × $SHHI_{t-1}$	0.003	-0.073	-0.002
	(0.015)	(0.051)	(0.012)
$CNDS_{t-1}$ × Log(Board $Size)_{t-1}$	-0.080***	-0.035	-0.023
	(0.028)	(0.062)	(0.017)
$CNDS_{t-1}$ × Board $Ownership_{t-1}$	0.018	-0.081	-0.014
	(0.022)	(0.075)	(0.017)
$CNDS_{t-1}$ × Busy $Board_{t-1}$	0.006	-0.238**	-0.001
	(0.021)	(0.118)	(0.008)
$CNDS_{t-1}$ × CEO $Duality_{t-1}$	0.016	-0.028	0.017**
	(0.011)	(0.030)	(0.007)
Observations	3440	3440	3440
Adjusted R^2	0.501	0.384	0.195
Year Fixed Effects	Yes	Yes	Yes
Supplier-Customer Pair Fixed Effects	Yes	Yes	Yes

Table IA.X: Different Governance Measures: Key Committee Full Independence

This table presents variants of the main results in Table II, where board independence is replaced with key committee full independence. The sample period is 1997–2016. The dependent variables are: *ROA*, computed as net income divided by total assets, in column 1; *ROE*, computed as income before extraordinary items divided by total common equity, in column 2; and *Sales Growth*, computed as annual sales growth rate (%) times 100 divided by total assets, in column 3. *CNDS* is an indicator that is equal to one if a firm experiences a negative downstream demand shock, i.e., when the annual detrended percentage change in a given customer company's downstream industry demand is negative. *Nominating Full Independence* is an indicator that is equal to one if all directors on nominating committee are independent. *Compensation Full Independence* is an indicator that is equal to one if all directors on compensation committee are independent. All specifications include controls in the main regression models, year fixed effects, and supplier-customer pair fixed effects. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Nominating Committee Full Independence			
$CNDS_{t-1}$	-0.010	-0.034	-0.004
	(0.007)	(0.023)	(0.006)
Nominating Full $Independence_{t-1}$	-0.017***	-0.050**	-0.024***
	(0.006)	(0.022)	(0.005)
$CNDS_{t-1}$ × Nominating Full $Independence_{t-1}$	0.028***	0.077***	0.025***
	(0.009)	(0.029)	(0.007)
Observations	3440	3440	3440
Adjusted R^2	0.500	0.383	0.196
Controls	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Supplier-Customer Pair Fixed Effects	Yes	Yes	Yes
Panel B: Compensation Committee Full Independence			
$CNDS_{t-1}$	-0.015	-0.026	-0.004
	(0.010)	(0.030)	(0.010)
Compensation Full $Independence_{t-1}$	0.002	0.031	-0.007
	(0.007)	(0.023)	(0.010)
$CNDS_{t-1}$ × Compensation Full $Independence_{t-1}$	0.029***	0.053*	0.019*
	(0.010)	(0.032)	(0.010)
Observations	3440	3440	3440
Adjusted R^2	0.500	0.383	0.192
Controls	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Supplier-Customer Pair Fixed Effects	Yes	Yes	Yes

