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Citation for published version:
Leung, WS, Li, J & Sun, J 2020, 'Labor unionization and supply-chain partners' performance', *Production and Operations Management*, vol. 29, no. 5, pp. 1325-1353. https://doi.org/10.1111/poms.13164

Digital Object Identifier (DOI):
10.1111/poms.13164

Link:
Link to publication record in Edinburgh Research Explorer

Document Version:
Peer reviewed version

Published In:
Production and Operations Management

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Forthcoming in *Production and Operations Management*

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Labor Unionization and Supply-Chain Partners' Performance

ABSTRACT

We investigate whether labor unionization of customer firms affects the operating performance of their dependent suppliers. Using a sample of U.S. union elections, our regression discontinuity tests show that passing a union election leads to a 6.9 percentage-point decline in supplier operating margin in the following year. Such negative effects are more pronounced for customers with stronger bargaining power vis-à-vis dependent suppliers. Additional tests show that the reduced supplier operating margins are due to weakened top lines and, more specifically, to squeezed selling prices. Finally, consistent with increased labor costs, unionization is shown to significantly increase cost of goods sold and slow labor-force downsizing among customer firms. Overall, our evidence suggests that increased labor costs and financial inflexibility due to unionization induce customers to price-squeeze their dependent suppliers.

Keywords: Labor unions; supply chain; bargaining power; regression discontinuity approach

1. Introduction

Although the power of labor unions has declined in recent decades, their role in shaping industrial relations remains influential.[1] From an economic perspective, unions monopolize the labor supply and can extract a rent from employers by raising wages above competitive levels. While empirical evidence on the impact of unionization on employment and wages has to date been inconclusive,[2] a related stream of finance literature emphasizes the role of firms' strategic responses to union bargaining (e.g., sheltering income from wage demands) and documents that unionization drives various important financing decisions (see, e.g., Bronars and Deere, 1991; DeAngelo and DeAngelo, 1991; Klasa et al., 2009; Matsa, 2010).

Despite the voluminous literature on unionization, few studies have explored its potential impact on the *related parties* of unionized firms. This paucity of research is surprising since firms do not operate in a vacuum, but often work closely with other entities, such as supply-chain partners, in sourcing, producing, and delivering goods and services to end consumers.[3] Indeed, recent evidence shows that the supply chain is a significant channel through which idiosyncratic shocks are propagated (see, e.g., Barrot and Sauvagnat, 2016; Agca et al., 2017). When downstream customers experience negative events, dependent suppliers are exposed to potential losses and undiversified risk (see, e.g., Hertzel et al., 2008; Dhaliwal et al., 2016; Houston et al., 2016). For that reason, the question of who ultimately bears union-induced costs cannot be fully answered without considering the often-complex supply-chain interrelationships between firms. To fill this gap, we use the supply chain as an empirical setting and examine the extent to which unionization of customers affects the operating performance of their dependent suppliers.

[1] As of 2016, at least one in ten American wage and salary workers are members of unions; their average hourly wage was at least 30 percent higher than that of non-unionized workers (*Bureau of Labor Statistics*, 2017).
[2] Earlier studies generally document a negative effect of unionization on firm earnings and value (see, e.g., Hirsch, 1991a; Hirsch 1991b; Ruback and Zimmerman, 1984; Abowd, 1989), whereas more recent evidence points to a rather limited effect of unions on employment, wages, output, and production (see, e.g., DiNardo and Lee, 2004).
[3] Anecdotally, firms with a long history of union presence, such as General Motors, Ford, Boeing, Verizon, and others, transact frequently and in bulk quantity with their input suppliers and have developed strong economic interdependencies with their partners over time.

Labor unionization is costly for employers and shareholders. For instance, firms may experience increased cost stickiness as unions bargain collectively for higher wages, greater benefits, and less hiring or firing (Lewis, 1986; Hirsch, 1997; Chen et al., 2017). In case of work disputes, unions may also threaten to organize strikes and work stoppages, causing disruptions to firm operations and production (Ashenfelter and Johnson, 1969). To mitigate the adverse impact of unions, firms may actively seek to improve their bargaining positions vis-à-vis unions by sheltering liquidity from the wage demands of workers, such as increasing debt and reducing cash holdings (Klasa et al., 2009; Matsa, 2010). Reduced liquidity due to such strategic maneuvers and increased union-induced cost stickiness greatly reduce firms' ability to buffer against negative shocks, making them more susceptible to cash-flow problems when profits decline. Hence, firms are incentivized to cut down on variable costs. Since the costs of purchasing input factors represent the majority of operating budgets (Quinn, 1997), rational customer firms may substantiate their cost-saving initiatives by squeezing their suppliers for lower input prices. Therefore, unionization creates incentives for firms to price-squeeze their upstream dependent suppliers, in effect hurting the latter's operating performance.

The extent of upstream price-squeezes depends on the relative bargaining power of supply-chain partners. The literature suggests that trading partners do not share gains and losses equitably and the ultimate division of profit is determined by their relative bargaining positions (Jeuland and Shugan, 1983; Kadiyali et al., 2000; Iyer and Villas-Boas, 2003). Since suppliers rely heavily on customers for sales and often devote considerable effort and resources to securing and retaining relationships, their bargaining positions tend to be weak (Williamson, 1971, 1979; Ganesan, 1994). Thus, when needs arise, such as when their cost structure changes, customers can initiate renegotiations and exert downward price pressure on upstream suppliers by threatening to switch to alternative firms (Choi, 1991; Hallen, et al., 1991; Iyer and

Villas-Boas, 2003).[4] Therefore, we hypothesize that the negative effect of customer unionization on supplier operating margin is more pronounced when customers are more powerful.

Empirically identifying the impact of customer unionization on supplier operating performance is difficult because of endogeneity concerns. Among the most important of such concerns is the possibility that omitted factors that drive the unionization status of customers may determine how they engage or treat their input suppliers, thereby leading to spurious correlations between unionization and supplier operating performance. To tackle these challenges, we adopt a regression discontinuity (RD) approach that exploits locally exogenous variation in unionization provided by union elections. Assuming that employees cannot precisely control election outcomes (confirmed in our analysis), variation in unionization provided by elections is plausibly locally exogenous and, thus, is likely to be uncorrelated with any other covariates.

After matching 39 years of U.S. labor union elections from the National Labor Relations Board (NLRB) to our supplier-customer dataset (from Compustat segment files), our final sample consists of 831 unique elections, affecting in total 232 customers and 1,662 suppliers. Diagnostic tests show little evidence of precise manipulation of election outcomes by voters.

Under the optimal bandwidth identified by the data-driven method of Imbens and Kalyanaraman (2012), our local linear estimation shows that customer firms' passing of a union election reduces the operating margin of their dependent suppliers by a significant 6.9 percentage points in the following year. Although varying across specifications and samples, the RD estimates are robust to alternative estimation approaches, bandwidth choices, weighting methods, samples, alternative standard errors, the inclusion of controls for state economic conditions, the inclusion of supplier and customer firm covariates and industry and year fixed effects, and a placebo test that randomizes the threshold for treatment assignment.

The identifying assumption for the local linear estimation is that in the optimal-bandwidth sample, supplier and customer firm characteristics and supplier operating margins in the pre-treatment year should

[4] In the automotive industry, for example, suppliers are asked to lower their price by 2 to 3 percent by large automakers when the latter plan to cut their annual spending by 4 to 6 percent (*Boston Consulting Group*, 2015).

be insignificantly different between the treatment group of winning elections and the control group of losing elections. We find no significant differences in pre-existing supplier operating margins (in both levels and changes) between the two groups; other supplier and customer firm covariates are also mostly indistinguishable between the groups.

Next, we examine the role of supply-chain bargaining power in governing the negative relation in question. To the extent that customer firms with greater bargaining power are more prone to and have a greater scope in exercising their power to price-squeeze their suppliers, we expect the negative union-effect on supplier operating margin to be more pronounced among these customers. Consistent with this view, our tests show that negative RD estimates are larger and more significant when the industry concentration of suppliers is lower relative to that of their customers and when suppliers are more sales-dependent. This evidence also reinforces our interpretation that the negative effect in question indeed operates through the supply-chain channel.

To gain insight into the mechanisms, we perform RD tests to distinguish whether reduced supplier operating margins are driven by lower sales revenue or by confounding increases in production or operating costs. Consistent with weakened top lines being the main source of performance loss, our local linear estimation shows that customer unionization significantly decreases the proportion of sales revenue coming from the treated customers, whereas little evidence of significant changes to supplier cost of goods sold and operating costs is documented. Moreover, and importantly, we find that supplier gross profit margins are significantly reduced subsequent to major customers passing union elections. Since, by definition, gross profit margin primarily reflects changes in selling price per unit (if cost of goods sold per unit is held relatively constant) and is thus less driven by changes in sales volume, this evidence lends support to our hypothesis that unionization induces firms to price-squeeze their dependent suppliers.

To examine whether our findings can indeed be attributed to unionization, we test for the consequences of unionization on customers firms. We find little evidence to support the slowing of customer sales if production or operation is disrupted by unionization. However, our local linear tests reveal that the cost of goods sold increases after passing a union election, which is consistent with increased input costs. Further, we examine annual percentage changes in numbers of employees, finding that the effect of unionization is asymmetric, i.e., the magnitude of negative changes (in employee numbers) is significantly reduced, but positive changes are not significantly affected. This evidence is consistent with increased inflexibility in downsizing the labor force.

Finally, we examine whether customer unionization reduces supplier firm value and find marginally significant results. Our local linear estimation shows that major customers passing a union election leads to an 11.3-percent decline in supplier market-to-book equity ratios in the following year.

The remainder of this paper is organized as follows: Section 2 explains our theoretical arguments, develops our hypotheses, and discusses our contributions in relation to the existing literature. Section 3 explains the data sources and sample selection. Section 4 explains the RD design and empirical methodology, presents diagnostic tests, and reports the estimation results. Section 5 presents more tests focusing on the cross-sectional heterogeneity and the underlying mechanisms. Section 6 presents further tests and reports results from alternative empirical test strategies. Section 7 concludes the paper.

2. Related Literature and Hypothesis Development

2.1 Customer Unionization and Supplier Operating Performance

Labor unions are widely believed to impose substantial costs onto employers and shareholders. First, firms may experience increased cost stickiness because of unions' collective bargaining for higher wages, greater work benefits, and less hiring and firing (Lewis, 1986; Hirsch, 1997; Chen et al., 2011; Chen et al., 2017; He et al., 2018). Second, the union wage premium also lowers production efficiency by distorting firms' production mix, employment, and investments, thereby reducing the cash flows that can be accrued to shareholders (Hirsh, 2004). Third, labor unions often intervene in a variety of corporate restructuring activities, which can cause serious disruptions to firm operations and adjustment to physical capital. For instance, in corporate bankruptcies, unions can protect worker interests by disrupting the priority and seniority of certain creditors' claims, and by favoring inefficient reorganization to secure workers' continued employment (Haggard, 1983; Campello et al., 2018). Moreover, in wage- or job-related disputes, unions can threaten to organize strikes and work stoppages, thereby imposing costs directly on unionized firms (Ashenfelter and Johnson, 1969). Together, unions' collective bargaining and increased labor protections not only raise firm labor costs but also reduce their flexibility to downsize the workforce as well as their ease of selling assets.

While bargaining with employee collectives in good faith is required by law, unionized firms might seek to reduce the impact of unions by improving their bargaining position. To achieve this improved position, firms might shelter liquidity from the wage demands of workers and unions by reducing financial flexibility. Consistent with this view, Matsa (2010) documents that firms strategically raise debt financing and make use of the associated increased cash-flow demands to improve their bargaining position with labor. Klasa et al. (2009) also show that firms strategically hold less cash to obtain a bargaining advantage over unions, especially when unions are more powerful and can potentially seek higher rent.

Such strategic responses to union bargaining by firms may, however, have nontrivial implications for other related parties. Although bargaining power over labor improves as a result, the reduced liquidity along with the other union-induced costs can substantially reduce the firm's buffer against negative income shocks, rendering them more vulnerable to cash-flow problems when profits decline. To cope with these situations, rational unionized firms would attempt to cut down on variable costs other than labor costs (since cutting the latter is less feasible in the presence of unions).[5] Given that the costs of purchasing input factors represent the majority of firms' operating budgets (Quinn, 1997), the supply chain is an important remaining channel through which unionized firms can substantiate their cost-saving initiatives. As such, we hypothesize that unionization creates incentives for firms to price-squeeze their upstream dependent

[5] An alternative way to reduce such union-induced cash-flow risks and inflexibility is to shift costs onto consumers by charging higher prices. However, by doing so, unionized firms may risk losing sales, market share, and competitiveness to non-unionized or foreign firms (Hirsch, 2004). Our empirical strategy is unable to test this hypothesis and, hence, we leave it for future research to shed more light on this issue.

suppliers, in effect shifting part of the increased costs onto the latter and hurting the latter's operating performance. Our first hypothesis is as follows:

H1: *Unionization of major customers significantly reduces suppliers' operating performance.*

Not all firms experiencing unionization price-squeeze their suppliers; the extent of such behaviors likely depends on the strength of the former's bargaining power vis-à-vis the latter. Although supply-chain partners work collaboratively to maximize the value delivered to end consumers, they typically do not share gains and losses equitably (for a survey, see Cachon and Netessine, 2004). The outcomes of negotiations (and renegotiations) in contract terms between partners and thus the ultimate division of profit along the supply chain are governed by their relative bargaining positions (Jeuland and Shugan, 1983; Kadiyali et al., 2000; Iyer and Villas-Boas, 2003).

One of the most important factors that determines bargaining power along the supply chain is the level of switching costs incurred by dependent suppliers. In general, suppliers are relatively small and highly dependent on customers for sales. They often devote considerable effort and resources to securing and retaining relationships with their customers, such as tailoring products to customers' specific needs, making irreversible R&D investment, and other strategies (Williamson, 1971, 1979; Ganesan, 1994). While such customer-specific investments are vital to sustaining long-term trading relationships, they offer little value outside of these relationships. As such, suppliers often incur substantial sunk costs when switching to alternative customers if existing relationships terminate. At the same time, the level of switching costs also depends on the supplier firm's outside options, i.e., the availability of alternative customers with similar demand for input factors. The fewer the alternatives, the higher the costs and effort suppliers must incur to search for and switch to alternative buyers and to make new relationship-specific investments. Hence, with higher switching costs, the more disadvantageous is a supplier's bargaining position and its major customers have a wider scope in price-squeezing it by threatening to terminate the trading relationship.

Note that a unique feature of supply-chain relationships is that partners can re-negotiate the pricing and terms of trade when the environment changes, because supply-chain relationships are often governed by "relational contracts" that are not legally enforceable and whose effect is based upon mutual trust (Baker et al., 2002). The explicit terms of such contracts are simply an outline; the potential and demand for continuing business provide primary incentives for firms to adhere to them. Supply-chain partners therefore have flexibility to act upon newly arrived information and to make timely adjustments through renegotiating contract terms with each other (Taylor and Plambeck, 2007; Baker et al., 2002). Following prior studies suggesting that changes in cost structures are major drivers for initializing negotiations and determining their outcomes (see, e.g., Cachon and Netessine, 2004; Leider and Lovejoy, 2016), we argue that, when needs such as heightened labor costs and inflexibility induced by unionization arise, major customers with strong bargaining power can initiate renegotiations and exert downward price pressure on upstream suppliers by threatening to switch to alternative suppliers (Choi, 1991; Hallen, et al., 1991; Iyer and Villas-Boas, 2003).[6] Thus, our second hypothesis is as follows:

> **H2:** *The negative effect of unionization of major customers on supplier operating performance is more pronounced when major customers have greater bargaining power.*

2.2 Relation to Existing Literature

Our paper makes two important contributions to the literature. First, we add to a large body of research examining the economic role of labor unions. In the economics literature, DiNardo and Lee (2004) show

[6] In the automotive industry, for example, suppliers are asked to lower their price by 2 to 3 percent by large automakers when the latter plan to cut their annual spending by 4 to 6 percent (*Boston Consulting Group*, 2015).

that labor unionization has a limited effect on employment, wage, and production, while Lee and Mas (2012) document a negative union effect on market value that materializes in 15 to 18 months. In a related strand of literature, a growing number of finance studies document a significant union effect on various corporate outcomes. For instance, Chen et al. (2011) find that labor union coverage is associated with higher cost of equity capital through increased fixed costs and thus higher operating leverage. Campello et al. (2018) argue that unionization is associated with costlier bankruptcy court proceedings and show that passing a union election leads to a bond value loss. Bradley et al. (2016) show that unionization creates misaligned incentives among employees that impede corporate innovation activities and investment. Another stream of finance literature analyzes firms' strategic incentives to obtain bargaining power over labor. Specifically, Matsa (2010) finds that firms increase debt financing and thus cash-flow demands to improve bargaining positions with labor. Klasa et al. (2009) document that firms hold less cash to obtain a bargaining advantage over unions.

