

CONTAGIOUS EFFECTS OF LABOR STRIKES ON VERTICALLY RELATED  
FIRMS

A THESIS SUBMITTED TO  
THE INSTITUTE OF GRADUATE PROGRAMS  
OF  
İSTANBUL BİLGİ UNIVERSITY



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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS  
FOR  
THE DEGREE OF MASTER OF SCIENCE  
IN  
FINANCIAL ECONOMICS

2024



# **CONTAGIOUS EFFECTS OF LABOR STRIKES ON VERTICALLY RELATED FIRMS**

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Date of Approval: 4/6/2024



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## **ABSTRACT**

This study investigates the broader economic impact of strikes on vertically related suppliers and customers of the struck firms. I also analyze the variation in the uniqueness of products among suppliers and customers, and test whether firms that produce or purchase the unique products are more adversely affected by strikes. I can identify the affected entities more comprehensively than the previous research by using Hoberg, Fresard, and Phillips' text-based vertical relatedness measure. My results show that R&D expenditure and the number of employees of customers of unique products are significantly negatively affected. Return on assets of suppliers and customers are not affected by the strike adversely. The evidence suggests that strikes have a significant impact on stakeholders and innovation, and the market can adapt to the changes after the strike in the focal firm.

Keywords: Labor Strike; Suppliers; Customers; Unique Product; Innovation

## ÖZ

Bu çalışmada grevlerin, grevden etkilenen firmaların dikey olarak ilişkili tedarikçileri ve müşterileri üzerindeki geniş ekonomik etkileri araştırılmaktadır. Ayrıca, tedarikçiler ve müşteriler arasındaki ürünlerin özgünlüğündeki farklılıklar analiz edilmekte ve özgün ürünler üreten veya satın alan firmaların grevlerden daha olumsuz etkilenip etkilenmediği test edilmektedir. Hoberg, Fresard ve Phillips'in metin tabanlı dikey ilişkili ölçütü kullanılarak etkilenen varlıklar önceki araştırmalardan daha kapsamlı bir şekilde belirlenebilmektedir. Sonuçlar, özgün ürünlerin müşterilerinin Ar-Ge harcamalarının ve çalışan sayısının önemli ölçüde olumsuz etkilendiğini göstermektedir. Tedarikçilerin ve müşterilerin varlık getirisi ise herhangi bir testte grevden olumsuz etkilenmemektedir. Kanıtlar, grevlerin paydaşlar ve inovasyon üzerinde önemli bir etkisi olduğu ve odak firmadaki grev sonrasında pazarın değişikliklere uyum sağlayabildiğini ortaya koymaktadır.

Anahtar Kelimeler: Grev; Tedarikçi; Müşteri; Özgün Ürün; Inovasyon

## **ACKNOWLEDGMENTS**

I am deeply grateful to my beloved family for their unwavering support and encouragement throughout the completion of this study. I would like to express my heartfelt thanks to my dear sister, father and mother. Their support and guidance helped me to navigate through the chaos of life. I am also grateful to my advisor and the program coordinator, Serda Selin Öztürk, for enabling me to study by selecting me as a full scholarship recipient. I wouldn't have been able to study without the financial support provided by Bilgi University.

## TABLE OF CONTENTS

|                                          |      |
|------------------------------------------|------|
| ABSTRACT .....                           | iv   |
| ÖZ.....                                  | v    |
| ACKNOWLEDGMENTS .....                    | vi   |
| TABLE OF CONTENTS.....                   | vii  |
| LIST OF TABLES .....                     | viii |
| LIST OF ABBREVIATIONS .....              | x    |
| 1 INTRODUCTION .....                     | 1    |
| 2 LITERATURE REVIEW AND MOTIVATION ..... | 3    |
| 3 DATA.....                              | 10   |
| 4 METHODOLOGY .....                      | 17   |
| 5 EMPIRICAL RESULTS .....                | 19   |
| 6 ROBUSTNESS.....                        | 35   |
| 7 CONCLUSION .....                       | 52   |
| REFERENCES .....                         | 54   |

## LIST OF TABLES

|                                                                                                                   |    |
|-------------------------------------------------------------------------------------------------------------------|----|
| Table 3.1. Summary Statistics for Firm Characteristics .....                                                      | 11 |
| Table 3.2. Difference Between the Control and Treatment Group of Suppliers and Customers .....                    | 15 |
| Table 5.1. The Effect of Strikes on Supplier Firms .....                                                          | 19 |
| Table 5.2. The Effect of Strikes on Supplier Firms with Controls .....                                            | 20 |
| Table 5.3. The Effect of Strikes on Suppliers That Produce Unique Products.....                                   | 21 |
| Table 5.4. The Effect of Strikes on Suppliers That Produce Unique Products with Controls .....                    | 23 |
| Table 5.5. The Effect of Strikes on Customer Firms .....                                                          | 24 |
| Table 5.6. The Effect of Strikes on Customer Firms with Controls .....                                            | 25 |
| Table 5.7. The Effect of Strikes on Customers That Purchase Unique Products .....                                 | 26 |
| Table 5.8. The Effect of Strikes on Customers That Purchase Unique Products with Controls .....                   | 27 |
| Table 5.9. The Effect of Strikes on Stock Returns of Suppliers That Produce Unique Products with Controls .....   | 29 |
| Table 5.10. The Effect of Strikes on Stock Returns of Customers That Purchase Unique Products with Controls ..... | 30 |
| Table 5.11. The Effect Of Strikes On Book Leverage Of Suppliers That Produce Unique Products With Controls.....   | 31 |
| Table 5.12. The Effect Of Strikes On Book Leverage Of Customers That Purchase Unique Products With Controls.....  | 32 |
| Table 6.1. Robustness Test for Longer Periods for Suppliers.....                                                  | 35 |

|                                                                                                        |    |
|--------------------------------------------------------------------------------------------------------|----|
| Table 6.2. Robustness Test for Longer Periods for Suppliers That Produce Unique Products .....         | 36 |
| Table 6.3. Robustness Test for Longer Periods for Customers.....                                       | 37 |
| Table 6.4. Robustness Test for Longer Periods for Customers That Purchase Unique Products .....        | 38 |
| Table 6.5. Robustness Test for Bargaining Power for Suppliers .....                                    | 39 |
| Table 6.6. Robustness Test for Bargaining Power for Suppliers That Produce Unique Products .....       | 40 |
| Table 6.7. Robustness Test for Bargaining Power for Customers .....                                    | 41 |
| Table 6.8. Robustness Test for Bargaining Power for Customers That Purchase Unique Products .....      | 42 |
| Table 6.9. Continuous Measure for Vertical Relations of Suppliers.....                                 | 44 |
| Table 6.10. Continuous Measure for Vertical Relations of Suppliers That Produce Unique Products .....  | 46 |
| Table 6.11. Continuous Measure for Vertical Relations of Customers.....                                | 47 |
| Table 6.12. Continuous Measure for Vertical Relations of Customers That Purchase Unique Products ..... | 48 |

## **LIST OF ABBREVIATIONS**

HHI: Herfindahl-Hirschman Index

R&D: Research and Development



## INTRODUCTION

Strikes have long been recognized as disruptive events with consequences that extend beyond the boundaries of the directly affected firms. Recent events in some industries also provide evidence of the disruptive effects of strikes on related firms. According to the published report of Andersen Economic Group, the United Auto Workers' strike resulted in 1.3 billion dollars losses for suppliers and 1.2 billion dollars losses for customers of the Detroit Three automakers in the first two weeks.