Table IA.XI: Alternative Explanation: CEO Skills

This table presents robustness checks to the main results in Table II, where *Board Independence* is replaced with *CEO Generalist Ability Index*, a measure of CEO skills suggested by Custódio et al. (2013). The sample period is 1997–2007. Standard errors of beta reported in parentheses are clustered at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1) ROA_t	(2) ROE_t	(3) Sales $Growth_t$
$CNDS_{t-1}$	-0.003	0.008	-0.003
	(0.008)	(0.026)	(0.005)
CEO Generalist Ability $Index_{t-1}$	-0.006*	0.032***	0.001
	(0.003)	(0.012)	(0.003)
$CNDS_{t-1}$ × CEO Generalist Ability $Index_{t-1}$	0.002	0.006	0.000
	(0.005)	(0.014)	(0.005)
Log(Total Assets)$_{t-1}$	-0.051***	-0.116**	-0.051***
	(0.010)	(0.047)	(0.015)
$Leverage_{t-1}$	0.057*	0.012	0.057**
	(0.031)	(0.158)	(0.026)
$Growth_{t-1}$	-0.006	-0.040	0.013
	(0.062)	(0.242)	(0.064)
Cash $Ratio_{t-1}$	0.093***	0.114	-0.057
	(0.036)	(0.118)	(0.041)
Stock $Volatility_{t-1}$	-0.723	-2.732	-0.187
	(0.463)	(1.799)	(0.394)
$SHHI_{t-1}$	-0.024	-0.135	-0.001
	(0.028)	(0.102)	(0.015)
Log(Board Size)$_{t-1}$	-0.007	0.017	0.037**
	(0.019)	(0.073)	(0.018)
Board $Ownership_{t-1}$	0.001	0.057	0.098
	(0.039)	(0.114)	(0.069)
Busy $Board_{t-1}$	0.006	0.066	0.010
	(0.014)	(0.068)	(0.007)
CEO $Duality_{t-1}$	0.000	-0.015	-0.007
	(0.005)	(0.022)	(0.006)
Observations	2078	2078	2078
Adjusted R^2	0.514	0.331	0.194
Year Fixed Effects	Yes	Yes	Yes
Supplier-Customer Pair Fixed Effects	Yes	Yes	Yes

Table IA.XII: Controlling for Information Acquisition Cost

This table reports estimates from regressing firm performance on board independence, downstream demand shock, along with the interaction between the two variables, controls, year fixed effects, and supplier-customer pair fixed effects, for the period 1997–2016. *Info Cost Index* is constructed as a proxy for information acquisition cost, following Duchin et al. (2010). The dependent variables are *ROA*, *ROE*, and Sales Growth. *CNDS* is an indicator that is equal to one if a firm experiences a negative downstream demand shock, i.e., when the annual detrended percentage change in a given customer company's downstream industry demand is negative. *Board Independence* is the fraction of outside directors on board. *CNDS* × *Board Independence* is the main explanatory variable. Detailed definitions of other variables are presented in Table A.I. All right-hand side variables are one-year lagged. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1) ROA_t	(2) ROE_t	(3) Sales $Growth_t$
$CNDS_{t-1}$	-0.034*	-0.141**	-0.040***
	(0.017)	(0.057)	(0.015)
Board $Independence_{t-1}$	-0.021	0.008	-0.055**
	(0.024)	(0.090)	(0.026)
$CNDS_{t-1}$ × Board $Independence_{t-1}$	0.063**	0.227***	0.073***
	(0.025)	(0.082)	(0.019)
Info Cost $Index_{t-1}$	-0.123***	-0.191*	0.054
	(0.037)	(0.115)	(0.039)
Log(Total $Assets)_{t-1}$	-0.051***	-0.063**	-0.032***
	(0.007)	(0.029)	(0.008)
$Leverage_{t-1}$	0.081***	-0.101	0.056**
	(0.022)	(0.143)	(0.025)
$Growth_{t-1}$	-0.115*	-0.190	-0.031
	(0.065)	(0.223)	(0.054)
Cash $Ratio_{t-1}$	0.102**	0.028	-0.071*
	(0.044)	(0.109)	(0.041)
Stock $Volatility_{t-1}$	-0.420	-0.684	0.040
	(0.376)	(1.298)	(0.312)
$SHHI_{t-1}$	-0.009	-0.145**	-0.013
	(0.017)	(0.073)	(0.011)
Log(Board $Size)_{t-1}$	0.018	0.051	0.031**
	(0.026)	(0.065)	(0.016)
Board $Ownership_{t-1}$	-0.040	0.022	0.042
	(0.032)	(0.117)	(0.050)
Busy $Board_{t-1}$	-0.010	0.077	0.004
	(0.011)	(0.060)	(0.004)
CEO $Duality_{t-1}$	-0.002	0.002	0.002
	(0.004)	(0.017)	(0.004)
Observations	3290	3290	3290
Adjusted R^2	0.502	0.383	0.216
Year Fixed Effects	Yes	Yes	Yes
Supplier-Customer Pair Fixed Effects	Yes	Yes	Yes