Our study poses a new question: Does firms' unionization affect other stakeholders such as dependent suppliers? Our empirical evidence suggests that the increased union-induced costs and reduced financial flexibility as a result of their strategic maneuvers to obtain bargaining power over labor induce firms to shift costs onto their dependent suppliers by exercising their bargaining power in the supply chain. Our findings yield important implications for labor policies by revealing a negative economic consequence of unionization that operates throughout the supply chain. Our evidence suggests that dependent suppliers may have to bear a portion of any union taxes, thereby opening a new avenue for future research.

Second, we contribute to a stream of literature that examines spillover effects along the supply chain. Gu et al. (2017) find that suppliers' relation-specific investments change with the risk-taking incentives of customer CEOs. Radhakrishnan et al. (2014) find a positive association between the quality of customers' capital market information and supplier operating performance. A strand of studies examines the effect of customer base concentration on upstream suppliers' profitability (Hui et al., 2019), inventory efficiency (Ak and Patatoukas, 2016), productivity (Serpa and Krishnan, 2017), sensitivity of sales to the state of economy (Osadchiy et al., 2016), accounting rates of return (Patatoukas, 2012), and cost of equity (Dhaliwal et al., 2016). Prior studies also explore how risk and shocks propagate along the production network (see, e.g., Atalay et al., 2011; Acemoglu et al., 2012; Wu and Birge, 2014; Agca et al., 2017; Wang et al., 2017). Other studies find that disruptions in downstream customer firms, such as bankruptcies and horizontal mergers and acquisitions, can significantly and negatively impact suppliers (Hertzel et al., 2008; Houston et al., 2016; Fee and Thomas, 2004), whereas Barrot and Sauvagnat (2016) and Carvalho et al. (2017) examine how upstream disruptions due to the occurrence of natural disasters could negatively affect downstream customers. Our study offers new empirical evidence that unionization leads to increased incentives to price-squeeze upstream suppliers and, therefore, can substantially hurt the latter's operating performance and market value.

The study most closely related to ours is Chen et al. (2017), which focuses on how supplier firm unionization affects their relationships with major customers. They find that major customers shift sales away from supplier firms who experience unionization to avoid disruptions and such reduced sales translate into weaker firm performance. Their results further show that suppliers suffer from higher cost of goods sold and increased employee numbers after unionization, consistent with higher input costs. Although our empirical tests identify an effect of unionization that travels upstream, while they analyze a downstream effect, our findings complement theirs in several ways. First, both studies reveal a negative externality of unionization that propagates through the supply chain. Second, findings from both studies confirm a significant role of supply-chain relationships in governing profit sharing between trading partners, thereby adding to a vast body of supply-chain literature. Third, both studies document a significant negative first-order effect of unionization on firms' cost of goods sold and employment changes, thus adding new empirical evidence to the debate on the economic impact of labor unions. More importantly, in light of their evidence, we are careful to control for the direct effect of unionization on supplier operating performance (see Section 3).[7]

3. Data and Descriptive Summary

We construct our databases using several sources. First, we collect information on supply-chain relationships from Compustat Segment files and construct a customer-supplier-year panel dataset covering the period from 1976 to 2018. Pursuant to Financial Accounting Standard No. 14, all publicly traded firms are required to report the names of their customers whose share is greater than 10 percent of their total revenue.[8] Based on such information, all major customers of supplier firms are identified in any given year, resulting in a network of interconnected firms. All stock and accounting information are taken from the CRSP and Compustat databases. All financial firms are excluded from both samples.

We collect data on labor union elections over the period from 1977 to 1999 from Holmes (2006)[9] and augment this dataset with more recent union elections data from the National Labor Relations Board (NLRB) until 2016. Following Lee and Mas (2012), we only include union elections that have no missing outcomes. If a firm has more than one election within a fiscal year, that with the largest number of eligible voters is retained, because the latter is likely to be more important for corporate outcomes. We then manually match these union elections to the major customers based on company names, addresses, and industry. This information allows us to identify all dependent suppliers affected by the elections.[10] Given the network structure of our data, a major customer's union election may affect more than one supplier. Moreover, to account for any potential confounding effects of suppliers' union elections on their operating

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[7] We thank two anonymous reviewers for referring us to Chen et al. (2017) and suggesting that we should carefully control for the direct effect of labor unionization on supplier operating performance.

[8] Some firms also voluntarily disclose their customers despite the fact that their share is smaller than 10 percent of its sales.

[9] We thank Professor Thomas Holmes for making these union elections data publicly available at http://users.econ.umn.edu/~holmes/data/geo_spill/.

[10] Customer elections taking place in calendar year *t-1* are matched with supplier firms with fiscal year ending in year *t,* and all our supplier outcomes analyzed are measured in fiscal year *t+1*, thus ensuring that all customer elections are held prior to the fiscal years in which supplier outcomes are computed.

performance, we match the union elections with the supplier firms and remove observations from one year before, the year of, and one year after a supplier union election. Our final sample consists of 831 unique customers' union elections over the period from 1978 to 2016,[11] affecting a total of 232 unique customers and 1,662 unique suppliers, and 6,200 customer-supplier-year observations.[12]

[Insert Table 1 about here]

Table 1 describes the 831 unique union elections held in major customer firms. Panel A reports the number of elections, descriptive statistics of the percentage vote share in favor of unionization (*Vote share*), the average number of eligible voters, and the number of affected supplier and customer firms at different levels of vote share (*Vote rank*). Falling within [-10%; +10%] from the cutoff of 50 percent, there are in total 242 union elections (165 lost and 77 won) from 118 unique customers, affecting a total of 828 unique suppliers. On average, a union election in our sample has 176.6 eligible voters. Since a customer firm's union election may affect multiple dependent suppliers, panel B reports the number of unique elections by the number of suppliers per customer. In our sample, the mean (median) [maximum] number of suppliers per customer is 7.5 (2.0) [99].[13] More precisely, 70.4 percent of all union elections occur in customer firms that source from one to five suppliers. Only 10.6 percent of elections occur in customer firms with 21 or more suppliers. We also report these statistics for different levels of *Vote share*, largely showing similar patterns. Panel C reports the number of observations and unique elections, and the average vote share and number of eligible voters by year. The number of unique elections and the average vote share are also plotted in Fig. 1.

[Insert Table 2 and Fig. 1 about here]

Table 2 reports summary statistics for our election sample. As shown in panel A, the mean (median) percentage of vote share for unionization is 46.0 (42.9) percent. On average, unions won 37.0 percent of the elections. These union election statistics closely resemble those reported in Lee and Mas (2012) and

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[11] Since customer union elections in 2016 are matched with suppliers with the fiscal year ending in year 2017 and supplier outcomes are measured in fiscal year *t*+1, supplier information up to fiscal year 2018 is used.
[12] The details of sample attrition can be found in Table IA.1 of the online Appendix.
[13] The customer firm buying from 99 suppliers in our sample is Wal-Mart Stores, Inc.

Bradley et al. (2016). Panel B shows a sample breakdown by some combination of the Fama-French 12 industries (financials excluded). For customer firms, the majority of union elections are concentrated in durable goods (38.1% of observations) and wholesale and retail services (25.6% of observations) industries; for suppliers, the two industries with the most coverage are manufacturing (25.7% of observations) and business equipment (20.9% of observations).

We measure supplier operating performance by their operating margins (*S.ROS*), computed as operating income before depreciation divided by total sales, in the first year following a customer union election. To reduce the effects of outliers, we winsorize all continuous variables at the 1st and 99th percentiles (detailed variable definitions can be found in Appendix A.1).[14]

Table 3 reports summary statistics for both suppliers and customers. Suppliers are considerably smaller than their customers. Suppliers' firm size, as captured by mean total assets, is $1.4 billion and that of customer firms is $86.8 billion. Other statistics show that suppliers typically have lower financial leverage, more R&D activities, less tangible assets, lower investment intensity, and greater cash holdings than customers. These findings are consistent with the view that suppliers have less liquidity, limited access to financing, and thus a weaker bargaining position vis-à-vis customer firms. Overall, these statistics are in line with those reported by prior supply-chain studies, e.g., Chen et al. (2017).

[Insert Table 3 about here]

4. Customer Unionization and Supplier Operating Performance

4.1 Empirical strategy

Identifying the effect of labor unionization on supplier operating performance is difficult because of endogeneity concerns. Among the most important concerns is the possibility that omitted factors that drive the unionization status of customer firms may determine how they engage with or treat their dependent

[14] Our results are even stronger and more significant if we winsorize any continuous variables that are scaled by total sales (since sales revenue is volatile and could be very small for some supplier-year) at the 2.5th and 97.5th percentiles.

suppliers, which leads to spurious correlations between customer unionization and supplier operating performance. The estimated relationship may also be subject to reverse-causality concerns. For instance, a major disruption in an existing trading relationship may increase input uncertainties and risks in customer firms that lead in turn to reduced workforce morale and an increase in labor disputes and, therefore, to a greater need for collective bargaining. To circumvent these challenges, we employ the RD approach and exploit the locally exogenous variation in unionization brought by union elections for identification.

In union elections, when the vote in favor of unionization surpasses a simple majority (i.e., is greater than 50 percent), the union obtains the right to bargain collectively on behalf of the firm's employees or, in other words, the firm experiences an increase in unionization after an election is passed. In our setting, although a naïve approach is to regress supplier performance on a binary variable of winning elections, such an approach is subject to endogeneity concerns, as discussed previously. To this end, we implement the RD approach that requires a clear-cut threshold for treatment assignment (the simple majority rule).

The RD approach compares the operating performance of suppliers whose major customers barely pass union elections with those suppliers whose major customers barely fail to pass a vote to unionize. Identification is based on the notion that unionization elections passing or failing by a narrow margin around the threshold of 50 percent are "locally exogenous," i.e., the assignment of a treatment effect (unionization status) to our sample of customer-supplier-pairs near the threshold is plausibly randomized (Lee and Lemieux, 2010). Thus, unionization for these elections is unlikely to be correlated with other unobserved characteristics that determine customers' unionization and supplier performance and, hence, is not subject to common endogeneity concerns. Moreover, because firms within narrow bandwidths around the threshold tend to be similar in all aspects, the inclusion of observable firm covariates is generally not necessary for obtaining consistent estimates of treatment effects (Lee and Lemieux, 2010).

Following Lee and Lemieux (2010), the empirical implementation of the RD approach involves estimating two separate regressions on each side of the assignment cutoff. The discontinuity estimate of the outcome variable at the cutoff point is obtained by computing the difference in the intercepts of the two regressions. To illustrate, we estimate an order p polynomial regression on each side of the assignment cutoff c:

$$Y = \alpha_L + \beta_{L,1}\,(X - c) + \beta_{L,2}\,(X - c)^2 + \ldots + \beta_{L,p}\,(X - c)^p + \varepsilon\,, \text{ where } X \leq c \tag{1}$$

$$Y = \alpha_R + \beta_{R,1}\,(X - c) + \beta_{R,2}\,(X - c)^2 + \ldots + \beta_{R,p}\,(X - c)^p + \varepsilon\,, \text{ where } X > c \tag{2}$$

In our setting, Y is supplier operating performance; the cutoff c is 50 percent, following the simple majority passing rule of union elections; X is the forcing variable, i.e., vote share for unionization; and ε is the error term. One can combine both equations (1) and (2) by estimating the following pooled regression:

$$Y = \alpha + \lambda\, D + \sum_{n=1}^{p}(X - c)^n\, \beta_{L,n} + \sum_{n=1}^{p}(X - c)^n\, D\,(\beta_{R,n} - \beta_{L,n}) + \varepsilon\,, \tag{3}$$

where D is an indicator for winning elections that equals one when vote share in favor of unionization (X) is larger than 50 percent, and zero otherwise. The interaction terms between D and ($X - c$), i.e., the fourth term of equation (3), allow the functional forms to differ on both sides of the cutoff point. λ is equivalent to (α_R - α_L), which is an estimate of the discontinuity in supplier operating performance (Y) at the cutoff point of 50 percent.

Since the above regression is estimated on the full sample, it is commonly referred to as the global polynomial regression. Although a larger sample size improves estimation precision, the imposition and assumption of functional form onto the relationship between supplier performance and customer election vote share over the full sample (including observations that are far away from the cutoff threshold) subjects the global polynomial approach to potential biases. Following recommendations in prior studies (see, e.g., Lee and Lemieux, 2010; Gelman and Imbens, 2014), we also consider the nonparametric RD approach and estimate local linear regressions using data within small windows around the cutoff threshold. Without making any strong assumption of functional forms, local linear regressions reduce the potential for bias at the expense of having lower statistical power due to smaller sample size.

Local linear regressions involve estimating two separate linear regressions on each side of the assignment cutoff using data within small windows around the discontinuity point. Formally, a local linear regression using data within a $\pm h$ margin around the cutoff point (50 percent in our setting) can be expressed in the following pooled regressions:[15]

$$Y = \alpha + \lambda\, D + \beta_L\, (X - c) + (\beta_R - \beta_L)\, D\, (X - c) + \varepsilon\,, \tag{4}$$

where $c\text{-}h \leq X \leq c\text{+}h$. Likewise, λ is an estimate of the discontinuity in supplier performance at the cutoff point.

Regarding the selection of bandwidth (h) for the local linear regressions, we follow the data-driven method of Imbens and Kalyanaraman (2012) in identifying the optimal bandwidths. Results from local linear regressions estimated using both triangular and rectangular kernel methods, along with their optimal bandwidth values, are reported in most of our analysis. The triangular kernel method gives higher weights to observations nearer to the cutoff threshold; the rectangular kernel method gives equal weights to observations within the optimal bandwidth around the cutoff; both methods give no weights to observation outside of the optimal bandwidth around the cutoff. Our identification relies on the assumption that in our sample within the optimal bandwidth pre-existing supplier and customer firm covariates and supplier operating performance do not differ significantly between the two groups of winning and losing customer elections.

As previously mentioned, while the inclusion of firm covariates is not necessary for obtaining consistent RD estimates in principle, Imbens and Lemieux (2008, pp. 625-626) point out that such inclusion reduces some bias that is due to the inclusion of additional observations not too close to the cutoff point in global polynomial regressions; it also reduces the small sample bias in local linear estimation.[16] Hence, throughout our paper, we report RD estimates with and without the inclusion of supplier and customer firm covariates, supplier and customer industry fixed effects, and year fixed effects.

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[15] The simplest form of local linear regression under the RD approach may not include the interaction between the forcing variable and the treatment variable, i.e., the fourth term of equation (4) (see equation (1) of Lee and Lemieux, 2010). Our results are very similar regardless of whether or not the interaction term is included.

[16] We thank an anonymous referee for referring us to Imbens and Lemieux (2008) and suggesting that we present estimation results that account for the supplier and customer firm covariates and fixed effects.

4.2 Diagnostic tests

The validity of the RD estimates relies on satisfying the assumption that individuals or firms (major customers in our case) receiving the treatment have imperfect control of treatment assignment or, in other words, cannot precisely manipulate the forcing variable (i.e., vote share for unionization in our case) near the known cutoff. The natural implication of this assumption is that one should not observe any jumps in the distribution of the forcing variable around the cutoff point. To evaluate this assumption, we graphically analyze the distribution of vote share and then perform a formal statistical test following the procedure of McCrary (2008).

Fig. 2 presents a histogram that shows the sample distribution of vote share for the 831 customer union elections across 50 equally sized bins. No apparent discontinuity in the sample distribution of vote share around the threshold of 50 percent is observed.