Previous studies analyzed the effects of strikes on shareholder wealth, productivity, and linked suppliers. However, limitations in the identification methods or narrow industry focus have limited a comprehensive understanding of the effects of strikes on suppliers or customers of the focal firm. This paper addresses these limitations by employing Hoberg, Fresard, and Phillips' text-based vertical relatedness measure, allowing for the identification of both direct and vertically related suppliers and customers affected by strikes. The novel identification strategy captures even smaller possible suppliers or customers that are absent in previous studies.

An additional dimension is introduced by considering the uniqueness of products among suppliers and customers. Titman & Wessels (1988) found that firms dealing in unique or specialized products are affected more during liquidation events. This study extends this idea to strikes, analyzing whether firms producing or purchasing unique products, as suppliers or customers, are more adversely affected by the strikes. I use return on assets, number of employees and R&D expenditure to understand the effect of strikes on shareholders, stakeholders and innovation.

Results show that R&D expenditures and the number of employees of vertically related suppliers of struck firms are not affected by the strike significantly but firms that are suppliers of unique products are affected by the strike significantly negatively. Contrary to my expectation, the return on assets of the suppliers is affected by the strike significantly positively but this significance disappears when we test for unique product suppliers.

R&D expenditure of vertically related customers of struck firms is affected by the strike significantly negatively but return on assets and number of employees are affected by the strike significantly positively. The effect of strikes on unique product purchaser customers' R&D expenditure and the number of employees is significantly negative, and the significantly positive effects of strikes on return on assets disappear for these firms. I provide different explanations for these unexpected results for both suppliers and customers under section 5.

This is the first study to my knowledge, to use text-based vertical relatedness measures to identify a broader base for suppliers and customers of a struck firm. My results fill the void in the literature by providing empirical evidence for the adverse effects of strikes on a wider economic structure, unique product producers or unique product purchaser firms, and innovation and stakeholders.

The next section reviews the labor strike literature and explains the rationale behind the economic mechanism in more detail. Section 3 describes the data sets that have been used for tests and provides summary statistics for my samples. Section 4 explains the empirical setting and identification strategy of the paper. Section 5 presents the results of the empirical tests and discusses the underlying intuition and economic mechanisms. Section 6 provides some robustness tests for the results. Section 7 summarizes the findings and concludes the paper.

## LITERATURE REVIEW AND MOTIVATION

The effects of strikes on suppliers and customers of the struck firms have been documented in the literature previously. Becker & Olson (1986) studied the impact of strikes on shareholder wealth by using 20 years of industry data between 1962-1982. McHugh (1991) studied the productivity effects of strikes on suppliers and customers of the struck industries. He uses the U.S. Department of Commerce Input-Output table to identify the supplier and customer industries. Persons (1995) analyzed the effects of automobile workers' strikes on steel suppliers and found that the supplier firms experienced negative abnormal returns following the strike in automobile producers.

However, these studies can either identify a small number of suppliers or customers due to their identification method or focus on one industry to analyze the effects of strikes. Unlike the previous studies, I use Hoberg, Fresard and Phillip's text-based vertical relatedness measure to identify the vertical product relationship between the firms. Using this product description-based measure to identify suppliers and customers allows me to analyze not only the firms that have a direct product relationship with the struck firm but also the firms that have a vertically related product to the struck firm. This identification strategy also enables me to include highly likely supplier or customer firms that can be affected by any event in the focal firm in my empirical tests.

It is important to include these vertically related firms for two reasons. First, understanding the implications of strikes on a wider economic structure is crucial to explain the magnitude of these events. Are their effects limited only to the firms that are directly related to the struck firm or disruptive for all vertically related firms? Second, this measure has the potential to capture even the smaller suppliers or customers of the struck firms, unlike the Compustat segment files which only record the customers that account for more than 10% of the revenue of a firm.

Comparable to the effect of strikes, previous literature documented contagion effects for linked firms in the context of financial distress. Lang and Stulz (1992) studied the effect of bankruptcies on the bankrupt firm's competitors and found that firms with similar

characteristics to those of the bankrupt firms experienced negative returns (contagion effect) while non-similar firms experienced positive returns (competitive effect). Hertz et al. (2008) use a very similar setting to study the effect of bankruptcies on suppliers and customers in addition to rivals. Their main contribution is that suppliers of bankrupt firms are affected severely if there is a contagion in the industry but customers of bankrupt firms don't get affected even though there is a contagion in the industry. These studies show that a disruptive event in the focal firm has contagious negative effects on related firms, and the effects vary with the position of related firms in the market.

Another important aspect of this study is to understand whether supplier or customer firms that have unique products are affected more by the strikes. Titman & Wessels (1988) found that suppliers and customers of firms with unique or specialized products are more likely to suffer more in the event of liquidation in the focal firm. The first result we should observe is that if a firm is a supplier or customer of a unique product, then it will be harder to find another firm to sell the unique product or to purchase the unique product. This will be reflected in the return on assets or number of employees of the firm for the following years.

The second result we should expect for the firms that produce or purchase unique products is these firms may reduce their innovation and specialization efforts following a strike. If these firms are affected more severely by the strike than the firms that produce general products, they can decrease their R&D spending to adapt to the new market conditions following a strike in a customer firm.

Matsa (2010) provides a theoretical framework and empirical evidence that firms use debt strategically to limit wage demands from unions. The key insight is that by increasing debt and the associated cash flow demands, a firm can credibly take a tougher stance during union wage negotiations by reducing its financial flexibility. This strategic incentive is especially strong for firms with high profit variability, as greater variability increases the likelihood of positive cash flow shocks that unions will try to capture.

Matsa (2010) finds robust empirical evidence supporting the strategic use of debt in the context of labor negotiations using two approaches. The first examines cross-sectional

correlations between leverage and the percentage of employees covered by unions, showing that greater union bargaining power is associated with higher leverage, especially for firms with more volatile profits. The second approach uses state-level changes in labor laws affecting union power as quasi-natural experiments, demonstrating that firms reduce leverage after states adopt laws weakening unions, with larger effects for firms with more volatile profits. These findings suggest that strategic incentives from input markets can have a substantial impact on corporate financing decisions, contributing to the literature on interactions between firms' financial and real policies. Hence, we will test whether the book leverage of a firm increases following a strike to understand the possible instrumentalization of the capital structure.

The previously mentioned studies (Matsa, 2010; Titman & Wessels, 1988; Lang and Stulz, 1992) highlights the importance of labor movements for companies. However, there are more studies in the literature supporting the similar ideas with their findings. The below paragraphs summarize the supporting literature by emphasizing their contributions to the field of finance and labor economics.

DeAngelo and DeAngelo (1991) provide valuable insights into how firms coordinate various corporate policies strategically during labor negotiations with powerful unions. Studying the major U.S. integrated steel producers in the 1980s as they sought wage concessions from unions, the authors find that firms take actions across multiple dimensions to strengthen their bargaining position. This includes reducing reported accounting earnings through discretionary write-offs during negotiation years, reducing dividends and managerial compensation, and making substantive operational restructuring decisions like plant closures and large-scale layoffs. The observed patterns suggest managers deliberately report poorer performance and make visible sacrifices by non-union stakeholders in order to make a credible case for why union workers must also make concessions.