[Insert Fig. 2 about here]

Next, we perform a formal statistical test for discontinuity. Using the two-step procedure of McCrary (2008), we estimate and plot the density of the forcing variables (i.e., vote share for unionization) in Fig. 3. The *x*-axis represents the percentage vote share for unionization. The dots are the density estimates; the solid line is the fitted density function of vote share; and the dotted lines are 95-percent confidence intervals. A first observation is that, despite a small discontinuity, the density of vote share appears to be continuous near the cutoff point, with an overlap in confidence intervals on both sides of the cutoff. Second, the McCrary test shows that the estimated density of vote shares on each side of the cutoff has a log difference of 0.23. Because this difference is statistically insignificant, the null of continuity in density at the cutoff cannot be rejected. Overall, our diagnostic tests suggest little evidence of precise manipulation of vote shares by employees around the threshold, consistent with prior studies on union elections (see, e.g., DiNardo and Lee, 2004; Bradley et al., 2016).

[Insert Fig. 3 about here]

Additionally, the RD approach requires no discontinuity in other covariates that are correlated with supplier operating performance near the cutoff threshold. That is, firms with unionization votes that barely pass should be similar to those that barely fail. To shed light on this, in Table 4 we compare the observable customer and supplier firm covariates for elections falling within a five-percent margin in vote share around the cutoff point (i.e., between 45% and 55%). Within such margins, our sample includes 106 unique union elections (930 observations) at 66 customer firms. Twenty-eight of them passed and the remaining 78 failed, affecting in total 420 and 195 suppliers, respectively. These observable customer and supplier firm characteristics are measured in the one year prior to union elections, and include firm size (*Ln(Total assets)*), financial leverage (*Leverage*), R&D intensity (*R&D/Sale*), asset tangibility (*PPE/TA*), capital expenditure to total assets (*CAPX/TA*), and cash holdings to net assets (*CPNA*). Our results confirm that the pre-treatment observable customer- and supplier-firm covariates are similar and are insignificantly different between closely won and closely lost elections (except for *C.Leverage*, which is significantly different at the five-percent level)[17], suggesting that this assumption is likely to hold and selection issues are unlikely to be severe. More importantly, supplier operating margin in the pre-treatment year ($S.ROS_{t-1}$) as well as their changes from *t-2* to *t-1* are insignificantly different between the winning and losing elections within a five-percent margin in vote share around the cutoff threshold.

[Insert Table 4 about here]

4.3 Graphical analysis

As a preliminary test, in Fig. 4, the relation between vote share for unionization (of customers) and supplier performance one year after elections is graphed. The *x*-axis denotes vote share for unionization. Customers who fail to unionize after elections appear on the left of the 50-percent cutoff threshold, whereas those who unionize appear to the right of the cutoff. Vote share for unionization is put into 20 equal-sized bins. For

[17] Since Table 4 examines a large number of characteristics, it is possible that some of them appear significantly different even if the two groups of firms are drawn from the same distribution. To increase confidence of our results, these characteristics are included in our RD tests as controls in some specifications.

each bin, the conditional means in *S.ROS* are computed, depicted in dots. On each side of the cutoff, we fit *S.ROS* as separate quadratic functions of vote share for unionization and show these functions with solid dark-blue lines. The dotted lines surrounding these fitted functions are their respective 95-percent confidence intervals.

[Insert Fig. 4 about here]

In Fig. 4, we observe a fall in *S.ROS* when moving from the left to the right of the cutoff point. For firms with winning elections close to the cutoff, supplier operating margin averages about 0.08, whereas that for firms losing elections near the cutoff averages about 0.12. Since the variation in vote share is locally exogenous between these wins and losses, the almost four-percentage-point decline in *S.ROS* represents the causal effect of unionization on supplier operating margin in the following year, consistent with our hypothesis.

4.4 Global polynomial regressions

Table 5 reports the estimation of the global polynomial regressions. The forcing variable, *Vote*, is centered by subtracting 0.5. Columns (1) and (3) present a standard RD regression that interacts *Unionization* with *Vote*. Columns (4) to (6) [(7) and (9)] present the second-order [third-order] global polynomial regressions. Standard errors are clustered at the customer-firm level. To save space, we suppress the estimates for the supplier and customer firm control variables (unabridged results can be found in Table IA.2 of the online appendix).

[Insert Table 5 about here]

In column (1), we document a negative estimate (coefficient=-0.012) for *Unionization*, albeit it is statistically insignificant. In column (2) where the supplier and customer firm covariates are added, the negative coefficient estimate for *Unionization* increases to -0.017, which is significant at the 10-percent level. Column (3) further introduces supplier and customer industry fixed effects to account for any timeinvariant omitted industry factors,[18] as well as year fixed effects to account for the effect of any market-wide shocks on supplier operating performance. The negative coefficient for *Unionization* reduces to -0.012 but remains significant at the ten-percent level.

Results from the second- and third-order global polynomial regressions in columns (4) to (9) are in general similar; the RD estimates for *Unionization* are noticeably larger and more significant compared to those reported in columns (1) to (3). Specifically, when the third-order global polynomial regression is used, as seen in column (9), the RD estimate increases to -0.039 and is significant at the five-percent level. In quantitative terms, passing a union election at the major customer leads to a 3.9-percentage-point decline in supplier operating margin in the following year, controlling for various supplier and customer characteristics and fixed effects.

Overall, our results from the global polynomial regressions suggest that customer unionization significantly reduces supplier operating performance.

4.5 Local linear regressions

While the RD estimates from global polynomial regressions are more precise due to a larger sample size, they could be biased since the linear specification becomes less accurate farther away from the cutoff point. To corroborate our results, we estimate local linear regressions with optimal bandwidths selected by the data-driven method of Imbens and Kalyanaraman (2012) and report these results in Table 6. Panel A (Panel B) reports results estimated using the triangular (rectangular) kernel method. To examine whether our results are sensitive to bandwidth choice, results based on 80 percent and 120 percent of the optimal bandwidth are reported. The number of observations, R-squared values, and bandwidth used are provided for each regression.

[Insert Table 6 about here]

[18] Industry fixed effects are constructed based on the Fama-French 49-industry classification. More details can be found at https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_49_ind_port.html.

Our local linear regressions show statistically and economically significant results across specifications. Based on the RD estimates from column (1) in panel A at the optimal bandwidth (*h*=0.181), a supplier suffers a 6.9-percentage-point decline in *S.ROS*, on average, after its major customer passed a union election. Column (2) introduces supplier and customer firm covariates and industry and year fixed effects. We find that the RD estimates remain similar in both magnitude and statistical significance.[19] Results do not appear to change much when alternative bandwidths (at 80 percent or 120 percent) are used. Panel B shows that the RD estimates based on the rectangular kernel method remain similar and are stable across bandwidth choices. Overall, our local linear estimation results are consistent with those reported in the graphical analysis and the global polynomial regressions.

The identifying assumption for the local linear regressions is that both the dependent and independent variables do not differ significantly between the treatment group of winning elections and the control group of losing elections in the sample within the optimal bandwidth around the cutoff threshold. To shed light on this, Table 7 compares the average supplier and customer firm covariates for elections falling within the optimal bandwidths around the cutoff point ($h_{triangular}$=0.181; $h_{rectangular}$=0.142). Under both kernel methods, the differences in means are insignificant for all supplier firm covariates and in most customer covariates, except for customers' leverage, asset tangibility, and capital investment intensity. Reassuringly, the lagged level and changes in supplier operating margins are indistinguishable (with large *p*-values) between the winning and losing elections.

[Insert Table 7 about here]

4.6 Robustness tests

Table 8 presents several robustness tests on the linear local regressions in Table 6 (see column 2) under the triangular kernel method, using the same optimal bandwidth (*h*=0.181).

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[19] The estimates for the supplier and customer control variables are suppressed to save space. The unabridged version of these local linear estimation can be found in Table IA.3 of the online appendix.

[Insert Table 8 about here]

First, financial crises represent major negative shocks to corporate liquidity, worsen industrial relations, and may increase the need for union bargaining. If union elections happen to be triggered in times of crisis, our results may be confounded by the crisis. To address this concern, following the crisis definition of Bekaert et al. (2014), we exclude customer union elections that took place during 1998 and between 2007 and 2009, and reestimate the local linear regressions. As column (1) shows, the RD estimates remain significant and have magnitudes similar to those of Table 5. Column (2) applies an alternative crisis window that further includes year 2010, showing that the RD estimates are not much affected.

Second, union elections involving a higher number of eligible voters are likely to be more salient for the customer firms; their effects are also likely to be easier to detect (Lee and Mas, 2012). In columns (3) and (4), we present robustness results in which the local linear estimation includes customer union elections with at least 10 and 25 eligible voters, finding that our results are qualitatively similar.[20]

Third, since union elections and the need to bargain collectively may be driven by macroeconomic factors and/or local economic conditions, in column (5) we use an alternative set of macroeconomic controls to replace year fixed effects, including annual real GDP growth, CPI growth, and the level of default spreads, finding that the RD estimates remain similar. In column (6), in addition to year fixed effects, we further control for the annual growth in state real GDP growth, log state GDP per capita, and state unemployment rates. The inclusion of these additional controls for state economic conditions cannot explain away our results.

Finally, we examine whether our results are sensitive to using alternative standard errors. As column (7) shows, when White robust standard errors are used, our RD estimates become even more significant, suggesting that our statistical inference thus far has been conservative.

[20] DiNardo and Lee (2004) include only elections with more than 20 voters.

4.7 Placebo tests

To rule out the notion that our results are purely driven by chance, we perform a placebo test. We randomly select an alternative threshold (other than the true 50% threshold) between 0% and 100% and estimate a local linear regression (using the triangular kernel method and without controls and fixed effects)[21] to obtain a placebo RD estimate. This procedure is repeated 5,000 times to obtain a distribution of RD estimates, which is then compared with our RD estimates based on the true 50% threshold (see the vertical red lines in Fig 5).

[Insert Fig. 5 about here]

Fig. 5 plots the histogram of the distribution of RD estimates for *S.ROS*. As shown, the placebo RD estimates for *S.ROS* are centered at zero, suggesting that the treatment effect is largely absent at these randomly chosen alternative thresholds. Hence, the documented negative effect of unionization on supplier operating performance is unlikely to be driven purely by chance.

5. Examining Cross-Sectional Heterogeneity and Mechanisms

5.1 The Role of Bargaining Power in the Supply Chain

To the extent that customers squeeze upstream suppliers for a greater share of channel profits after an increase in unionization, such appropriations are likely to be of a larger magnitude and economic significance when customers have stronger bargaining power vis-à-vis their suppliers. To examine our second hypothesis, we perform subsample RD analysis based on two empirical proxies for bargaining power in the supply chain.

Our first measure is the relative ratio in industry concentration between suppliers and customers, defined as supplier HHI divided by customer HHI (based on two-digit SIC industries) (*Relative HHI ratio*). Suppliers with a relatively lower industry concentration (than customers) generally have more potentially

[21] We also perform a placebo test based on the local linear regression that includes all supplier and customer firm covariates and industry and year fixed effects. The results from this alternative placebo test are qualitatively similar and are unreported for brevity. Details are available from the authors upon request.

competing suppliers with similar capabilities and, thus, they can be more easily replaced. By the same token, customers operating in relatively more concentrated industries buy in larger volumes and have a smaller number of alternatives. Hence, suppliers would require significant effort and time to find alternative customers to replace lost sales when an existing supply-chain relationship terminates (Crook and Combs, 2007). As such, if our theory of supply-chain appropriation is correct, a negative unionization effect should be more pronounced when *Relative HHI ratio* is lower. In line with this view, columns (1) to (4) of Table 9 show that the negative RD estimates of unionization are more pronounced for those customer-supplier-dyads with below-median *Relative HHI ratio*.

[Insert Table 9 about here]

Second, dependent suppliers with a larger proportion of supply-chain sales to a customer in total revenue have greater difficulty finding an alternative customer that can replace a similar amount of sales revenue if the existing relationship terminates. The strong reliance of suppliers on a customer for sales therefore places them in a more disadvantageous position in negotiations with the customer. Thus, our second proxy for supply-chain power is suppliers' degree of dependence on the unionized customer for sales, defined as the ratio of the supply-chain sales to supplier total sales (*SC sale/S.Sale*). In columns (5) to (8), the negative RD estimates are considerably larger and are only statistically significant for suppliers with above-median *SC sale/S.Sale,* consistent with our conjecture.

Overall, our subsample results not only inform the type of suppliers that are most negatively affected by customers' unionization, but also reinforce our conjecture that the negative effect in question indeed operates throughout the supply chain.

5.2 Further Evidence on Mechanisms

In this section, we present further evidence on the mechanisms behind our results. Indeed, worsened performance on the part of suppliers could be driven by reduced sales revenue, increased production or operating costs, or both. If customers price-squeeze suppliers as a result of unionization, we should find that sales revenue decline as opposed to costs increasing. In addition, such declines in sales revenue should be driven by reduced selling prices, as opposed to lowered sales volume.

[Insert Table 10 about here]

To test these conjectures, we perform local linear estimations (using both kernel methods) and examine the effect of unionization on supply-chain sales, computed as log supply-chain sales scaled by supplier sales (*ln(Percent sale)*). As shown in column (1) of panel A in Table 10, we find that the proportion of supply-chain sales declines significantly after passing a customer union election, consistent with reduced sales revenue.

Next, we exploit the idea that operating income is calculated as gross profit (i.e., sales minus cost of goods sold (COGS)) minus selling, general, and administrative (SG&A) expenses, and decompose supplier operating margin into gross profit margin, computed as gross profits divided by sales (*S.GP/Sale*), and SG&A expenses to sales (*S.SG&A/Sale*). This decomposition is desirable since gross profit margin is, by definition, less affected by changes in the number of units sold (i.e., sales volume), which likely reflects confounding changes in product demand and supply. To illustrate, gross profit margin is computed as:

$$\frac{(Selling\ price\ \times\ Number\ of\ units\ sold\ -\ Cost\ of\ goods\ sold\ per\ unit\ \times Number\ of\ units\ sold)}{Selling\ price\ \times\ Number\ of\ units\ sold}$$

$$= 1 - \frac{Cost\ of\ goods\ sold\ per\ unit}{Selling\ price} \qquad (5)$$

If supplier cost of goods sold per unit is not much affected by customer unionization (the denominator), gross profit margin likely captures changes in selling prices well. We test this empirically by further analyzing supplier cost of goods sold to sales (*S.COGS/Sale*).

Columns (2) to (4) present local linear estimations (using the triangular kernel method) for *S.GP/Sale*, *S.COGS/Sale*, and *S.SG&A/Sale*, respectively. Columns (2) and (3) show that, while passing a customer union election significantly reduces supplier gross profit margins, it has an insignificant effect on cost of goods sold. This evidence is consistent with reduced selling prices and thus price-squeezing by major customers. Results in column (4) further confirm that supplier operating costs do not respond to customer unionization. Together, our results are unlikely to be driven by confounding changes to supplier cost functions. Panel B reports the local linear estimation based on the rectangular kernel method, which are qualitatively similar. Furthermore, to evaluate covariate balance, we compare the lagged supplier and customer firm covariates at the optimal bandwidths. These results can be found in Table IA.4 of the online appendix.

5.3 Consequences of Unionization on Customers

Unionization is costly for firms because labor unions bargain collectively with employers for wage increases, more job benefits, and less hiring and firing, which may cause serious disruptions to firm operation and production. If our findings can indeed be attributed to unionization, we may find that customers' sales growth and labor force downsizing are slowed, and their cost of goods sold is raised after a winning union election. This section presents RD tests that explore the economic consequences of unionization on customers using election data at the *customer-year level* (831 union elections in total).

[Insert Table 11 about here]

Panels A and B of Table 11 report the local linear estimation under both triangular and rectangular kernel methods, respectively. Customer controls, and industry and year fixed effects are included in each model. As column (1) shows, we find little evidence that unionization significantly affects customers' sales growth; unionization does not appear to influence major customers' production and operation. In column (2) (at the optimal bandwidth), consistent with increased labor costs, our results show that passing a union election significantly (at the ten-percent level) increases customers' cost of goods sold by 3.5 percentage points.[22, 23]

In columns (3) and (4), we decompose the annual percentage change in the number of employees into two variables: *C.-ve ΔEmployee* (*C.+ve ΔEmployee*), which take the value of the negative (positive) changes and a value of zero for positive (negative) changes. This decomposition allows us to separately study the effect of unionization between firms who have a growing employee base and those who are likely to be downsizing. Our tests reveal that the passage of a customer union election significantly alleviates negative changes in the number of employees, but has an insignificant effect on positive changes in employee numbers.[24] This evidence is consistent with firms facing increased inflexibility in downsizing their labor force after experiencing an increase in unionization.