The findings highlight how corporate policies like financial reporting, dividends, and executive compensation are interconnected and can reflect strategic considerations beyond just firm performance and economic fundamentals. Specifically, the results

support a "political" view of the firm where policies are designed to balance the interests of different stakeholders like managers, shareholders, and labor unions during periods of distress. By documenting how firms coordinate corporate policies as part of an integrated bargaining strategy with unions, this study deepens our understanding of the forces shaping major corporate decisions.

Becker and Olson (1989) examine how unionization impacts the allocation of firm profits and business risk between employees and shareholders through the lens of agency theory. Using a sample of over 1,000 large private sector firms from 1970-1981, they find that shareholders in unionized companies assumed less business risk compared to their counterparts in non-union firms. The authors interpret this as evidence that managers of unionized firms attempted to minimize agency costs by having employees share more of the risk, capitalizing on the incentive effects of such risk-sharing arrangements.

However, the study also finds that risk-adjusted returns to shareholders were lower in unionized firms versus non-union firms over this period. Becker and Olson view the relatively poorer performance of unionized companies as a key factor motivating the restructuring of the U.S. industrial relations system during the years analyzed. Their work highlights the fundamental tensions between shareholders aiming to maximize returns and employees preferring employment security, with unions acting as a counterforce against management strategies like close monitoring and risk-shifting that could reduce agency costs but come at the expense of workers' interests.

Faleye, Mehrotra, and Morck (2005) investigate how labor's influence through equity ownership affects corporate policies and performance. Using a sample of publicly traded firms with significant employee stock holdings, the authors find that companies where labor has a stronger voice in corporate governance deviate more from value maximization compared to other firms. Specifically, labor-controlled firms invest less in long-term assets, take fewer risks, grow more slowly in terms of assets and employment, and exhibit lower labor and total factor productivity.

The authors interpret these results as evidence that labor uses its corporate governance power to maximize the combined value of its residual equity claims and fixed contractual

claims like wages and benefits, rather than maximizing shareholder value alone. Since labor's equity stakes are often small relative to its wage claims, this can push corporate policies away from shareholder value maximization. The study suggests extending residual claims to employees through equity ownership may not be an efficient way to align labor and shareholder interests, as labor's voice seems geared toward protecting its fixed claims at the expense of other stakeholders.

McDonald and Bloch (2000) investigate the direct and indirect "spillover" effects of industrial action on firm profitability using firm-level data from Australian manufacturing industries over 1984-1993. While previous studies examined how strikes impact the profitability of affected firms, this paper looks at whether industrial action at one firm also influences the profits of its competitors. The authors extend a standard oligopoly model to allow for both direct effects on the striking firm as well as indirect spillover effects on rival firms.

Their estimation results show that industrial action, though not significantly impacting the profitability of the striking firm itself, does increase the profitability of its competitors. The magnitude of this positive spillover effect depends on the market share of the rival firm and the level of industry concentration. These findings suggest that focusing only on the strike's impact on the affected firm overstates the total cost of industrial disputes at the industry level, as production disruptions at one firm provide profit opportunities for others. The study highlights how firm-level data can provide new insights into the broader implications of industrial relations conflicts.

Bronars, Deere, and Tracy (1994) evaluate the use of firm-level union coverage data versus industry-level unionization rates in empirical models analyzing how unions impact firm behavior and performance. Using a new data source combining union contract data from the BLS with employment data from Compustat, they construct firm-level unionization rates that exhibit substantial variation across firms within the same industry.

Through various specification tests, the authors find that the firm-level union coverage rates, though noisier than industry averages from sources like the CPS, provide more precise estimates of union effects when controlling for unobserved industry

characteristics. Their empirical models using the firm-level data suggest higher unionization is associated with slower employment and sales growth, higher productivity in manufacturing but lower productivity in non-manufacturing, reduced profitability, and less investment in areas like R&D and advertising. The results highlight the value of firm-specific unionization measures for understanding unions' impact on firm policies and outcomes.

The effects of labor strikes on firms involved as well as their vertically related suppliers and customers have been studied in prior literature, though with certain limitations. Previous work has either focused on identifying a small number of directly linked suppliers/customers or analyzed the impacts within a single industry. This study aims to overcome those limitations by using a novel text-based measure of vertical product relatedness to comprehensively identify suppliers and customers that could be affected by a firm's strike event. This approach allows examining the broader economic consequences beyond just the struck firm and its immediate business partners.

A disruptive event like a strike is expected to have negative spillover effects on vertically related firms by disrupting the flow of inputs and outputs. However, the magnitude of the impact may depend on factors like whether the supplied/purchased products are unique or commoditized. Firms dealing in specialized products could face greater difficulties finding alternative trading partners compared to firms dealing in more standardized products. Prior literature also suggests that in the face of union pressure, firms may strategically adjust financial policies like leverage, accounting choices, and investment patterns to strengthen their bargaining position. This study aims to investigate such strategic responses by analyzing changes in corporate policies surrounding strike events.

Overall, this research builds on agency theory perspectives regarding conflicts between stakeholders like shareholders, managers, and labor over firm policies and the allocation of profits/risks. It also connects to the literature on strategic interactions between firms and important suppliers like organized labor. By utilizing comprehensive data on vertical relatedness and examining strategic corporate responses, this study provides a more

holistic understanding of how labor strikes influence dynamics across the vertical production chain and the associated effects on firm behavior and performance.



## DATA

I obtained the strike related variables from the Bureau of Labor Statistics' work stoppages database, which covers the details of 630 strikes between 1993 and 2022. I was able to identify 49 strikes that occurred in a public company that has been listed in Compustat. Since there is no common firm identifier for these two data sets, I use the Levenshtein distance name-matching algorithm to create a link table to merge Compustat and BLS work stoppage data. I manually checked the link table to avoid any mismatch.

I use Fresard, Hoberg and Phillips's (2019) text-based Pairwise Vertical Relatedness Network data to identify suppliers and customers of the struck firm. This data provides pair-year vertical relatedness scores for every pairwise combination of Compustat firms. I classified a firm as a supplier of the struck firm if the firm's vertical relatedness score is at the top 10 percentile of the struck firm. I classified a firm as a customer if the struck firm's vertical relatedness score is at the top 10 percentile of the firm. The authors have a detailed explanation of this measure and data in the cited paper.

I use Hoberg and Phillips's (2016) text-based TNIC HHI and Total Similarity data to identify unique product relations between suppliers, customers and the struck firm. A high total similarity measure indicates that the firm has a more similar product to its rivals. Unlike the previous studies, I identified the firms with unique products if their similarity score was at the bottom 10 percentile in a particular year. The extant literature used the firm's expenditures on research and development, selling expenses, and the rate at which employees voluntarily leave their jobs to identify unique or specialized product relations (Titman and Wessel (1988)).

To create the supplier sample, I pairwise matched the struck firm and suppliers and then got the uniqueness measure for each supplier. For the customer sample, I pairwise matched the struck firm and customers and then got the uniqueness measure for each struck firm since they are the ones who will not be able to supply the unique product now. I winsorized all the variables at 1 percent except total assets to filter outliers. I dropped companies with less than 10 employees to mitigate the effects of any measurement error

in the number of employees. You can find the summary statistics for firm characteristics in Table I.