In unreported tests, we check covariate balance by comparing supplier and customer firm covariates between the winning and losing elections at the optimal bandwidths for the above four customer outcomes, finding that most lagged covariates and customer outcomes are insignificantly different prior to the elections (see Table IA.5 of the online appendix). Overall, our evidence suggests that customer firms experience increased input costs and rigidity after an increase in unionization, consistent with a greater need to price-squeeze or switch costs onto upstream suppliers.

[22] To gauge the magnitude of increased labor costs, in our election sample at the *customer-year* level, we approximate labor expense as the product of the total number of employees (reported in Compustat) and the industry-average annual labor cost, the latter computed as annual US employee hourly compensation (from the Bureau of Labor Statistics (BLS)) multiplied by 2,087 annual working hours (according to US Code 5504(b)) following Wang et al. (2019). The average labor expense for the major customers in our sample is $16.9 billion, corresponding to 52.1 percent of its average cost of goods sold. An increase of 3.5 percentage points in *C.COGS/Sale* is equivalent to ($30.5 billion sales × 0.035) $1.07 billion increase in cost of goods sold, representing a 6.3 percent increase in labor expenses.

[23] The magnitude of the reduced customer cost of goods sold due to unionization is in line with Chen et al. (2017), who document that supplier unionization reduces its cost of goods sold to sales ratio by 4.1 percentage points.

[24] In an unreported analysis, we alternatively divide the customer-year election sample into two groups (one with negative changes and the other with positive changes in employee numbers) and estimate the local linear regressions on the two subsamples, documenting identical conclusions. These results are available upon request.

6. Additional Analysis

6.1 Customer Unionization and Supplier Firm Value

In this section, we estimate local linear regressions (using both kernel methods) to examine the impact of customer unionization on supplier firm value, measured as the natural log of market-to-book equity ratios (*S.ln(Q)*). Reported in Table 12, our results reveal a marginally significant (at the 10-percent level), negative effect of customer unionization on supplier firm value, controlling for supplier and customer firm covariates and industry and year fixed effects. Specifically, based on the RD estimates under the triangular kernel method and at the optimal bandwidth, the passage of a customer union election leads to a ($\exp^{(-0.120)}-1 = -0.113$) 11.3 percent decline in supplier market-to-book equity ratio.

[Insert Table 12 about here]

Moreover, we perform a subsample analysis (using the optimal bandwidths identified in column 1 of panel A) dividing the sample according to the two proxies of supply-chain bargaining power (see Section 5.1). Consistent with our hypothesis, we find that the negative effect of customer unionization is more pronounced when customers are in stronger bargaining positions.

In an unreported analysis, we check covariate balance by comparing supplier and customer firm covariates and the level and change in *S.ln(Q)* prior to elections. The difference-in-means tests confirm that there is no significant difference between the winning and losing elections falling within the optimal bandwidths around the cutoff threshold (except for supplier firm size) (see Table IA.4 of the online appendix).

6.2 Alternative Empirical Strategy I — Matched Difference-In-Differences (DID) Tests

In previous sections, our RD approach exploits the locally exogenous variation in unionization provided by labor union elections for identification. To enhance robustness, we adopt an alternative empirical strategy and compare, before and after an election, the operating performance of suppliers whose customers have a winning union election with that of a group of control suppliers whose customers do not. Note that, unlike our RD tests, there is no plausibly exogenous variation in unionization under this alternative strategy; the identification thus comes from finding a control group of supplier firms who are as close as possible in observable covariates and thus could offer potentially valid counterfactual outcomes (in the absence of winning customer union elections).

We first construct a supplier-customer-year panel dataset over the period from 1977 to 2017 based on the segment files from Compustat.[25] After merging the 831 customer union elections with this dataset, we apply propensity-score-matching techniques and estimate a logistic regression to model the likelihood of a customer union election victory as a function of lagged supplier and customer baseline covariates and year dummy variables. Using the propensity scores estimated from the full-sample regression, in each year we match each supplier whose customers have a winning election with a control supplier from the same industry (based on the Fama-French 12-industry classification), with the nearest propensity score,[26] and whose customers do not have an election victory or have a union election. For each matched pair (920 matched pairs in total), we retain the data from one year before and one year after the election for analysis (the treatment year is dropped). The observations of the matched pairs in each year (or "cohort") are then pooled into a panel.

[Insert Table 13 about here]

Column (1) of panel A in Table 13 reports estimation results of the logistic regression on the prematched full sample. Column (2) reports results from a linear probability model on the postmatched sample in the year prior to the winning elections, controlling for interacted year-cohort fixed effects. As column (2) shows, none of the supplier and customer firm covariates is statistically significant in explaining the treatment status (i.e., having a winning customer union election); R-squared is low (i.e, 1.2 percent),

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[25] Since our sample consists of customer union elections between 1978 and 2016 and because we need one year before and after the elections for the analysis, the sample period of this larger dataset spans the period from 1977 to 2017. This panel dataset consists of 1,867 customers and 5,098 suppliers. We apply a similar procedure to reduce the direct effect of supplier labor union elections: if a supplier has a union election in year *t,* we exclude its observations in year *t*-1, *t*, and *t*+1.

[26] We require the difference in propensity score of the matched pair to be smaller than 1% in absolute value. The matching is done without replacement.

suggesting that the matching is successful in eliminating the differences in observable covariates between the treatment and control groups. Panel B reports the average values of the covariates for the two groups and the difference-in-mean test results (standard errors clustered at the customer firm level), confirming that the covariates are balanced prior to the elections.

We estimate the following DID regressions:

$$S.Operating\ performance_{i,j,t} = \beta_0 + \beta_1\, Treat_{i,j} + \beta_2\, Post_t + \beta_3\, Treat_{i,j} \times Post_t + \delta\, X_{i,j,t-1} + Pair \times Cohort\ FE + Year \times Cohort\ FE + \varepsilon_{i,j,t}, \quad (6)$$

where i, j, and t denote suppliers, customers, and years; $Treat_{i,j}$ equals one for suppliers whose customers have a winning union election, and zero otherwise; $Post_t$ equals one in the year after a customer union election, and zero before the election; $X_{i,j,t-1}$ is a vector of supplier and customer baseline control variables; $\varepsilon_{i,j,t}$ is the regression residual. Following Gormley and Matsa (2011), we include pair-cohort fixed effects to control for any fixed differences between supplier-customer pairs and year-cohort fixed effects to account for any time trend. β_3 is a DID estimate of the effect of winning a customer union election on supplier operating performance. Standard errors are clustered at the customer firm level.

Panel C reports the DID estimates. In column (1), where no control variables are included, we find that *S.ROS* declines significantly (at the ten-percent level) in the first year after a winning customer union election, relative to control suppliers. Column (2) further includes the supplier and customer controls and shows similar results. Specifically, supplier operating margin declines by 1.3 percentage points after their major customers pass union elections. Results for supplier gross profit margins reported in columns (3) and (4) are even stronger: Suppliers suffer a 1.7-percentage-point decline in gross profit margins (significant at the five-percent level or better) after a winning customer union election. This evidence again suggests that the reduced operating margins likely stem from reduced selling prices (see our discussions in section 5.2). Columns (5) and (6) report the DID estimates for supplier log market-to-book equity ratios (*S.ln(Q)*), similarly showing that supplier firm value also declines by 5.4 percent (significant at the ten-percent level or better) in the first year after winning customer union elections.

Overall, results under this alternative empirical strategy reinforce our interpretation that customer unionization negatively affects supplier operating performance.

6.3 Alternative Empirical Strategy II — Industry-Level Unionization Rates

In addition to the RD approach and the matched DID tests (in section 6.2), in this section we adopt one more alternative empirical strategy and exploit the variation in unionization rates across industries for both suppliers and customers to identify the relation in question.

We collect data on annual industry unionization rates from 1983 to 2017 from the Union Membership and Coverage Database.[27] The unionization rates represent the proportion of total workers in a Census Industry Classification (CIC) industry covered by labor unions for collective bargaining. The unionization rates are then matched with industries of both suppliers and customers in each year in the full-sample supplier-customer-year panel dataset, as discussed in section 6.2.[28] We retain only customers operating in the manufacturing industries (i.e., with SIC codes between 2,000 and 3,990), consistent with prior union studies (see, e.g., Klasa et al., 2009). After excluding missing values, our full sample consists of a total of 879 unique customers, 2,829 unique suppliers, and 19,174 supplier-customer-year observations. The industry distribution and summary statistics can be found in Table IA.6 and panel A of Table IA.7 in the online appendix.

Our unreported cross-sectional tests show that customer industry unionization rates are negatively and significantly associated with lower supplier operating margin and log market-to-book equity ratios, after controlling for supplier industry unionization rates, supplier and customer firm covariates, and year

[27] The Union Membership and Coverage Database is maintained by Professor Barry Hirsch and Professor David Macpherson and can be downloaded from www.unionstats.com. We thank the professors for making these data publicly available.
[28] For the 1983-1991 period, the three-digit CIC codes are converted into SIC codes using Census 1980 codes; for the 1992-2002 period, the three-digit CIC codes are translated into SIC codes using industry information from the Union Membership and Coverage Database; for the period from 2003 to 2017, we use information from the Census Industry Codes with Crosswalk to match the four-digit CIC codes to NAICS codes.

fixed effects, consistent with our earlier findings. These unreported results can be found in panel B of Table IA.7 in the online appendix.

Overall, our findings based on industry unionization rates are largely consistent with the results from our RD and matched DID tests, thus lending more credence to our interpretation.

6.4 Other Discussions

Since the segment files from Compustat primarily contain supplier-customer dyads in which the share of supply-chain sales is at least ten percent of the supplier's total sales, such data restriction may limit the generalizability of our findings to suppliers without major customers. While this limitation may not be fully addressed, we believe that this concern is not severe under our research design.

Our research objective is to identify a negative spillover effect of unionization that travels from major customers to upstream suppliers. Intuitively, since major customers (those contributing more than ten percent of suppliers' total sales) are, in general, larger in firm size and market share than are their dependent suppliers, any shocks to them and their subsequent responses are likely to have an economically large impact on the latter. If this intuition is correct, the effect of customer unionization on suppliers, if any, is likely to be driven by these major customers and would be readily captured in our identification tests. This view is also supported by our empirical findings. Results in section 5.2 show that the negative customer-unionization effect increases with the share of supply-chain sales in supplier revenue (see also Table IA.8 of the online appendix).[29] Therefore, while the extent of generalizability of our findings to suppliers who have no major customers remains unclear, we believe that the effect of unionization of customers whose sales contribution is below ten percent is unlikely to be significant.

To further explore this issue, we gather a sample of all available publicly listed companies in Compustat over the period from 1978 to 2017 (16,824 firms in total; 6,779 firms had reported at least one

[29] In addition to the subsample analysis reported in section 5.2, we estimate local linear regressions that interact customer unionization with *SC sale/S.Sale*, finding a negative and significant interaction term, consistent across different specifications and bandwidth choices.

major customer) and compare firms with and without major customers in the baseline observable covariates and their industry distribution. Unreported analysis shows that firms with major customers are more profitable, smaller in size, less leveraged, more R&D intensive, have lower asset tangibility, and more cash holdings than those without. While these differences are statistically significant at the one-percent level, they appear to be moderate in magnitude. Moreover, we run two-sample proportion tests to examine whether industry membership (based on the Fama-French 49-industry classification) differs between the two groups for each industry. While industry memberships are significantly different in 39 of the 45 industries (financials excluded) between the two groups, the average absolute differences in industry membership between the two groups across the 45 industries is only 1.05 percent. These results can be found in Table IA.9 of the online appendix.

Overall, while we discuss above why this data restriction may not severely limit the generalizability of our findings and affect our estimation in our setting, we acknowledge that this concern is not fully addressed. Caution should be exercised when applying our findings to publicly listed firms without major customers.

Finally, we perform additional RD tests to examine firms' strategic incentives to increase bargaining power over labor and document that unionization significantly (at the ten-percent level) increases financial leverage and reduces cash holdings of manufacturing firms, consistent with prior finance studies (Klasa et al., 2009; Matsa, 2010). These unreported results can be found in Table IA.10 of the online appendix.

7. Conclusion

Although the body of literature on unionization is large, relatively few studies have considered its potential impact on the *supply-chain partners* of unionized firms. In this paper, we use the supply chain as an empirical setting and gauge the degree to which unionization in customer firms affects the performance of their dependent suppliers.

Labor unions are widely associated with making wages sticky, lowering production efficiencies, and imposing other adjustment costs onto firms. Previous studies have shown that firms strategically reduce their financial flexibility by raising debt financing and holding less cash to shelter liquidity from wage demands by employee collectives to lessen the impact of unions (Klasa et al., 2009; Matsa, 2010). Nonetheless, such strategic maneuvers come with costs, since lower liquidity reduces firms' buffers against negative income shocks, making them more susceptible to cash-flow problems. To cope with such union-induced costs and cash-flow risks, unionized firms must cut other variable costs, most notably through the supply-chain channel, whereby bargaining power is exercised to price-squeeze upstream suppliers. We therefore hypothesize that unionization is negatively associated with supplier operating performance.

Using U.S. union elections from 1978 to 2016 and a large sample of publicly listed supplier and customer firms, we adopt a regression-discontinuity (RD) test approach and exploit the "locally exogenous" variation in unionization provided by union elections to identify the relation in question. Our results show that supplier operating margins decline significantly following union election victories. The RD test results are robust to alternative estimation techniques, bandwidth choices, weighting methods, the inclusion of controls for state economic conditions, supplier and customer firm covariates, industry and year fixed effects, and sample restrictions. Our placebo test also confirms that our findings are unlikely to be driven by chance.

We then explore the role of supply-chain bargaining power in governing the negative relation in question, finding that the negative union-effect on supplier operating margin is more pronounced when the industry concentration of suppliers is lower relative to that of their customers and when suppliers are more sales-dependent on customers. This evidence is consistent with the view that customers with stronger bargaining power have a larger scope to price-squeeze suppliers by threatening to switch to alternative suppliers.

Further tests reveal that lower supplier operating margins can be attributed to reduced top-line performance, more specifically, to squeezed selling prices, as opposed to increased operating costs.

Moreover, examining the economic consequences of unionization on customer firms, our local linear tests at optimal bandwidths show that the passage of union elections significantly increases customer firms' cost of goods sold and slows labor force downsizing, consistent with increased labor and adjustment costs following unionization. Finally, we examine firm value and show that customer unionization significantly reduces suppliers' market-to-book equity ratios.

Our study offers several important implications. First, our results complement those of Chen et al. (2017) and reveal a negative consequence of labor unionization that operates through the supply-chain channel. Subsequent research on union taxes or costs should take into consideration the interrelationships between unionized firms and their supply-chain partners, thereby opening a new avenue and direction for future research on labor unions. Second, our paper adds to the body of economics and finance literature on the effects of unionization on various corporate outcomes and decisions. Third, our paper adds to the growing stream of literature documenting that corporate or industry disruptions can affect supply-chain partners' performance (see, e.g., Hertzel et al., 2008; Houston et al., 2016). Our paper complements these studies by showing that unionization represents economically important disruptions that reduce upstream firm performance. Finally, this study is one of the few to show that firms exploit other stakeholders for their own gain when opportunities arise by exercising their bargaining power, lending support to the theoretical literature in supply-chain management.

Finally, our RD analysis is subject to at least two caveats. First, because our identification relies on a relatively small number of winning and losing elections that fall within the optimal bandwidths around the cutoff threshold, our estimates may have good local validity but potentially weak external validity. Second, since our sample consists only of customer-supplier dyads in which customers have a union election, our sample dyads may not be directly comparable to other dyads with no union elections, suggesting that the generalization of our findings under the RD approach to the wider universe of firms may be less than satisfactory. Nonetheless, since our interest is in whether barely passing or failing an election affects supplier performance, our estimation of the treatment effect is unaffected. However, our

RD tests do not answer the question of whether holding union elections would affect supplier performance. We leave the answer to that question for future research.