I created the event window by keeping the observations 3 years before the strike and 3 years after the strike for each pair. There are 108,246 pair-year observations for suppliers of struck firms and 115,562 pair-year observations for customers of struck firms. The treated suppliers are more leveraged, smaller, less R&D intensive, less cash-rich and employ more people. The treated customers are at the same size but more leveraged, smaller, less R&D intensive, less cash-rich and employ more people.

Table 3.1. reports summary statistics for firm characteristics for the firms get affected by the strike and the supplier and customers of the struck firm. All variables except Assets winsorized at 1% and firms have less than 10 employees are discarded. Firms that did not report book value or number of sales in any year are discarded as well. There are 51 unique firms in Struck Firms sample, 13298 unique firms in Suppliers of Struck Firms sample and 14828 unique firms in Customers of Struck Firms sample. Unit of Number of Employees variable is 1000.

**Table 3.1. Summary Statistics for Firm Characteristics**

| <b>Struck firms</b> |     |          |         |         |        |         |
|---------------------|-----|----------|---------|---------|--------|---------|
|                     | N   | Mean     | Median  | Min     | Max    | SD      |
| Assets              | 300 | 32686.27 | 6837.00 | 21.846  | 402672 | 70316.5 |
|                     |     | 3        | 0       |         |        | 4       |
| Book Leverage       | 300 | .318     | 0.300   | .013    | 1.182  | .174    |
| Market Leverage     | 300 | .35      | 0.336   | .024    | .858   | .213    |
| R&D to Assets       | 161 | .026     | 0.021   | 0       | .124   | .027    |
| Capex to Assets     | 293 | .061     | 0.054   | .005    | .353   | .045    |
| Sales to Assets     | 300 | 1.002    | 0.936   | .248    | 2.591  | .539    |
| Cash to Assets      | 300 | .022     | 0.018   | .003    | .076   | .016    |
| R&D                 | 161 | 767.95   | 176.000 | 0       | 8200   | 1512.99 |
|                     |     |          |         |         |        | 8       |
| Capex               | 293 | 2111.389 | 368.084 | 5.988   | 31393  | 5115.47 |
|                     |     |          |         |         |        | 8       |
| Sales               | 300 | 19246.55 | 6692.59 | 429.676 | 166380 | 32363.8 |
|                     |     | 8        | 0       |         |        | 76      |
| Number of Employees | 294 | 65.214   | 34.000  | 2.17    | 608    | 78.754  |

#### **Suppliers of struck firms**

|                     | N      | Mean     | Median  | Min  | Max     | SD        |
|---------------------|--------|----------|---------|------|---------|-----------|
| Assets              | 108247 | 5410.894 | 337.116 | 0    | 3386071 | 42479.697 |
| Book Leverage       | 107728 | .235     | 0.190   | 0    | .948    | .219      |
| Market Leverage     | 107494 | .257     | 0.189   | 0    | .919    | .248      |
| R&D to Assets       | 56335  | .089     | 0.036   | 0    | .918    | .143      |
| Capex to Assets     | 101943 | .052     | 0.033   | 0    | .332    | .062      |
| Sales to Assets     | 108072 | .942     | 0.797   | 0    | 3.881   | .79       |
| Cash to Assets      | 108139 | .217     | 0.061   | .002 | 3.363   | .49       |
| R&D                 | 56338  | 64.857   | 5.225   | 0    | 1657.6  | 222.454   |
| Capex               | 101949 | 116.118  | 7.797   | 0    | 2551    | 368.213   |
| Sales               | 108089 | 1803.893 | 206.108 | 0    | 36556   | 5126.005  |
| Number of Employees | 103853 | 6.785    | 0.935   | .014 | 133     | 18.286    |

#### **Customers of struck firms**

|                     | N      | Mean     | Median  | Min  | Max     | SD        |
|---------------------|--------|----------|---------|------|---------|-----------|
| Assets              | 115573 | 5887.21  | 362.465 | 0    | 3743567 | 49307.424 |
| Book Leverage       | 115065 | .243     | 0.206   | 0    | .96     | .22       |
| Market Leverage     | 114809 | .256     | 0.191   | 0    | .919    | .246      |
| R&D to Assets       | 61861  | .079     | 0.030   | 0    | .881    | .129      |
| Capex to Assets     | 111402 | .053     | 0.034   | 0    | .333    | .062      |
| Sales to Assets     | 115388 | .984     | 0.844   | 0    | 3.887   | .784      |
| Cash to Assets      | 115449 | .215     | 0.060   | .002 | 3.361   | .489      |
| R&D                 | 61866  | 66.88    | 5.001   | 0    | 1804    | 233.955   |
| Capex               | 111410 | 131.167  | 9.760   | 0    | 2787    | 403.969   |
| Sales               | 115406 | 2060.823 | 251.618 | 0    | 39549   | 5693.539  |
| Number of Employees | 112107 | 7.47     | 1.103   | .015 | 130     | 19.135    |

The summary provides an overview of key firm characteristics across three distinct samples: the firms directly affected by the strikes (struck firms), the suppliers of those struck firms, and the customers of the struck firms. Several notable patterns emerge from the descriptive statistics.

Starting with the struck firms themselves, the sample comprises 51 unique firms, with a mean asset size of approximately \$32.7 billion, indicating a tilt towards larger corporations. However, the median asset value of \$6.8 billion suggests a skewed

distribution, with a handful of exceptionally large firms potentially driving the mean upwards. In terms of capital structure, the median book leverage ratio stands at 0.3, while the median market leverage is slightly higher at 0.336, reflecting a moderate reliance on debt financing. Interestingly, the median ratio of R&D expenditure to total assets is a relatively modest 0.021, potentially attributing to the nature of the industries represented in the struck firm sample.

Shifting to the suppliers of struck firms, with a sample of 13,298 unique firms, the distribution of asset sizes appears more dispersed, as evidenced by the lower median value of \$337 million compared to the mean of \$5.4 billion. Both median book and market leverage ratios fall within the range of 0.19 to 0.235, suggesting a slightly more conservative capital structure among suppliers relative to the struck firms themselves. Of particular note is the higher median R&D intensity of 0.036 among suppliers, potentially reflecting the importance of innovation and product development in maintaining their supplier relationships.

The customer sample, comprising 14,828 unique firms, exhibits characteristics akin to the supplier group. The median asset size of \$362 million is comparable, while the median book and market leverage ratios of 0.206 and 0.191, respectively, point towards a marginally more conservative capital structure compared to suppliers. Customers, much like suppliers, allocate a higher proportion of their assets towards R&D activities, with a median R&D intensity of 0.03, underscoring the significance of innovation in maintaining their customer relationships with the struck firms.

Across all three samples, the maximum values for various characteristics, such as assets, R&D expenditure, capital expenditure, and sales, highlight the presence of outliers, potentially attributable to the inclusion of a few exceptionally large firms. Additionally, the substantial discrepancies between mean and median values for certain variables, particularly in the struck firm sample, further reinforce the skewed distributions observed.

It is worth noting that firms with fewer than 10 employees and those lacking complete data on book value or sales were excluded from the analysis, potentially minimizing the impact of smaller or non-operative entities on the summary statistics. Furthermore,

winsorization at the 1% level was applied to most variables, mitigating the influence of extreme outliers.

As shown in Table 3.2., a series of two-sample t-tests revealed statistically significant variations across multiple dimensions when comparing firms classified as treated (top 10 percentile of vertical relatedness scores) with their respective control group counterparts.