References

Abowd, J. M. 1989. The effect of wage bargains on the stock market value of the firm. *Amer. Econom. Rev.*, 79 (4), 774–800.

Acemoglu, D., V. M. Carvalho, A. Ozdaglar, A. Tahbaz-Salehi. 2012. The network origins of aggregate fluctuations. *Econometrica*, 80 (5), 1977–2016.

Agca, S., V. Babich, J. R. Birge, J. Wu. 2017. Credit risk propagation along supply chains: Evidence from the CDS market. Georgetown McDonough School of Business Research Paper No. 3078752. Available at SSRN: https://ssrn.com/abstract=3078752 or http://dx.doi.org/10.2139/ssrn.3078752

Ak, B. K., P. Patatoukas. 2016. Customer-base concentration and inventory efficiencies: Evidence from the manufacturing sector. *Production and Oper. Management* 25 (2), 258–272.

Ashenfelter, O., G. E. Johnson. 1969. Bargaining theory, trade unions, and industrial strike activity. *Amer. Econom. Rev.,* 59 (1), 35–49.

Atalay E., A. Hortasu, J. Roberts, C. Syverson. 2011 Network structure of production. *Proc. National Academy of Sciences,* 108 (13), 5199–5202.

Baker, G., R. Gibbons, K. J. Murphy. 2002. Relational contracts and the theory of the firm. *Quart. J. Econom*., 117 (1), 39–84.

Barrot, J. N., J. Sauvagnat. 2016. Input specificity and the propagation of idiosyncratic shocks in production networks. *Quart. J. Econom.,* 131 (3), 1543–1592.

Bekaert, G., M. Ehrmann, M. Fratzscher, A. Mehl. 2014. The global crisis and equity market contagion. *J. Finance*, 69 (6), 2597–2649.

Bradley, D., I. Kim, X. Tian. 2016. Do unions affect innovation? *Management Sci.,* 63 (7), 2251–2271.

Bronars, S., D. Deere. 1991. The threat of unionization, the use of debt, and the preservation of shareholder wealth. *Quart. J. Econom.,* 106 (1), 231–254.

Boston Consulting Group 2015. Auto suppliers face a growing financial squeeze as automakers demand both deep cost cuts and local production. Retrieved May 11th, https://www.bcg.com/d/press/3mar2015-auto-suppliers-deep-cost-cuts-local-production-842.

Bureau of Labor Statistics 2017. Union membership (annual) news release. Retrieved May 11th, https://www.bls.gov/news.release/archives/union2_01262017.htm.

Cachon, G. P., S. Netessine. 2004. Game theory in supply chain analysis. Simchi-Levi D., Wu S.D., Shen ZJ., eds. *Handbook of Quantitative Supply Chain Analysis.* International Series in Operations Research & Management Science. (Springer, Boston, MA), 13–65.

Campello, M, J. Gao, J. Qiu, Y. Zhang. 2018. Bankruptcy and the cost of organized labor: Evidence from union elections. *Rev. Financial Stud.,* 31 (3), 1014–1063.

Carvalho, V. M., M. Nirei, Y. Saito, A. Tahbaz-Salehi. 2017. Supply Chain Disruptions: Evidence from the Great East Japan Earthquake. Becker Friedman Institute for Research in Economics Working Paper No. 2019–01.

Chen, G., J. S. Judd, S. Pandit. 2017. Firm unionization and disruptions in customer relationship. Available at SSRN: https://ssrn.com/abstract=3010829 or http://dx.doi.org/10.2139/ssrn.3010829.

Chen, H., M. Kacperczyk, H. Ortiz-Molina. 2011. Labor unions, operating flexibility, and the cost of equity. *J. Financial Quant. Anal.,* 46 (1), 25–58.

Choi, S. C. 1991. Price competition in a channel structure with a common retailer. *Marketing Sci.,* 10 (4), 271–296.

Crook, T. R., J. G. Combs. 2007. Sources and consequences of bargaining power in supply chains. *J. Oper. Management,* 25 (2), 546–555.

DeAngelo, H., L. DeAngelo. 1991. Union negotiations and corporate policy: a study of labor concessions in the domestic steel industry during the 1980s. *J. Financial Econom.,* 30 (1), 3–43.

Dhaliwal, D., J. S. Judd, M. Serfling, S. Shaikh. 2016. Customer concentration risk and the cost of equity capital. *J. Accounting and Econom.,* 61 (1), 23–48.

DiNardo, J., D. S. Lee. 2004. Economic impacts of new unionization on private sector employers: 1984–2001. *Quart. J. Econom.,* 119 (4), 1383–1441.

Fama, E., J. D. MacBech. 1973. Risk, return and equilibrium: Empirical tests. *J. Political Econom.,* 81 (3), 607-636.

Fee, C. E., S. Thomas. 2004. Sources of gains in horizontal mergers: Evidence from customer, supplier, and rival firms. *J. Financial Econom.,* 74 (3), 423–460.

Ganesan, S. 1994. Determinants of long-term orientation in buyer-seller relationships. *J. Marketing,* 58 (2), 1–19.

Gelman, A., G. Imbens. 2014. Why high-order polynomials should not be used in regression discontinuity designs. NBER Working Paper No. 20405.

Gormley, T. A., D. A. Matsa. 2011. Growing out of trouble? Corporate responses to liability risk. *Rev. Financial Stud.*, 24 (8), 2781–2821.

Gu, T., N. R. Sanders, A. Venkateswaran. 2017. CEO incentives and customer-supplier relations. *Production and Oper. Management,* 26 (9), 1705–1727.

Haggard, T. 1983. Appointment of union representatives to creditors' committees under Chapter 11 of the bankruptcy code. *S.C.L. Rev.,* 35, 517–531.

Hallen, L., J. Johanson, N. Seyed-Mohamed. 1991. Interfirm adaptation in business relationships. *J. Marketing,* 55 (2), 29–37.

He, J., X. Tian, H. Yang, L. Zuo. 2018. Asymmetric cost behavior and dividend policy. Available at SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2716565.

Hertzel, M. G., Z. Li, M. S. Officer, K. J. Rodgers. 2008. Inter-firm linkages and the wealth effects of financial distress along the supply chain. *J. Financial Econom.,* 87 (2), 374–387.

Hirsch, B. T. 1991a. Labor unions and the economic performance of firms. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research.

Hirsch, B. T. 1991b. Union coverage and profitability among U.S. firms. *Rev. Econom. and Stat.,* 73 (1), 69–77.

Hirsch, B. T. 1997. Unionization and economic performance: Evidence on productivity, profits, investment, and growth. Fazil Mihlar, eds. *Unions and right-to-work laws* (Vancouver, B.C.: Fraser Institute), 35–70.

Hirsch, B. T. 2004. What do unions do for economic performance? *J. Labor Research,* 25 (3), 415–456.

Houston, J. F., C. Lin, Z. Zhu. 2016. The financial implications of supply chain changes. *Management Sci.,* 62 (9), 2520–2542.

Hui, K. W., C. Liang, P. E. Yeung. 2019. The effect of major customer concentration on firm profitability: Competitive or collaborative? *Rev. Accounting Stud.,* 24 (1), 189—229.

Imbens, G., K. Kalyanaraman. 2012. Optimal bandwidth choice for the regression discontinuity estimator. *Rev. Economic Stud.,* 79 (3), 933–959.

Imbens, G., T. Lemieux. 2008. Regression discontinuity designs: A guide to practice. *J. Econometric,s* 142 (2), 615-635.

Iyer, G., J. M. Villas-Boas. 2003. A bargaining theory of distribution channels. *J. Marketing Res.* 40 (1), 80-100.

Jeuland, A., S. M. Shugan. 1983. Managing channel profits. *Marketing Sci.,* 2 (3), 52–69.

Kadiyali, V., P. Chitagunta, N. Vilcassim. 2000. Manufacturer retailer channel interactions and implications for channel power: An empirical investigation of pricing in a local market. *Marketing Sci.,* 19 (2), 127148.

Klasa, S., W. F. Maxwell, H. Ortiz-Molina. 2009. The strategic use of corporate cash holdings in collective bargaining with labor unions. *J. Financial Econom.,* 92 (3), 421–442.

Lee, D. S., T. Lemieux. 2010. Regression discontinuity designs in economics. *J. Econom. Literature,* 48 (2), 281–355.

Lee, D. S., A. Mas. 2012. Long-run impacts of unions on firms: New evidence from financial markets, 1961–1999. *Quart. J. Econom.,* 127 (1), 333–378.

Leider, S., W. S. Lovejoy. 2016. Bargaining in supply chains. *Management Sci*., 62 (10), 2765–3082.

Lewis, H. G. 1986. Union relative wage effects: A Survey. University of Chicago Press, Chicago.

Matsa, D. A. 2010. Capital structure as a strategic variable: Evidence from collective bargaining. *J. Finance,* 65 (3), 1197–1232.

McCrary, J. 2008. Manipulation of the running variable in the regression discontinuity design: A density test. *J. Econometrics,* 142 (2), 698–714.

Osadchiy, N., V. Gaur, S. Seshadri. 2016. Systematic risk in supply chain networks. *Management Sci.,* 62 (6), 1755–1777.

Patatoukas, P. 2012. Customer-base concentration: Implications for firm performance and capital markets. *The Account. Rev.,* 87 (2), 363–392.

Quinn, F. J. 1997. What's the buzz? *Logistics Management,* 36 (2), 43–46.

Radhakrishnan, S., Z. Wang, Y. Zhang. 2014. Customers' capital market information quality and suppliers' performance. *Production and Oper. Management,* 23 (10), 1690–1705.

Ruback, R. S., M. B. Zimmerman. 1984. Unionization and profitability: Evidence from the capital market. *J. Political Econom.,* 92 (6), 1134–1157.

Serpa, J. C., H. Krishnan. 2017. The impact of supply chains on firm-level productivity. *Management Sci.,* 64 (2), 495–981.

Taylor, A., E. Plambeck. 2007. Supply chain relationships and contracts: The impact of repeated interaction on capacity investment and procurement. *Management Sci.,* 53 (10), 1577–1593.

Wang, Y., J. Li, R. Anupindi. 2017. Risky suppliers or risky supply chains? An empirical analysis of sub-tier supply network structure on firm risk in the high-tech sector. Ross School of Business Paper No. 1297. Available at SSRN: https://ssrn.com/abstract=2705654 or http://dx.doi.org/10.2139/ssrn.2705654.

Williamson, O. E. 1971. The vertical integration of production: Market failure considerations. *Amer. Econom. Rev.,* 61 (2), 112–123.

Williamson, O.E. 1979. Transaction-cost economics: The governance of contractual relations. *J. Law and Econom.,* 22 (2), 233–261.

Wu, J., J. Birge. 2014. Supply chain network structure and firm returns. Available at SSRN: https://ssrn.com/abstract=2385217 or http://dx.doi.org/10.2139/ssrn.2385217.

Figure 1
Number of Elections and Average Vote Share over Time

This figure plots the number of elections (blue solid line; left *y*-axis) and the average vote share for unionization (red dashed line; right *y*-axis) of our union election sample over the period from 1978 to 2016.

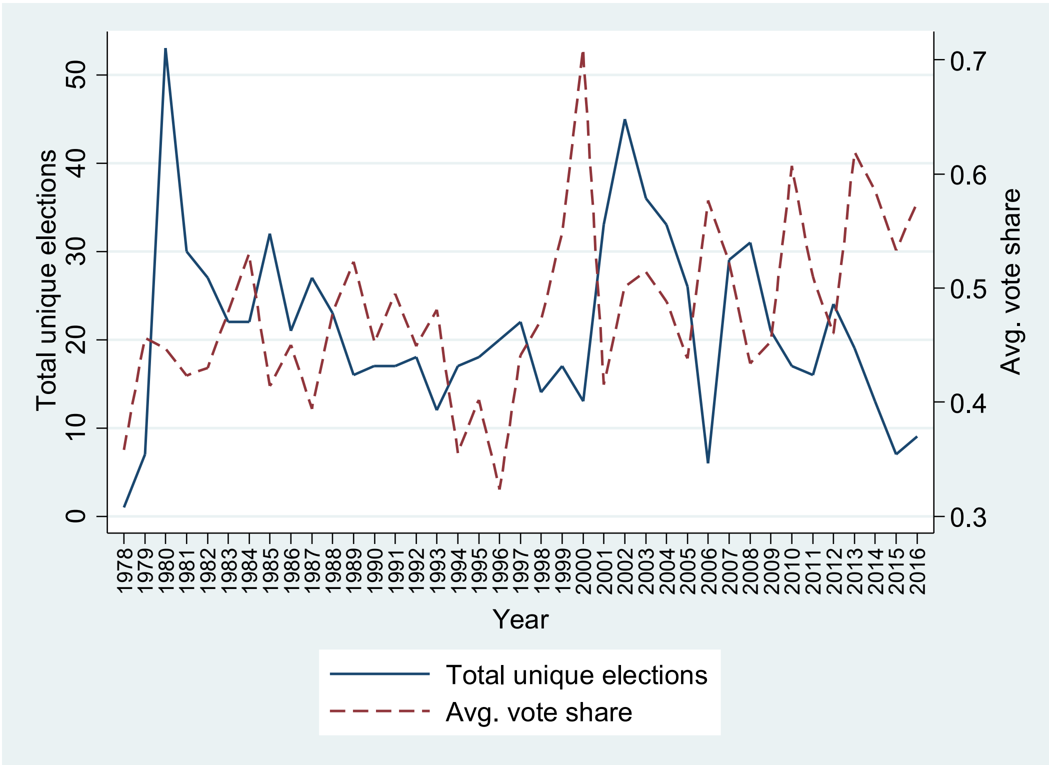

Figure 2
Distribution of Votes

This figure plots a histogram showing the density of the 831 union elections among customer firms at different levels of vote share for unionization. *Vote share* is divided into 50 equal-sized bins.

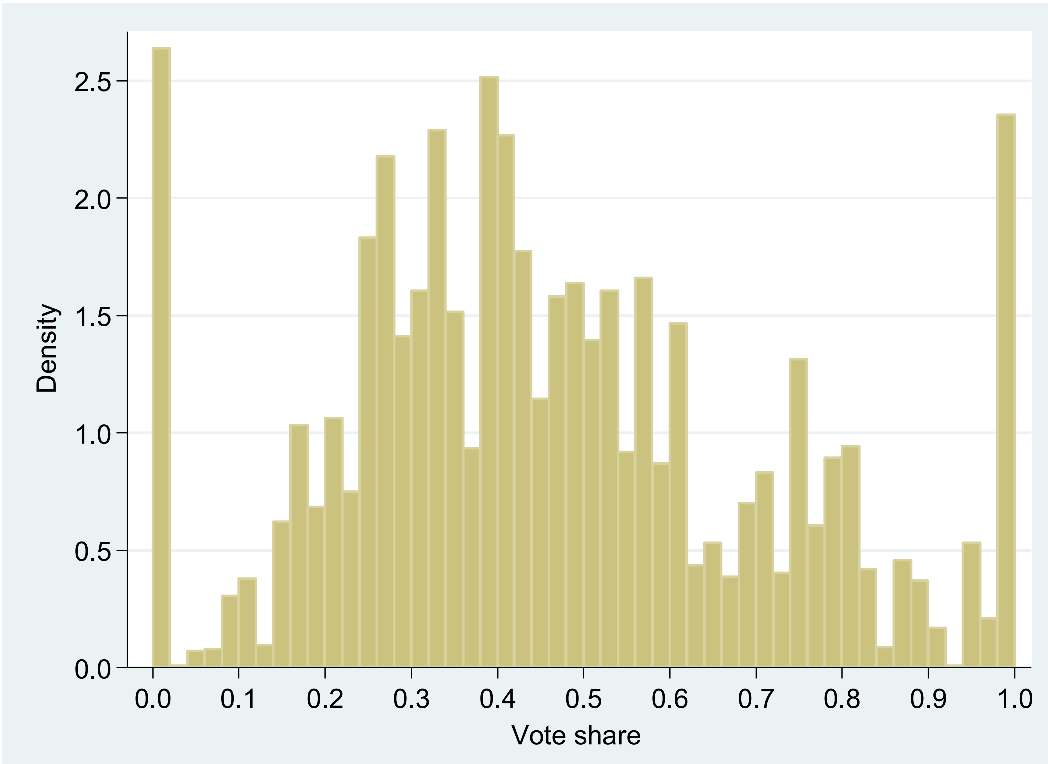

Figure 3
Density of Union Vote Shares

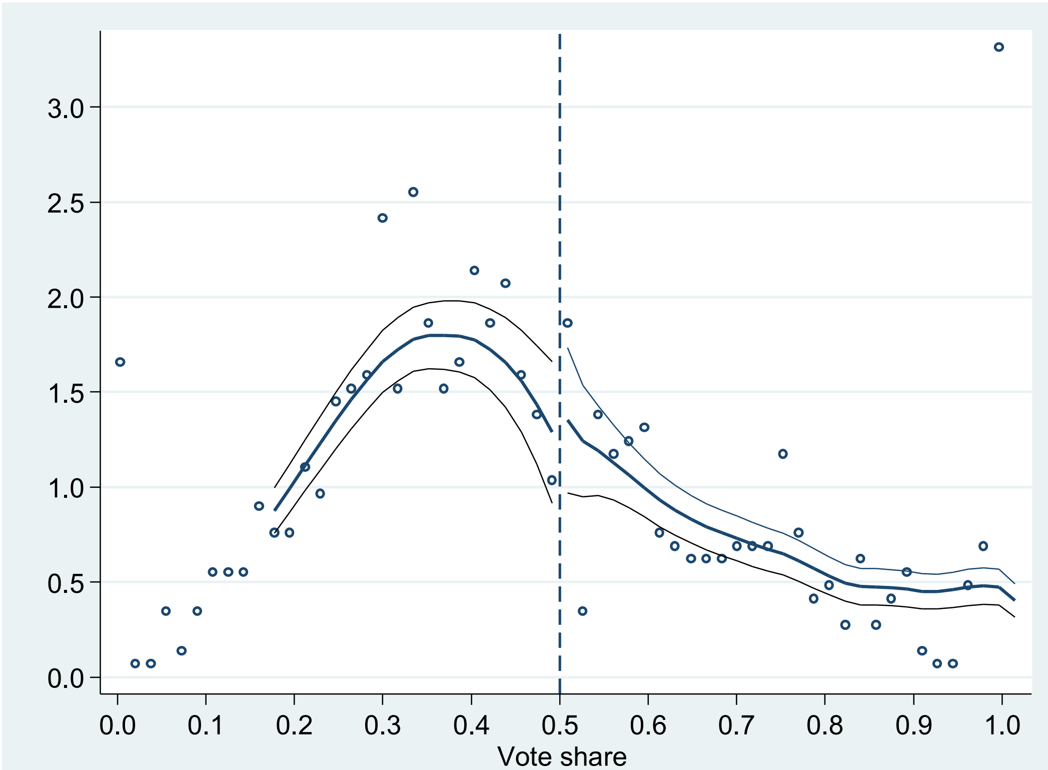

Figure 4
Regression Discontinuity (RD) Plot – *S.ROS* $_{t+1}$

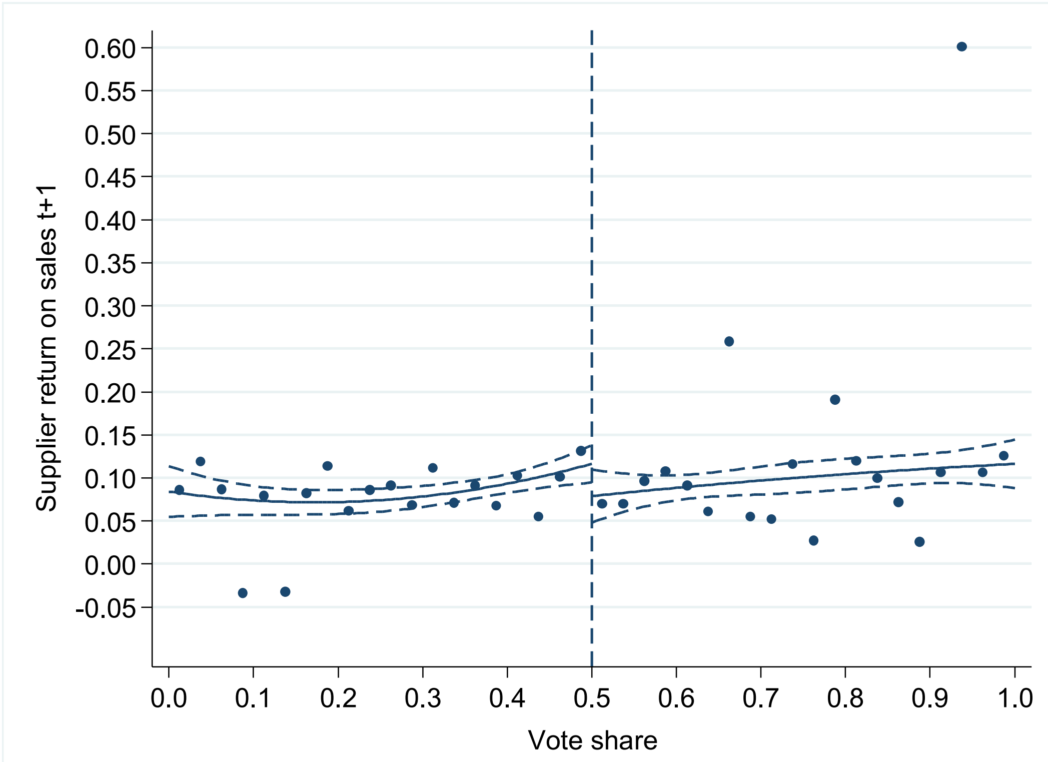

Figure 5
Placebo Tests

This figure plots the histograms of the distribution of RD estimates from local linear regressions (under the triangular kernel method) from placebo tests. The *x*-axis represents the RD estimates from a placebo test that randomly assumes a threshold other than 50% (for 5,000 times). The true RD estimates based on the true 50% threshold are denoted by the red vertical lines.

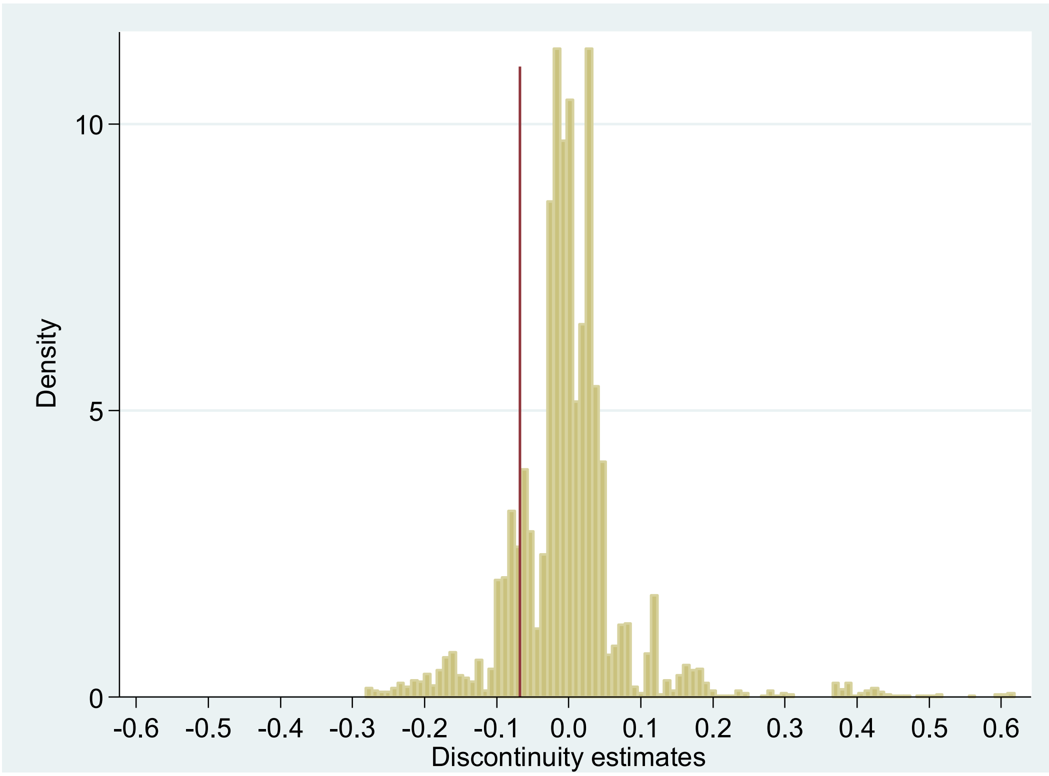

Table 1. Descriptive Statistics and Distribution of the Election

This table reports the descriptive statistics and distribution of the 831 unique elections of customer firms. Panel A shows the distribution of the elections by ranges of *Vote (Vote rank)*. It also shows the number of customers and suppliers affected by the elections at different vote ranks as well as the average number of eligible voters for the elections. Panel B shows the distribution of customer firms by the number of supplier firms per customer (in sample) and *Vote rank*. Panel C shows the distribution of union elections and the average vote share and eligible voters by year. Figures highlighted in gray refer to those elections with *Vote* between 0.40 and 0.60.

Panel A. Details on the 831 unique elections

	Range		*Vote share*						Affecting	
Rank	>	≤	Mean	Min.	Max.	# elections	%	Avg. eligible	Customers	Suppliers
1	≥0%	10%	1.2%	0.0%	9.8%	38	4.6%	45.1	36	333
2	10%	20%	15.9%	10.0%	19.7%	55	6.6%	436.1	45	286
3	20%	30%	25.5%	20.0%	29.8%	111	13.4%	151.2	81	588
4	30%	40%	35.1%	30.0%	39.9%	159	19.1%	259.1	89	666
5	40%	50%	45.3%	40.0%	50.0%	165	19.9%	165.8	95	704
6	50%	60%	55.7%	50.5%	59.8%	77	9.3%	167.8	58	379
7	60%	70%	63.8%	60.0%	70.0%	62	7.5%	79.2	43	339
8	70%	80%	75.1%	70.3%	79.1%	57	6.9%	57.5	48	371
9	80%	90%	83.9%	80.0%	90.0%	38	4.6%	33.9	31	256
10	90%	≤100%	98.4%	90.9%	100.0%	69	8.3%	192.9	47	282
						Total: 831	100.0%	176.6		

Panel B. Average number of firms per customer (in-sample)

			Rank									
# suppliers per customer	# elections	%	1	2	3	4	5	6	7	8	9	10
1	289	34.8%	15	27	38	52	64	29	12	16	12	24
2	156	18.8%	5	10	22	33	29	11	14	10	8	14
3	77	9.3%	4	5	7	17	17	7	10	3	2	5
4	49	5.9%	3	2	7	7	8	8	2	2	2	8
5	14	1.7%	1	1	1	2	1	3	4	0	1	0
6-10	80	9.6%	4	1	10	17	15	4	5	11	4	9
11-20	78	9.4%	0	4	14	17	12	4	10	8	5	4
21-30	40	4.8%	3	1	6	7	9	3	2	4	2	3
31-40	22	2.6%	0	2	3	3	5	3	2	2	1	1
41-50	5	0.6%	0	1	0	0	0	2	1	0	1	0
51-60	14	1.7%	1	0	1	3	4	3	0	1	0	1
61-70	4	0.5%	0	1	1	1	1	0	0	0	0	0
71 or more	3	0.4%	2	0	1	0	0	0	0	0	0	0
	831	100.0%	38	55	111	159	165	77	62	57	38	69
Mean	7.5		10.1	6.3	8.1	6.9	7.3	8.3	7.0	8.8	7.4	5.9
Median	2.0		2	2	2	2	2	2	3	3	2	2

Panel C. Distribution by year

Year	Obs.	Total unique elections	Avg. vote share	Avg. eligible
1978	11	1	35.8%	58.0
1979	26	7	45.6%	254.9
1980	246	53	44.7%	386.6
1981	222	30	42.3%	319.7
1982	187	27	43.0%	164.0
1983	190	22	47.9%	81.0
1984	238	22	53.0%	281.1
1985	294	32	41.4%	222.1
1986	178	21	45.0%	145.0
1987	201	27	39.4%	131.4
1988	237	23	47.8%	111.2
1989	217	16	52.3%	108.6
1990	200	17	45.2%	104.4
1991	199	17	49.5%	90.9
1992	195	18	44.9%	120.6
1993	72	12	48.1%	160.5
1994	142	17	35.5%	84.4
1995	138	18	40.2%	164.5
1996	125	20	32.3%	124.9
1997	169	22	44.1%	135.5
1998	47	14	47.2%	128.3
1999	146	17	54.9%	58.6
2000	57	13	71.0%	95.6
2001	236	33	41.5%	678.6
2002	267	45	50.1%	235.1
2003	259	36	51.4%	110.7
2004	215	33	48.8%	135.8
2005	257	26	43.8%	82.6
2006	31	6	57.7%	44.5
2007	258	29	52.2%	112.7
2008	301	31	43.4%	172.0
2009	134	21	45.3%	55.0
2010	107	17	60.7%	36.1
2011	67	16	51.0%	148.3
2012	110	24	46.0%	121.9
2013	90	19	61.9%	65.7
2014	68	13	58.5%	73.9
2015	26	7	53.3%	54.0
2016	37	9	57.5%	111.4
Total	6,200	831		

Table 2. Descriptive Statistics of Union Elections

This table reports the descriptive statistics for our union election sample. Panel A reports the number of observations, means, standard deviations, and medians of *Unionization* and *Vote*. *Unionization* is an indicator that equals one if the majority of employees voted for unionization in a given election, and zero otherwise. *Vote* is the percentage vote for unionization in a given election. Panel B reports an industry breakdown of our election sample according to the Fama-French 12-industry classification for both suppliers and customer firms (excluded financials).

Panel A. Election details

	Obs.	Mean	Stdev	Median
Unionization	6,200	0.37	0.48	0.000
Vote	6,200	0.46	0.25	0.429

Panel B. Industry distribution

	Supplier (Unique=1,659)			Customers (Unique=232)		
Fama-French 12 industries	Obs.	%	Unique firms	Obs.	%	Unique firms
NonDurables	474	7.6%	149	150	2.4%	20
Durables	623	10.0%	106	2,364	38.1%	16
Manufacturing	1,592	25.7%	308	784	12.6%	48
Oil, Gas, and Coal Extraction and Products	290	4.7%	130	429	6.9%	16
Chemicals and Allied Products	156	2.5%	34	40	0.6%	11
Business Equipment	1,297	20.9%	386	147	2.4%	14
Telephone and Television Transmission	115	1.9%	44	508	8.2%	16
Utilities	155	2.5%	37	43	0.7%	10
Wholesale, Retail, and Some Services	294	4.7%	112	1,586	25.6%	53
Healthcare, Medical Equipment, and Drugs	514	8.3%	132	64	1.0%	12
Others	690	11.1%	224	85	1.4%	16
	6,200	100.0%	1,662	6,200	100.0%	232

Table 3. Summary Statistics

This table reports summary statistics, including the number of observations, means, medians, standard deviations, and percentile statistics of several main firm characteristics, for both suppliers and customers. Detailed definitions of the variables can be found in Appendix A.1.