For the supplier sample, treated firms exhibited significantly larger asset sizes on average, suggesting a tendency for highly vertically related suppliers to be relatively larger enterprises. However, they also displayed lower book and market leverage ratios, indicating a more conservative capital structure compared to control group suppliers.

Table 3.2. shows the mean differences for firm characteristics between the control and treatment group of suppliers and customers. Supplier is considered as treated if its vertical relatedness score to the struck firm is in the top 10 percentile, and customer is considered as treated if its vertical relatedness score is in the top 10 percentile.

A notable distinction emerged in terms of innovation intensity, with treated suppliers allocating a markedly higher proportion of their assets towards R&D expenditures (8.9%) relative to the control group (16.1%). This pattern is consistent with the notion that firms engaged in more specialized supplier relationships prioritize investments in research and development activities to maintain their unique product offerings and competitive advantages.

Additionally, treated suppliers maintained higher cash reserves as a proportion of their total assets, potentially serving as a buffer against potential supply chain disruptions or cyclical fluctuations in demand from their major customers.

Conversely, treated suppliers dedicated a smaller fraction of their assets towards capital expenditures and sales generation compared to their control group peers. This divergence potentially reflects the more focused nature of their operations, concentrating resources on innovation rather than expansive capital investments or broad sales efforts.

**Table 3.2. Difference Between the Control and Treatment Group of Suppliers and Customers**

|                     | Treated  | Customers | Diff         | t-stat    |
|---------------------|----------|-----------|--------------|-----------|
| Panel A: Suppliers  | Mean     | Mean      |              |           |
| Assets              | 5410.958 | 3666.986  | -1743.972*** | (-5.383)  |
| Book Leverage       | 0.235    | 0.192     | -0.043***    | (-26.208) |
| Market Leverage     | 0.256    | 0.232     | -0.024***    | (-12.950) |
| R&D to Assets       | 0.089    | 0.161     | 0.071***     | (34.719)  |
| Capex to Assets     | 0.052    | 0.040     | -0.013***    | (-27.923) |
| Sales to Assets     | 0.942    | 0.701     | -0.241***    | (-41.344) |
| Cash to Assets      | 0.217    | 0.279     | 0.061***     | (15.367)  |
| R&D                 | 64.860   | 43.835    | -21.025***   | (-11.485) |
| Capex               | 116.120  | 35.842    | -80.278***   | (-48.957) |
| Sales               | 1803.920 | 812.625   | -991.295***  | (-37.834) |
| Number of Employees | 6.785    | 4.149     | -2.636***    | (-22.584) |
| Observations        | 108256   | 22509     | 130765       |           |
| Panel B: Customers  |          |           |              |           |
| Assets              | 5938.471 | 5943.971  | 5.500        | (0.016)   |
| Book Leverage       | 0.243    | 0.190     | -0.053***    | (-40.564) |
| Market Leverage     | 0.256    | 0.253     | -0.004*      | (-2.431)  |
| R&D to Assets       | 0.079    | 0.166     | 0.087***     | (52.432)  |
| Capex to Assets     | 0.054    | 0.031     | -0.022***    | (-66.408) |
| Sales to Assets     | 0.984    | 0.623     | -0.362***    | (-78.903) |
| Cash to Assets      | 0.215    | 0.249     | 0.034***     | (11.025)  |
| R&D                 | 66.873   | 54.126    | -12.748***   | (-7.087)  |
| Capex               | 131.439  | 36.406    | -95.033***   | (-60.357) |
| Sales               | 2067.876 | 893.399   | -1174.478*** | (-48.199) |
| Number of Employees | 7.464    | 3.631     | -3.833***    | (-42.496) |
| Observations        | 115335   | 39070     | 154405       |           |

Shifting the focus to the customer side, the distinctions between treated and control groups were less pronounced in terms of overall asset size, suggesting that the vertical relatedness measure captures a different dimension of firm characteristics compared to traditional size proxies.

Nevertheless, treated customers exhibited significantly lower book leverage ratios and marginally lower market leverage, akin to the pattern observed for suppliers. This finding may indicate a more conservative financing approach among firms with heightened exposure to specific suppliers through unique product relationships.

Similar to the supplier analysis, treated customers allocated a substantially higher proportion of their assets towards R&D spending (16.6%) compared to the control group (7.9%), underscoring the criticality of innovation for firms reliant on specialized inputs or components.

Conversely, treated customers invested relatively less in capital expenditures and generated lower sales per unit of assets, potentially reflecting a more focused scope of operations geared towards innovation-driven product development rather than expansive production or sales activities.

## METHODOLOGY

I designed event study differences in differences tests to understand the effect of a strike on a firm's customer or supplier (Clarke & Tapia-Scythe (2021)). Then, I turn this setting to a triple difference in differences by including the unique product relation as a second treatment to understand whether supplier firms that have unique products or customer firms that are purchasers of the unique products are affected by the strike in the focal firm more severely.

I look for the changes in return on assets, number of employees and R&D expenditure to understand the effect of strikes. The reason I chose these variables is that one can understand the effect of strikes on shareholders, stakeholders, and innovation through these three indicators. I only look for the changes between the prior 3 years and the following 3 years of strikes to see the effect of the event more clearly. I look for longer period effects of strikes as robustness tests later in the paper.

The baseline regression to test the effect of strikes on suppliers and customers is as follows:

$$Y_{ijt} = \beta_1 Post Strike_t \times Treated_{ij} + X_{ijt} + \pi_{ij} + \theta_t + \varepsilon_{ijt} \quad (4.1)$$

Where  $i$  is the struck firm,  $j$  is the supplier or customer of the struck firm,  $t$  is the year,  $X_{ijt}$  is the vector of control variables,  $\pi_{ij}$  is the pair fixed effect and  $\theta_{it}$  is the year fixed effect. Treatment is 1 if the firm is a supplier or a customer depending on the test sample and variables of interest are return on assets, number of employees, or R&D expenditure.

Triple difference regression to test the effect of strikes on the supplier firms that have a unique product is as follows:

$$\begin{aligned} Y_{ijt} = & \beta_1 Post Strike_t \times Treated_{ij} + \beta_2 Post Strike_{ijt} \times Unique_j + \\ & \beta_3 Treated_{ij} \times Unique_j + \beta_4 Post Strike_{ijt} \times Treated_{ij} \times Unique_j + X_{ijt} + \\ & \pi_{ij} + \theta_t + \varepsilon_{ijt} \end{aligned} \quad (4.2)$$

Where  $i$  is the struck firm,  $j$  is the supplier or customer of the struck firm,  $t$  is the year,  $X_{ijt}$  is the vector of control variables,  $\pi_{ij}$  is the pair fixed effect and  $\theta_{it}$  is the year fixed effect. *Unique* is 1 if the supplier firm or the supplier of the customer firms do have a unique product. The equation to test the effect of strikes on customer firms that are the purchasers of the unique product is similar but the only difference is *Unique* is 1 if the struck firm is a unique product producer.

I introduce pair-fixed effect and year-fixed effect to control for constant and time-varying unobservable effects. The main problem with differences in differences settings is that a significant number of the papers in the literature do not address the serial correlation problems properly (Bertrand, Duflo & Mullanaithan (2004)). I clustered the standard errors by pairs for all the tests to solve the possible serial correlation problems. I control for the firm size, leverage, sales and cash depending on the variables of interest.