		Obs.	Mean	Stdev	5%	25%	Median	75%	95%
Supplier	ROS_{t+1}	6,200	0.091	0.341	-0.226	0.053	0.117	0.191	0.432
	$Total\ assets_{t-1}$	6,200	1,368	3,668	10	50	190	894	6,600
	$Leverage_{t-1}$	6,200	0.238	0.193	0.000	0.072	0.221	0.358	0.591
	$R\&D/Sale_{t-1}$	6,200	0.078	0.257	0.000	0.000	0.008	0.052	0.280
	PPE/TA_{t-1}	6,200	0.293	0.215	0.031	0.130	0.244	0.407	0.776
	$CAPX/TA_{t-1}$	6,200	0.066	0.065	0.008	0.024	0.045	0.082	0.205
	$Cash/NA_{t-1}$	6,200	0.303	0.635	0.003	0.021	0.075	0.267	1.424
Customer	$Total\ assets_{t-1}$	6,200	86,789	96,053	4,164	18,375	49,622	125,167	237,168
	$Leverage_{t-1}$	6,200	0.265	0.163	0.061	0.127	0.233	0.375	0.559
	$R\&D/Sale_{t-1}$	6,200	0.021	0.020	0.000	0.000	0.018	0.037	0.051
	PPE/TA_{t-1}	6,200	0.315	0.186	0.054	0.141	0.300	0.449	0.608
	$CAPX/TA_{t-1}$	6,200	0.070	0.049	0.010	0.031	0.062	0.098	0.156
	$Cash/NA_{t-1}$	6,200	0.077	0.066	0.008	0.031	0.058	0.102	0.231

Table 4. Covariate Balance Between Union Elections Within a 5% Margin

This table compares the suppliers' and customers' firm variables between the winning and losing union elections within a 5% margin, i.e., [45%, 55%]. The differences in means and the corresponding *p*-values from the mean difference tests are reported (standard errors are clustered at the customer firm level). Detailed definitions of the variables can be found in Appendix A.1. Symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

		Win	Lose	Win-Lose	*p*-value
Supplier	ROS_{t-1}	0.062	0.100	-0.038	0.110
	ΔROS_{t-1}	-0.007	-0.002	-0.005	0.765
	$ln(Total\ assets)_{t-1}$	5.570	5.300	0.271	0.144
	$Leverage_{t-1}$	0.251	0.242	0.009	0.545
	$R\&D/Sale_{t-1}$	0.041	0.043	-0.002	0.866
	PPE/TA_{t-1}	0.340	0.334	0.006	0.822
	$CAPX/TA_{t-1}$	0.074	0.074	0.000	0.947
	$Cash/NA_{t-1}$	0.161	0.206	-0.045	0.136
Customer	$ln(Total\ assets)_{t-1}$	11.008	10.972	0.036	0.847
	$Leverage_{t-1}$	0.279	0.232	0.047**	0.036
	$R\&D/Sale_{t-1}$	0.032	0.027	0.005	0.490
	PPE/TA_{t-1}	0.315	0.358	-0.043	0.214
	$CAPX/TA_{t-1}$	0.084	0.103	-0.019	0.262
	$Cash/NA_{t-1}$	0.132	0.069	0.063	0.113

Table 5. Regression Discontinuity: Global Polynomial Regressions

This table reports the RD estimates from the first-, second-, and third-order global polynomial regressions. The dependent variable is supplier operating margin (*S.ROS*) in the first year after the union elections. *Unionization* is an indicator for unionization that equals one when the vote in favor of unionization exceeds the simple majority of 50%, and zero otherwise. *Vote* is the percentage vote share in favor of unionization, centralized by subtracting 0.50. Supplier and customer controls include: log total assets, leverage, R&D intensity, asset tangibility, capital expenditure to total assets, and cash to net assets. Detailed definitions can be found in Appendix A.1. Supplier industry, customer industry, and year fixed effects are included in some specifications. Industry fixed effects are constructed based on the Fama-French 49-industry classification. T-statistics based on customer-firm-clustered robust standard errors are reported in parentheses. Symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	$S.ROS_{t+1}$								
	1st order polynomials			2nd order polynomials			3rd order polynomials		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Unionization	-0.012	-0.017*	-0.012*	-0.034***	-0.036**	-0.025*	-0.074***	-0.064***	-0.039**
	(-1.642)	(-1.944)	(-1.663)	(-2.838)	(-2.092)	(-1.851)	(-3.168)	(-2.979)	(-2.284)
Vote	0.034	0.024	0.022	0.071	-0.077	-0.024	0.548**	0.359	0.091
	(1.033)	(0.647)	(0.966)	(0.567)	(-0.576)	(-0.290)	(2.115)	(0.986)	(0.476)
$Vote^2$				0.076	-0.208	-0.097	2.677**	2.156	0.529
				(0.323)	(-0.754)	(-0.571)	(2.239)	(1.249)	(0.597)
$Vote^3$							3.507**	3.187	0.847
							(2.310)	(1.468)	(0.744)
Unionization × *Vote*	0.014	0.019	0.031	0.211	0.441**	0.266*	0.243	0.276	0.372
	(0.299)	(0.390)	(0.968)	(0.959)	(2.565)	(1.774)	(0.576)	(0.534)	(0.871)
Unionization × $Vote^2$				-0.519*	-0.405	-0.257	-5.558**	-4.049*	-1.937
				(-1.816)	(-0.993)	(-0.822)	(-2.328)	(-1.934)	(-1.041)
Unionization × $Vote^3$							-0.434	-1.574	0.481
							(-0.159)	(-0.442)	(0.183)
Supplier and customer controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Industry FE	No	No	Yes	No	No	Yes	No	No	Yes
Year FE	No	No	Yes	No	No	Yes	No	No	Yes
Obs.	6,200	6,200	6,200	6,200	6,200	6,200	6,200	6,200	6,200
R-squared	0.001	0.294	0.363	0.002	0.296	0.363	0.004	0.297	0.363

Table 6. Regression Discontinuity: Local Linear Regressions Using the Optimal Bandwidth

This table reports the RD estimates from the local linear regressions using the optimal bandwidth identified by the data-driven method of Imbens and Kalyanaraman (2012). Panel A reports the local linear estimation based on the triangular kernel method and panel B reports results based on the rectangular kernel method. The dependent variable is supplier operating margin (*S.ROS*) in the first year after union elections. We also report the RD estimates at the 80% and 120% of the optimal bandwidth for robustness. Column (2) includes supplier and customer baseline controls, supplier and customer industry fixed effects, and year fixed effects. Industry effects are constructed using the Fama-French 49-industry classification. T-statistics based on customer-firm-clustered robust standard errors are reported in parentheses. Observation number, R-squared, and the bandwidth used are also reported. Symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Triangular kernel method

	$S.ROS_{t+1}$	
	(1)	(2)
Optimal bandwidth	-0.069**	-0.060***
	(-2.389)	(-2.712)
Obs.	3,106	3,106
R^2	0.005	0.496
80% optimal bandwidth	-0.076**	-0.083***
	(-2.438)	(-3.520)
Obs.	2,606	2,606
R^2	0.006	0.505
120% optimal bandwidth	-0.059**	-0.041**
	(-2.249)	(-2.256)
Obs.	3,632	3,632
R^2	0.003	0.488
Supplier and customer controls	No	Yes
Industry FE	No	Yes
Year FE	No	Yes
100% Optimal bandwidth	0.181	0.181
80% Optimal bandwidth	0.144	0.144
120% Optimal bandwidth	0.217	0.217

Panel B. Rectangular kernel method

	$S.ROS_{t+1}$	
	(2)	(2)
Optimal bandwidth	-0.049	-0.046*
	(-1.483)	(-1.733)
Obs.	2,549	2,549
R^2	0.003	0.499
80% optimal bandwidth	-0.063**	-0.090***
	(-2.372)	(-3.409)
Obs.	2,205	2,205
R^2	0.003	0.483
120% optimal bandwidth	-0.072**	-0.042*
	(-2.068)	(-1.852)
Obs.	2,944	2,944
R^2	0.004	0.505
Supplier and customer controls	No	Yes
Industry FE	No	Yes
Year FE	No	Yes
100% Optimal bandwidth	0.142	0.142
80% Optimal bandwidth	0.113	0.113
120% Optimal bandwidth	0.170	0.170

Table 7. Covariate Balance at the Optimal Bandwidths

This table examines the balance in supplier and customer firm covariates at the optimal bandwidths identified by the data-driven method of Imbens and Kalyanaraman (2012). We report average statistics and report the mean differences in these covariates between winning and losing elections based on the optimal bandwidths identified under both triangular and rectangular kernel methods. The *p*-values for the mean difference tests are reported (standard errors are clustered at the customer firm level). Detailed definitions of the variables can be found in Appendix A.1. Symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	Triangular				**Rectangular**			
	100% optimal bandwidth (0.181)				100% optimal bandwidth (0.142)			
	Win	Lose	W-L	*p*-value	Win	Lose	W-L	*p*-value
$S.ROS_{t-1}$	0.064	0.064	0.001	0.967	0.055	0.053	0.002	0.942
$S.\Delta ROS_{t-1}$	0.009	0.005	0.004	0.795	0.013	0.010	0.003	0.820
$S.ln(Total\ assets)_{t-1}$	5.414	5.278	0.136	0.185	5.435	5.253	0.181*	0.070
$S.Leverage_{t-1}$	0.248	0.240	0.008	0.420	0.247	0.237	0.011	0.242
$S.R\&D/Sale_{t-1}$	0.062	0.063	-0.001	0.946	0.074	0.069	0.005	0.752
$S.PPE/TA_{t-1}$	0.318	0.316	0.002	0.927	0.307	0.304	0.004	0.831
$S.CAPX/TA_{t-1}$	0.070	0.070	-0.000	0.949	0.067	0.067	-0.000	0.978
$S.Cash/NA_{t-1}$	0.240	0.266	-0.027	0.354	0.270	0.285	-0.015	0.664
$C.ln(Total\ assets)_{t-1}$	10.796	10.800	-0.005	0.983	10.753	10.760	-0.008	0.977
$C.Leverage_{t-1}$	0.297	0.248	0.049**	0.040	0.301	0.247	0.054**	0.021
$C.R\&D/Sale_{t-1}$	0.024	0.022	0.002	0.702	0.023	0.021	0.001	0.790
$C.PPE/TA_{t-1}$	0.282	0.336	-0.055**	0.014	0.264	0.335	-0.071***	0.003
$C.CAPX/TA_{t-1}$	0.066	0.086	-0.020*	0.052	0.059	0.082	-0.023**	0.021
$C.Cash/NA_{t-1}$	0.104	0.066	0.038	0.130	0.097	0.068	0.030	0.208

Table 8. Robustness Tests

This table reports robustness results. The RD estimates are from local linear regressions using the optimal bandwidth (h=0.181) identified by the data-driven method of Imbens and Kalyanaraman (2012) in our baseline tests in Table 5. The triangular kernel method is used. The dependent variable is supplier operating margin (*S.ROS*) in the first year after union elections. The RD estimates at the 80% and 120% of the optimal bandwidth are also reported. In column (1), we exclude elections taken place during crises, including the years 1998 and 2007-2009, following Bekaert et al. (2014). Expanding the crisis window to also cover the year 2010, column (2) excludes elections taken place in the expanded crisis window. Columns (3) and (4) only include elections with at least 10 or 25 eligible voters, respectively. Columns (5) replaces year fixed effects with time-series macroeconomic variables, including annual real GDP growth, CPI growth, and the spreads between AAA and BAA corporate bond yields. Column (6) augments year fixed effects with state annual real GDP growth, log real GDP per capita, and unemployment rates. Column (7) applies White robust standard errors to the local linear regressions. Supplier and customer baseline controls and fixed effects are included in each model unless states otherwise. T-statistics based on customer-firm-clustered robust standard errors are reported in parentheses, unless stated otherwise. Symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	Exclude		Eligible voters		Macroeconomic controls		S.E.
	2007-09; 1998	2007-10; 1998	≥10	≥25	GDP, CPI, and default spread	State GDP, GDP per capita, and unemployment	White
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Optimal bandwidth	-0.054***	-0.054***	-0.070***	-0.079***	-0.064***	-0.051**	-0.060***
	(-2.737)	(-2.763)	(-3.377)	(-3.877)	(-3.138)	(-2.120)	(-2.809)
Obs.	2,802	2,758	2,922	2,423	3,106	2,964	3,106
R^2	0.489	0.494	0.508	0.531	0.482	0.504	0.496
80% optimal bandwidth	-0.078***	-0.075***	-0.095***	-0.091***	-0.078***	-0.075***	-0.083***
	(-3.725)	(-3.748)	(-4.140)	(-3.644)	(-3.434)	(-2.726)	(-3.552)
Obs.	2,329	2,285	2,450	2,064	2,606	2,487	2,606
R^2	0.501	0.508	0.518	0.537	0.486	0.510	0.505
120% optimal bandwidth	-0.039**	-0.041**	-0.051***	-0.061***	-0.049***	-0.031	-0.041**
	(-2.308)	(-2.397)	(-3.026)	(-3.977)	(-2.915)	(-1.604)	(-2.232)
Obs.	3,295	3,246	3,391	2,811	3,632	3,452	3,632
R^2	0.478	0.483	0.499	0.520	0.476	0.496	0.488
Supplier and customer controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	No	Yes	Yes

Table 9. Heterogeneity in the Relative Bargaining Power in the Supply Chain

This table reports results for subsample analysis by two proxies for supply chain partners' relative bargaining power. The dependent variable is supplier operating margin (*S.ROS*) in the first year after union elections. The RD estimates are from local linear regressions using the optimal bandwidth (*h*=0.181) identified by the data-driven method of Imbens and Kalyanaraman (2012) in our baseline tests in Table 5. The triangular kernel method is used. In columns (1) to (4), our sample is divided into high and low groups according to the median value of the relative ratio in market concentration between the suppliers' and customers' 2-digit SIC industries (*Relative HHI ratio*). In panel B, we partition our sample into high and low groups based on the median value of the degree of suppliers' dependency on the supply chain sales (*SC sale/S.Sale*). T-statistics based on customer-firm-clustered robust standard errors are reported in parentheses. Symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	$S.ROS_{t+1}$							
	Relative HHI ratio $_{t-1}$				*SC sale/S.Sale* $_{t-1}$			
	High		Low		High		Low	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Unionization	-0.026	-0.037	-0.107**	-0.060*	-0.169***	-0.099**	-0.013	-0.013
	(-0.762)	(-1.156)	(-2.614)	(-1.984)	(-2.727)	(-2.438)	(-0.475)	(-0.481)
Obs.	1,578	1,578	1,528	1,528	1,175	1,175	1,294	1,294
R^2	0.003	0.457	0.015	0.625	0.017	0.590	0.003	0.454
Supplier and customer controls	No	Yes	No	Yes	No	Yes	No	Yes
Industry FE	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes

Table 10. Further Evidence on Mechanisms

This table examines the mechanisms behind reduced supplier operating performance after their major customers passed union elections. The RD estimates are from local linear regressions using the optimal bandwidth identified by the data-driven method of Imbens and Kalyanaraman (2012). Both the triangular (panel A) and rectangular kernel methods (panel B) are used. Dependent variables include the natural logarithm of supply chain sales to supplier total sales (*ln(Percent Sale)*), gross profit margin (*S.GP/Sale*), proportion of cost of goods sold to sales (*S.COGS/Sale*), and proportion of selling, general, and administrative expenses to sales (*S.Operating cost/Sale*). All dependent variables are measured at the supplier-firm level and at the end of the first year after the union elections. The RD estimates at the 80% and 120% of the optimal bandwidth are also reported. Supplier and customer baseline controls and fixed effects are included in all models. T-statistics based on customer-firm-clustered robust standard errors are reported in parentheses. Number of observations, R-squared, and the bandwidths selected are also reported. Symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Triangular kernel method

	Dependent variables (suppliers)			
	ln(Percent Sale) $_{t+1}$	*S.GP/Sale* $_{t+1}$	*S.COGS/Sale* $_{t+1}$	*S.SG&A/Sale* $_{t+1}$
	(1)	(2)	(3)	(4)
Optimal bandwidth	-0.193**	-0.049**	-0.017	0.017
	(-2.392)	(-1.972)	(-0.809)	(0.878)
Obs.	2,204	2,606	4,330	3,393
R^2	0.258	0.359	0.250	0.509
80% optimal bandwidth	-0.192*	-0.058**	-0.027	0.015
	(-1.824)	(-2.049)	(-1.218)	(0.653)
Obs.	1,825	2,263	3,404	2,773
R^2	0.271	0.348	0.255	0.513
120% optimal bandwidth	-0.148**	-0.034	-0.013	0.017
	(-2.122)	(-1.566)	(-0.667)	(0.940)
Obs.	2,610	2,986	4,883	3,996
R^2	0.249	0.361	0.240	0.500
Supplier and customer controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
100% Optimal bandwidth	0.201	0.144	0.255	0.203
80% Optimal bandwidth	0.161	0.116	0.204	0.162
120% Optimal bandwidth	0.241	0.173	0.306	0.244