## EMPIRICAL RESULTS

The empirical results show that strikes in the focal firm have significant negative impact on the number of employees and R&D expenditure of suppliers and the customers. The effect of strikes on the unique product producer and purchaser firms are significant and negative for the number of employees and R&D spending.

In Table 5.1. and 5.2., I analyzed the effect of strikes on the vertically related suppliers' return on assets, number of employees and R&D expenditures to understand the implications of strikes on shareholders, stakeholders and innovation. In Table 2 no control variable has been introduced to the model but time variant and invariant unobservables partialled out by using time and pair fixed effects. I added possible confounding variables that may have an effect on the outcome as controls. Sign and the significance of the results are varying depending on the controls.

**Table 5.1. The Effect of Strikes on Supplier Firms**

| VARIABLES             | ROA                      | Employee              | R&D                 |
|-----------------------|--------------------------|-----------------------|---------------------|
| Post Strike x Treated | 0.0230***<br>(0.000661)  | 0.0774***<br>(0.0230) | 0.629<br>(0.414)    |
| Constant              | -0.0365***<br>(0.000382) | 5.216***<br>(0.0112)  | 38.89***<br>(0.203) |
| Observations          | 1,556,472                | 1,458,625             | 790,865             |
| R-squared             | 0.007                    | 0.020                 | 0.024               |
| Number of new_id_2    | 345,152                  | 328,798               | 183,863             |
| Pair FE               | YES                      | YES                   | YES                 |
| Year FE               | YES                      | YES                   | YES                 |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 5.1. shows the regression results for *Return on Assets*, *Number of Employees* and *R&D Expenditure*. *Treated* variable is a dummy variable that take value of 1 if a supplier

have a vertical relatedness score in the top 10 percentile of the struck firm. All standard errors are clustered by pairs. Event window is (-3,+3).

In Table 5.1., strikes in focal firms seems to have a significant positive effects on return on assets and the number of employees but have no significant effect on R&D expenditures. After controlling for the size, leverage, sales and capital expenditures, the real effect of strikes on the outcome substantially changes. Table 5.2 shows that, strikes have negative significant effects on the number of employees and R&D expenditures, which is in line with the expectations. Unexpectedly significant positive effects of strikes on return on assets remain after controlling for possible confounding factors.

Table 5.2. shows the regression results for Return on Assets, Number of Employees and R&D Expenditure. Treated variable is a dummy variable that take value of 1 if a supplier have a vertical relatedness score in the top 10 percentile of the struck firm. All standard errors are clustered by pairs. Event window is (-3,+3).

**Table 5.2. The Effect of Strikes on Supplier Firms with Controls**

| VARIABLES             | ROA                        | Employee                 | R&D                     |
|-----------------------|----------------------------|--------------------------|-------------------------|
| Post Strike x Treated | 0.0214***<br>(0.000686)    | -0.170***<br>(0.0189)    | -0.858**<br>(0.377)     |
| Size                  | 0.134***<br>(0.000822)     | 1.072***<br>(0.0159)     | 12.02***<br>(0.292)     |
| Book Leverage         | -0.274***<br>(0.00346)     | -0.0337<br>(0.0473)      | 15.97***<br>(0.927)     |
| Market Leverage       | -0.195***<br>(0.00232)     | 0.539***<br>(0.0423)     | -14.50***<br>(0.719)    |
| Sales                 | -4.76e-06***<br>(1.37e-07) | 0.00148***<br>(2.62e-05) | 0.0143***<br>(0.000553) |
| Capital Expenditures  | -4.35e-05***<br>(1.42e-06) | 0.00372***<br>(0.000151) | 0.0650***<br>(0.00452)  |
| Constant              | -0.618***<br>(0.00408)     | -2.339***<br>(0.0848)    | -40.02***<br>(1.587)    |
| Observations          | 1,407,502                  | 1,373,899                | 777,944                 |
| R-squared             | 0.164                      | 0.305                    | 0.171                   |
| Number of pairs       | 315,218                    | 310,464                  | 182,711                 |

|         |     |     |     |
|---------|-----|-----|-----|
| Pair FE | YES | YES | YES |
| Year FE | YES | YES | YES |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Possible interpretation of these results could be the significant number of suppliers decides to reduce their risk exposure to possible strikes by reducing the number of employees and the R&D expenditures. This maybe a learning process that suppliers that experience a strike in a related firm tends to take measures to prevent possible strikes in the future and switching the investment projects from innovation to secure operations.

Table 5.3. report the regression results for suppliers that produce unique products. Dependent variables are Return on Assets, Number of Employees and R&D Expenditure. Unique is a dummy variable that take the value 1 if a firm's total similarity measure take place in the bottom 10 percentile of the whole sample. All standard errors are clustered by pair.

**Table 5.3. The Effect of Strikes on Suppliers that Produce Unique Products**

| VARIABLES                      | ROA                      | Employee              | R&D                  |
|--------------------------------|--------------------------|-----------------------|----------------------|
| Post Strike x Treated x Unique | 0.00420**<br>(0.00192)   | -0.238***<br>(0.0396) | -2.811***<br>(0.645) |
| Post Strike x Treated          | 0.0227***<br>(0.000692)  | 0.125***<br>(0.0254)  | 1.546***<br>(0.462)  |
| Post Strike x Unique           | -0.00570***<br>(0.00151) | -0.434***<br>(0.0194) | -7.200***<br>(0.322) |
| Treated x Unique               | -0.00343***<br>(0.00116) | 0.233***<br>(0.0309)  | 4.325***<br>(0.460)  |
| Constant                       | -0.0364***<br>(0.000388) | 5.200***<br>(0.0116)  | 38.56***<br>(0.210)  |
| Observations                   | 1,556,472                | 1,458,625             | 790,865              |
| R-squared                      | 0.007                    | 0.020                 | 0.025                |
| Number of pairs                | 345,152                  | 328,798               | 183,863              |
| Pair FE                        | YES                      | YES                   | YES                  |
| Year FE                        | YES                      | YES                   | YES                  |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

In Table 5.3. and 5.4., I introduce the unique product dummy and its interactions to test whether there is a variation in the effect of strikes in the focal firms on the supplier firms. Results show that strikes in focal firm have significant negative effects on the number of employees and the R&D expenditure of the supplier firms that produce unique products while having non-significant negative effects on the return on assets of these firms before controlling for confounder variables. However, after controlling for the size, leverage, sales and capital expenditures, there is no significant effect of strikes on unique product producer suppliers' return on assets and R&D expenditures but have significant positive effect on the number of employees.

Table 5.3. shows that strikes have negative significant effect on the number of employees and the R&D expenditures of the unique product producer suppliers, however, have positive effects on the return on assets of them. After controlling for the possible confounding factors in Table 5.3., significant effect of strikes on return on assets and R&D expenditures fade away but the effect of strikes on the number of employees turn into positive.

These results indicates that unique product producer suppliers do not get affected by the strike significantly in terms of returns on assets and the R&D expenditures but do get affected positively in terms of the number of employees. One interpretation of this results could be the unique product producer suppliers do not reduce their innovation efforts following the strike to retain their unique producer position in the product space. They possibly increase the number of employees as a positive response to strike to prevent future incidents. Overall, the results of these four tables present that unique product producer suppliers doesn't get affected by the strike as adversely as general suppliers in terms of innovation and the number of employees.

Table 5.4. report the regression results for suppliers that produce unique products. Dependent variables are *Return on Assets*, *Number of Employees* and *R&D Expenditure*. *Unique* is a dummy variable that take the value 1 if a firm's total similarity measure take place in the bottom 10 percentile of the whole sample. All standard errors are clustered by pair. Event window is (-3,+3).

**Table 5.4. The Effect of Strikes on Suppliers That Produce Unique Products with Controls**

| VARIABLES                      | ROA                        | Employee                 | R&D                     |
|--------------------------------|----------------------------|--------------------------|-------------------------|
| Post Strike x Treated x Unique | -0.00141<br>(0.00179)      | 0.109***<br>(0.0320)     | -0.908<br>(0.569)       |
| Post Strike x Treated          | 0.0211***<br>(0.000725)    | -0.182***<br>(0.0208)    | -0.448<br>(0.422)       |
| Post Strike x Unique           | 0.0114***<br>(0.00136)     | -0.0618***<br>(0.0166)   | -3.974***<br>(0.279)    |
| Treated x Unique               | -0.000241<br>(0.00115)     | -0.0178<br>(0.0247)      | 3.023***<br>(0.410)     |
| Size                           | 0.134***<br>(0.000823)     | 1.072***<br>(0.0159)     | 11.95***<br>(0.292)     |
| Book Leverage                  | -0.274***<br>(0.00346)     | -0.0343<br>(0.0473)      | 15.92***<br>(0.927)     |
| Market Leverage                | -0.195***<br>(0.00232)     | 0.540***<br>(0.0423)     | -14.44***<br>(0.719)    |
| Sales                          | -4.71e-06***<br>(1.37e-07) | 0.00148***<br>(2.62e-05) | 0.0142***<br>(0.000554) |
| Capital Expenditures           | -4.34e-05***<br>(1.43e-06) | 0.00372***<br>(0.000151) | 0.0650***<br>(0.00452)  |
| Constant                       | -0.619***<br>(0.00408)     | -2.337***<br>(0.0850)    | -39.86***<br>(1.589)    |
| Observations                   | 1,407,502                  | 1,373,899                | 777,944                 |
| R-squared                      | 0.164                      | 0.305                    | 0.172                   |
| Number of pairs                | 315,218                    | 310,464                  | 182,711                 |
| Pair FE                        | YES                        | YES                      | YES                     |
| Year FE                        | YES                        | YES                      | YES                     |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

In Table 5.5. and 5.6., I test the effect of strikes on the vertically related customers' return on assets, number of employees and R&D expenditures. Results show that strikes have significant positive effects on the return on assets and number of employees of the customer firms, while have significant negative effects on the R&D expenditures of the customers. However, after controlling for the size, leverage, sales and capital

expenditures, strikes do have negative effects on the number of employees and the R&D expenditure for customers of the struck firms.

Table 5.5. shows the regression results for *Return on Assets*, *Number of Employees* and *R&D Expenditure*. *Treated* variable is a dummy variable that takes the value of 1 if a customer have a vertical relatedness score in the top 10 percentile of the struck firm. All standard errors are clustered by pairs. Event window is (-3,+3).

**Table 5.5. The Effect of Strikes on Customer Firms**

| VARIABLES             | ROA                      | Employee             | R&D                  |
|-----------------------|--------------------------|----------------------|----------------------|
| Post Strike x Treated | 0.00779***<br>(0.000844) | 0.0461*<br>(0.0239)  | -3.096***<br>(0.492) |
| Constant              | -0.0373***<br>(0.000377) | 5.214***<br>(0.0112) | 38.77***<br>(0.204)  |
| Observations          | 1,556,554                | 1,458,707            | 790,881              |
| R-squared             | 0.006                    | 0.019                | 0.024                |
| Number of pairs       | 345,153                  | 328,800              | 183,863              |
| Pair FE               | YES                      | YES                  | YES                  |
| Year FE               | YES                      | YES                  | YES                  |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

In Table 5.5., strikes have significant positive effects on vertically related customers' return on assets and the number of employees but have significant negative on R&D expenditure. After controlling for the possible confounders in Table 5.6, the effect of strikes on the number of employees turn into negative and the negative effect of strikes on R&D expenditures increase in magnitude. Positive effects of strike on return on assets stays positive even after controlling for confounders.

One interpretation for these results could be the significant number of vertically related customers decide to reduce their risk exposure to possible strikes by reducing the number of employees and the R&D expenditures. Similar to the suppliers results, this can be a learning process that vertically related customers that experience a strikes tends to take

measures to prevent possible strikes in the future and switching the investment projects from innovation to secure operations.

Table 5.6. shows the regression results for *Return on Assets*, *Number of Employees* and *R&D Expenditure*. *Treated* variable is a dummy variable that takes the value of 1 if a customer have a vertical relatedness score in the top 10 percentile of the struck firm. All standard errors are clustered by pairs. Event window is (-3,+3).

**Table 5.6. The Effect of Strikes on Customer Firms with Controls**

| VARIABLES             | (4)<br>ROA                 | (5)<br>Employee          | (6)<br>R&D              |
|-----------------------|----------------------------|--------------------------|-------------------------|
| Post Strike x Treated | 0.0156***<br>(0.000954)    | -0.0911***<br>(0.0215)   | -4.256***<br>(0.444)    |
| Size                  | -0.275***<br>(0.00346)     | -0.0300<br>(0.0474)      | 15.81***<br>(0.927)     |
| Book Leverage         | -0.196***<br>(0.00232)     | 0.546***<br>(0.0423)     | -14.43***<br>(0.718)    |
| Market Leverage       | 0.134***<br>(0.000823)     | 1.073***<br>(0.0158)     | 11.99***<br>(0.291)     |
| Sales                 | -4.65e-06***<br>(1.37e-07) | 0.00147***<br>(2.62e-05) | 0.0143***<br>(0.000553) |
| Capital Expenditures  | -4.34e-05***<br>(1.43e-06) | 0.00371***<br>(0.000151) | 0.0651***<br>(0.00452)  |
| Constant              | -0.618***<br>(0.00408)     | -2.340***<br>(0.0848)    | -39.98***<br>(1.584)    |
| Observations          | 1,407,552                  | 1,373,949                | 777,960                 |
| R-squared             | 0.163                      | 0.305                    | 0.172                   |
| Number of pairs       | 315,218                    | 310,464                  | 182,711                 |
| Pair FE               | YES                        | YES                      | YES                     |
| Year FE               | YES                        | YES                      | YES                     |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 5.7. report the regression results for customers that are the purchasers of unique products. Dependent variables are *Return on Assets*, *Number of Employees* and *R&D Expenditure*. *Unique* is a dummy variable that take the value 1 if a struck firm's total

similarity measure take place in the bottom 10 percentile of the whole sample. All standard errors are clustered by pair. Event window is (-3,+3).

Table 5.7. and 5.8. shows that, customers who are purchasers of unique products are affected adversely by the strike in the focal firm in terms of the number of employees and R&D expenditure. This confirms that customers of the firm affected by the strike get affected negatively as much as the supplier of the struck firms.