Panel B. Rectangular kernel method

	Dependent variables (suppliers)			
	ln(Percent Sale) $_{t+1}$	*S.GP/Sale* $_{t+1}$	*S.COGS/Sale* $_{t+1}$	*S.SG&A/Sale* $_{t+1}$
	(1)	(2)	(3)	(4)
Optimal bandwidth	-0.227***	-0.057**	0.002	0.004
	(-2.623)	(-2.251)	(0.102)	(0.206)
Obs.	1,819	2,205	3,378	2,760
R^2	0.257	0.383	0.261	0.516
80% optimal bandwidth	-0.203	-0.081**	-0.035	0.006
	(-1.608)	(-2.111)	(-1.528)	(0.229)
Obs.	1,601	1,587	2,760	2,426
R^2	0.265	0.352	0.265	0.521
120% optimal bandwidth	-0.208***	-0.036	-0.012	0.028
	(-3.161)	(-1.245)	(-0.467)	(1.380)
Obs.	2,109	2,500	3,976	3,211
R^2	0.245	0.379	0.254	0.505
Supplier and customer controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
100% Optimal bandwidth	0.158	0.113	0.200	0.159
80% Optimal bandwidth	0.126	0.091	0.160	0.128
120% Optimal bandwidth	0.189	0.136	0.240	0.191

Table 11. Consequences of Unionization on Customers

This table examines the effect of unionization on customers' sales growth, cost of goods sold, and changes in numbers of employees. These tests are estimated on a customer-year panel. The RD estimates are from local linear regressions using the optimal bandwidth identified by the data-driven method of Imbens and Kalyanaraman (2012). Both the triangular (panel A) and rectangular kernel methods (panel B) are used. The dependent variables are customers' annual percentage sales growth (*C.Sales growth*), proportion of cost of goods sold to sales (*C.COGS/Sale*), and two variables of annual percentage changes in employees. We decompose the annual percentage changes in employees into a positive and negative change variable. For instance, *C.-ve ΔEmployee* (*C.+ve ΔEmployees*) is annual percentage changes in employees when changes are negative (positive), and zero when changes are positive (negative). All dependent variables are measured at the end of the first year after the union elections. The RD estimates at the 80% and 120% of the optimal bandwidth are also reported. Customer controls, industry and year fixed effects are included in all models. Industry fixed effects are constructed based on the Fama-French 49-industry classification. T-statistics based on customer-firm-clustered robust standard errors are reported in parentheses. Number of observations, R-squared, and the bandwidths selected are also reported. Symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Triangular kernel method

	C.Sales growth $_{t+1}$	*C.COGS/Sale* $_{t+1}$	*C.-ve ΔEmployee* $_{t+1}$	*C.+ve ΔEmployees* $_{t+1}$
	(1)	(2)	(3)	(4)
Optimal bandwidth	0.007	0.035*	0.037**	0.002
	(0.248)	(1.904)	(2.524)	(0.137)
Obs.	460	577	320	650
R^2	0.391	0.655	0.403	0.160
80% optimal bandwidth	0.006	0.026	0.030*	-0.001
	(0.181)	(1.275)	(1.840)	(-0.047)
Obs.	354	473	267	569
R^2	0.440	0.670	0.429	0.174
120% optimal bandwidth	-0.001	0.038**	0.035***	0.005
	(-0.024)	(2.145)	(2.635)	(0.330)
Obs.	535	637	395	708
R^2	0.352	0.645	0.380	0.152
Customer controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
100% Optimal bandwidth	0.205	0.265	0.141	0.319
80% Optimal bandwidth	0.164	0.212	0.113	0.255
120% Optimal bandwidth	0.246	0.318	0.169	0.382

Panel B. Rectangular kernel method

	C.Sales growth $_{t+1}$	*C.COGS/Sale* $_{t+1}$	*C.-ve ΔEmployee* $_{t+1}$	*C.+ve ΔEmployees* $_{t+1}$
	(1)	(2)	(3)	(4)
Optimal bandwidth	0.018	0.041*	0.050**	0.002
	(0.550)	(1.820)	(2.226)	(0.164)
Obs.	349	468	264	565
R^2	0.368	0.643	0.391	0.161
80% optimal bandwidth	0.022	0.025	0.038*	0.004
	(0.593)	(1.048)	(1.703)	(0.206)
Obs.	296	359	209	463
R^2	0.425	0.680	0.421	0.183
120% optimal bandwidth	0.009	0.036*	0.042**	0.005
	(0.325)	(1.820)	(2.493)	(0.376)
Obs.	428	536	312	634
R^2	0.335	0.649	0.424	0.156
Customer controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
100% Optimal bandwidth	0.161	0.208	0.111	0.250
80% Optimal bandwidth	0.129	0.167	0.089	0.200
120% Optimal bandwidth	0.193	0.250	0.133	0.300

Table 12. Customer Unionization and Supplier Firm Value

This table examines whether customer unionization affects suppliers' firm value using both local linear (Panel A) and global polynomial regressions (Panel B). Panel A reports the RD estimates from local linear regressions using the optimal bandwidth identified by the data-driven method of Imbens and Kalyanaraman (2012) based on both triangular and rectangular kernel methods. The dependent variable is suppliers' log Tobin's q (*S.ln(Q)*) in the first year after union elections. We also report the RD estimates at the 80% and 120% of the optimal bandwidth for robustness. Both columns include supplier and customer baseline controls, supplier and customer industry fixed effects, and year fixed effects. Industry effects are constructed using the Fama-French 49-industry classification. Observation number, R-squared values, and the bandwidth used are also reported. Panel B reports results of subsample tests at the optimal bandwidths under the triangular kernel estimation based on two empirical proxies of supply-chain bargaining power: (1) the relative ratio in market concentration between the suppliers' and customers' 2-digit SIC industries (*Relative HHI ratio*), and (2) the proportion of supply-chain sales to supplier sales (*SC sale/S.Sale*). Suppliers' and customers' firm controls, supplier and customer industry fixed effects, and year fixed effects are included in all local linear regressions in Panel C. In all panels, *t*-statistics based on customer-firm-clustered robust standard errors are reported in parentheses. Symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Local linear regressions

	$S.ln(Q)_{t+1}$	
	Triangular	*Rectangular*
	(1)	(2)
Optimal bandwidth	-0.120*	-0.194***
	(-1.822)	(-2.696)
Obs.	4,729	3,813
R^2	0.432	0.431
80% optimal bandwidth	-0.122	-0.064
	(-1.623)	(-0.726)
Obs.	3,961	3,159
R^2	0.443	0.445
120% optimal bandwidth	-0.110*	-0.111*
	(-1.882)	(-1.735)
Obs.	5,227	4,509
R^2	0.424	0.413
Supplier and customer firm controls	Yes	Yes
Industry FE	Yes	Yes
Year FE	Yes	Yes
100% Optimal bandwidth	0.296	0.232
80% Optimal bandwidth	0.237	0.186
120% Optimal bandwidth	0.355	0.279

Panel B. Bargaining power tests (Triangular kernel method)

	S.ln(Q) $_{t+1}$			
	Relative HHI ratio $_{t-1}$		*SC sale /S.Sale* $_{t-1}$	
	High	Low	High	Low
Unionization	-0.094	-0.177*	-0.233**	-0.136
	(-1.029)	(-1.930)	(-2.139)	(-1.535)
Obs.	2,427	2,302	1,840	1,913
R^2	0.406	0.509	0.468	0.472
Supplier and customer firm controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table 13. Matched Difference-in-Differences (DID) Tests

This table reports results of an alternative difference-in-differences (DID) test that compares the operating margins, gross profit margins, and log market-to-book equity ratios of treated suppliers whose major customers have passed a union election with control suppliers matched using propensity-score-matching techniques, in the year prior to and after the passed elections. On a supplier-customer-year panel consisting of 1,867 customers and 5,098 suppliers over the years from 1977 to 2017 (if a supplier has a union election in year *t,* we exclude its observations in years *t*-1, *t*, and *t*+1 to control for the effect of suppliers' election unions on their firm performance), we estimate a logistic regression to model the likelihood of a customer's winning union election as a function of the lagged supplier and customer baseline controls and year dummy variables. Using the estimated propensity scores from the full-sample logit regressions, in each year, we match each supplier with a customer union election victory with a control supplier from the same industry (based on the Fama-French 12-industry classification), without a customer election victory or whose customers do not have a union election, and have the nearest propensity score (requiring that the difference in propensity score of the matched pair should not exceed 1% in absolute value; no replacement). For each of the matched pairs, we keep data from one year before and after the event for analysis. The matched pairs in each year, or in each "cohort," are then stacked into a panel for the DID analysis (920 matched pairs in total). Column (1) in panel A reports results of the logit regression on the prematched full sample. Column (2) reports results from an OLS regression modelling the likelihood of a customer union election victory using supplier and customer controls and interacted cohort-year fixed effects. Panel B reports results from difference-in-mean tests on the supplier and customer controls at the beginning of the treatment year (standard errors are clustered at the customer firm level). Panel C reports the DID estimates on the matched sample. Dependent variables are supplier operating margin (*S.ROS*), gross profit margin (*S.GP/Sale*), and log market-to-book equity ratios (*S.ln(Q)*). *Treat* is a dummy that equals one for suppliers whose major customer has a winning union election and zero otherwise. *Post* is a dummy that equals one after the customer union election victory and zero otherwise. The lagged supplier and customer controls are included. Detailed definitions of the variables can be found in Appendix A.1. Pair-cohort and year-cohort fixed effects are accounted for to allow the effects of the supplier-customer-pair and year fixed effects to vary across cohorts. Standard errors are clustered at the customer firm level. Symbols *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Logistic and linear probability regressions

	Prematched full sample	Postmatched
	Logit	Linear probability model
	(1)	(2)
S.ln(Total assets) $_{t-1}$	0.014	0.012
	(0.505)	(1.358)
S.Leverage $_{t-1}$	-0.229	-0.059
	(-1.232)	(-0.929)
S.R&D/Sale $_{t-1}$	-0.006	0.009
	(-0.069)	(0.212)
S.PPE/TA $_{t-1}$	0.653*	-0.134
	(1.809)	(-0.967)
S.CAPX/TA $_{t-1}$	-0.819	0.331
	(-1.365)	(1.181)
S.Cash/NA $_{t-1}$	-0.114*	0.005
	(-1.651)	(0.160)
C.ln(Total assets) $_{t-1}$	0.508***	-0.000
	(5.746)	(-0.015)

C.Leverage $_{t-1}$	0.044	0.105
	(0.069)	(0.409)
C.R&D/Sale $_{t-1}$	-9.136**	-1.501
	(-2.062)	(-0.731)
C.PPE/TA $_{t-1}$	-2.330***	-0.023
	(-2.692)	(-0.084)
C.CAPX/TA $_{t-1}$	0.568	-0.647
	(0.192)	(-0.680)
C.Cash/NA $_{t-1}$	-0.865	0.161
	(-0.711)	(0.540)
Year FE	Yes	
Year FE × Cohort FE		Yes
Obs.	44,090	1,840
Pseudo R^2	0.151	
R^2		0.012

Panel B. Difference-in-mean tests at event *t-1*

	Treat (N=920)	Control (N=920)	Treat-control	*t*-stat
S.ln(Total assets)	5.744	5.665	0.079	0.474
S.Leverage	0.232	0.242	-0.009	-0.791
S.R&D/Sale	0.098	0.090	0.008	0.334
S.PPE/TA	0.294	0.313	-0.018	-0.784
S.CAPX/TA	0.065	0.065	0.000	0.056
S.Cash/NA	0.351	0.324	0.028	0.403
C.ln(Total assets)	10.416	10.478	-0.062	-0.358
C.Leverage	0.242	0.237	0.005	0.258
C.R&D/Sale	0.022	0.024	-0.002	-0.448
C.PPE/TA	0.314	0.325	-0.012	-0.371
C.CAPX/TA	0.064	0.068	-0.004	-0.668
C.Cash/NA	0.090	0.087	0.002	0.182

Panel C. Matched DID regressions

	S.ROS $_t$		*S.GP/Sale* $_t$		*S.ln(Q)* $_t$	
	(1)	(2)	(3)	(4)	(5)	(6)
Treat × Post	-0.015*	-0.013*	-0.021***	-0.017**	-0.073**	-0.056*
	(-1.919)	(-1.707)	(-2.609)	(-2.149)	(-2.066)	(-1.716)
S.ln(Total assets) $_{t-1}$		-0.083***		-0.140***		-0.394***
		(-5.623)		(-11.228)		(-9.097)
S.Leverage $_{t-1}$		0.187***		0.143***		0.634***
		(3.268)		(3.089)		(3.649)
S.R&D/Sale $_{t-1}$		-0.045		-0.005		0.101*
		(-1.318)		(-0.135)		(1.700)
S.PPE/TA $_{t-1}$		0.127		0.135*		-0.175
		(1.170)		(1.721)		(-0.618)
S.CAPX/TA $_{t-1}$		-0.182*		-0.207**		-0.154
		(-1.670)		(-2.053)		(-0.445)
S.Cash/NA $_{t-1}$		-0.003		0.008		0.030

		(-0.226)		(0.543)		(1.301)
C.ln(Total assets) $_{t-1}$		0.033		0.013		-0.089
		(1.556)		(0.633)		(-1.452)
C.Leverage $_{t-1}$		-0.084		-0.046		0.113
		(-1.490)		(-0.839)		(0.444)
C.R&D/Sale $_{t-1}$		0.517		0.622		-0.905
		(1.165)		(0.771)		(-0.568)
C.PPE/TA $_{t-1}$		-0.049		-0.058		0.133
		(-0.668)		(-0.674)		(0.382)
C.CAPX/TA $_{t-1}$		-0.180		-0.081		0.081
		(-0.878)		(-0.449)		(0.136)
C.Cash/NA $_{t-1}$		0.030		-0.011		-0.240
		(0.788)		(-0.298)		(-0.948)
Pair FE × Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE × Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	3,680	3,680	3,680	3,680	3,680	3,680
R^2	0.845	0.855	0.878	0.891	0.874	0.884

Appendix A.1. Variable Definitions

Variables	Description	Source
ROS	Operating margin, calculated as operating income before depreciation divided by total sales.	Compustat
Unionization	An indicator that equals one if a majority of employees votes for unionization in a given election, and zero if a majority of employees vote against unionization in a given election.	NLRB Thomas J. Homes website (http://www.econ.umn.edu/~holmes/data/geo_spill/)
Vote	The percentage of votes in favor of unionization in a given election. We centralize this variable by subtracting 0.5.	NLRB Thomas J. Homes website (http://www.econ.umn.edu/~holmes/data/geo_spill/)
ln(Total assets)	Firm size, defined as the natural logarithm of deflated total assets (base year is 2000).	Compustat
Leverage	Book leverage, calculated as the sum of total debt divided by total assets.	Compustat
R&D/Sale	R&D intensity, calculated as R&D expenditure divided by total sales.	Compustat
PPE/TA	Asset tangibility, calculated as property, plant and equipment divided by total assets.	Compustat
CAPX/TA	Capital investment intensity, defined as the ratio of capital expenditure to total assets.	
Cash/NA	Cash-to-net-assets ratio, calculated as cash and short-term investments divided by total net assets. Net assets is total assets minus cash and short-term investments.	Compustat
Sales growth	Annual percentage change in sales.	Compustat
COGS/Sale	Cost of goods sold divided by total sales.	Compustat
GP/Sale	Gross profit to total sales. Gross profit is defined as total revenue minus cost of goods sold.	Compustat
SG&A/Sale	Total selling, general, and administrative expenses divided by total sales.	Compustat
-ve ΔEmployee	Annual percentage changes in employee number when changes in employees are negative. It takes a value of zero when changes in employees are positive.	Compustat
+ve ΔEmployee	Annual percentage changes in employee number when changes in employees are positive. It takes a value of zero when changes in employees are negative.	Compustat

SC sale/S.Sale	A measure of suppliers' sales dependency, defined as the ratio of supply-chain sales to suppliers' total sales.	Compustat Segment files Compustat
ln(Percent sale)	Natural logarithm of *SC sale/S.Sale*.	Compustat Segment files
Relative HHI ratio	The ratio of suppliers' *HHI (2-digit SIC)* to customers' *HHI (2-digit SIC)*. *HHI (2-digit SIC)* is the Herfindahl-Hirschman Index of market concentration, computed as the sum of squared market share within each 2-digit SIC industry. Market share is computed as total sales divided by the total 2-digit SIC industry sales.	Compustat