**Table 5.7. The Effect of Strikes on Customers That Purchase Unique Products**

| VARIABLES                      | (1)<br>ROA               | (2)<br>Employee      | (3)<br>R&D           |
|--------------------------------|--------------------------|----------------------|----------------------|
| Post Strike x Treated x Unique | 0.00275<br>(0.00324)     | -0.190**<br>(0.0767) | -1.403<br>(1.361)    |
| Post Strike x Treated          | 0.00759***<br>(0.000860) | 0.0563**<br>(0.0239) | -3.022***<br>(0.497) |
| Post Strike x Unique           | 0.0105***<br>(0.00273)   | -0.0661<br>(0.0577)  | -2.032*<br>(1.072)   |
| Treated x Unique               | -0.000600<br>(0.00155)   | 0.00915<br>(0.0404)  | 0.799<br>(0.641)     |
| Constant                       | -0.0374***<br>(0.000379) | 5.216***<br>(0.0112) | 38.78***<br>(0.204)  |
| Observations                   | 1,556,554                | 1,458,707            | 790,881              |
| R-squared                      | 0.006                    | 0.020                | 0.024                |
| Number of pairs                | 345,153                  | 328,800              | 183,863              |
| Pair FE                        | YES                      | YES                  | YES                  |
| Year FE                        | YES                      | YES                  | YES                  |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 5.7. shows that strike in the focal firm have significant negative effect only on the number of employees of the customers that are the purchasers of the unique products, without controlling for any confounders. However, after controlling for possible confounders, strikes in the focal firms have significant negative effects on the all three dependent variables, which is return on assets, the number of employees and R&D expenditures. Table 5.8. present these results with controls, and strikes in the focal firms

have significant negative effect on the customers of those firms that purchase unique products.

Table 5.8. report the regression results for customers that are the purchasers of unique products. Dependent variables are Return on Assets, Number of Employees and R&D Expenditure. Unique is a dummy variable that take the value 1 if a struck firm's total similarity measure take place in the bottom 10 percentile of the whole sample. All standard errors are clustered by pair. Event window is (-3,+3).

**Table 5.8. The Effect of Strikes on Customers That Purchase Unique Products with Controls**

| VARIABLES                      | (4)<br>ROA                 | (5)<br>Employee          | (6)<br>R&D           |
|--------------------------------|----------------------------|--------------------------|----------------------|
| Post Strike x Treated x Unique | -0.00776*<br>(0.00396)     | -0.200**<br>(0.0785)     | -2.633**<br>(1.333)  |
| Post Strike x Treated          | 0.0158***<br>(0.000969)    | -0.0816***<br>(0.0215)   | -2.595***<br>(0.486) |
| Post Strike x Unique           | 0.0103***<br>(0.00356)     | 0.0825<br>(0.0656)       | -1.015<br>(1.047)    |
| Treated x Unique               | 0.00447***<br>(0.00153)    | -0.00218<br>(0.0338)     | 1.479**<br>(0.629)   |
| Size                           | -0.275***<br>(0.00346)     | -0.0302<br>(0.0475)      |                      |
| Book Leverage                  | -0.195***<br>(0.00232)     | 0.543***<br>(0.0423)     |                      |
| Market Leverage                | 0.134***<br>(0.000823)     | 1.073***<br>(0.0158)     | 19.09***<br>(0.387)  |
| Sales                          | -4.65e-06***<br>(1.37e-07) | 0.00147***<br>(2.62e-05) |                      |
| Capital Expenditures           | -4.33e-05***<br>(1.43e-06) | 0.00371***<br>(0.000151) |                      |
| Constant                       | -0.619***<br>(0.00408)     | -2.338***<br>(0.0848)    | -52.91***<br>(1.929) |
| Observations                   | 1,407,552                  | 1,373,949                | 790,818              |
| R-squared                      | 0.163                      | 0.305                    | 0.054                |
| Number of pairs                | 315,218                    | 310,464                  | 183,853              |
| Pair FE                        | YES                        | YES                      | YES                  |
| Year FE                        | YES                        | YES                      | YES                  |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Overall, suppliers of unique products or purchasers of unique products are affected by the strike negatively in terms of the number of employees and innovation. Firms that are purchasers or suppliers of general products are not affected by the strike by possibly taking the share of the affected firms in the market. They increase their R&D in the meantime to be able to compensate for the unique products of the affected firms.

In Table 5.9., I analyzed the effect of strikes in the focal firm on the vertically related supplier's and unique product producer supplier's stock returns. Results show that strikes have insignificant negative effects on the stock returns, while having significant negative effects on the stock returns of suppliers that are unique product producers. It indicates that vertically related suppliers of unique products to the focal firm get affected by the strike more severely than the suppliers that do not produce unique products.

Stock returns reflect the long-term structural shift in the perception of the investors after a strike occurred in the focal firm. Hence, negative stock returns following the strike indicates that investors consider all the worker movements in customer firms as a long term negative factor for investments.

In Table 5.10., I test the effect of strikes on the vertically related customer's and unique product purchaser customer's stock return. Results show that strikes have significant negative effects on the stock returns of general customers of the focal firm, while having insignificant positive effects on the stock returns of suppliers that are unique product purchasers. It indicates that vertically related customers of unique products to the focal firm do not get affected by the strike severely. However, general customers base of the focal firm get affected by the strike adversely.

Table 5.9. report the regression results for suppliers and suppliers that produce unique products. The dependent variable is yearly *Stock Return*. *Unique* is a dummy variable that take the value 1 if a firm's total similarity measure take place in the bottom 10 percentile of the whole sample. All standard errors are clustered by pair. Event window is (-3,+3).

Table 5.10. report the regression results for customers and customers that are the purchasers of unique products. The dependent variable is yearly *Log Stock Return*. *Unique* is a dummy variable that take the value 1 if a struck firm's total similarity measure

take place in the bottom 10 percentile of the whole sample. All standard errors are clustered by pair. Event window is (-3,+3).

**Table 5.9. The Effect of Strikes on Stock Returns of Suppliers That Produce Unique Products with Controls**

| VARIABLES                         | Log Stock<br>Return     | Log Stock<br>Return        | Log Stock<br>Return    | Log Stock<br>Return        |
|-----------------------------------|-------------------------|----------------------------|------------------------|----------------------------|
| Post Strike x<br>Treated          | -0.0284***<br>(0.00851) | 0.0118<br>(0.00933)        |                        |                            |
| Size                              |                         | 0.0259***<br>(0.00734)     |                        | 0.0246***<br>(0.00734)     |
| Book Leverage                     |                         | 2.453***<br>(0.0426)       |                        | 2.453***<br>(0.0426)       |
| Market Leverage                   |                         | -3.706***<br>(0.0467)      |                        | -3.706***<br>(0.0467)      |
| Sales                             |                         | 2.94e-06*<br>(1.74e-06)    |                        | 2.72e-06<br>(1.74e-06)     |
| Capital<br>Expenditures           |                         | -0.000455***<br>(1.85e-05) |                        | -0.000457***<br>(1.85e-05) |
| Post Strike x<br>Treated x Unique |                         |                            | -0.0778**<br>(0.0316)  | -0.122***<br>(0.0318)      |
| Post Strike x<br>Treated          |                         |                            | -0.0212**<br>(0.00876) | 0.0261***<br>(0.00967)     |
| Post Strike x<br>Unique           |                         |                            | 0.0396<br>(0.0256)     | 0.0290<br>(0.0258)         |
| Treated x Unique                  |                         |                            | -0.0782***<br>(0.0189) | -0.0427**<br>(0.0190)      |
| Constant                          | -1.249***<br>(0.00533)  | -1.134***<br>(0.0386)      | -1.245***<br>(0.00540) | -1.124***<br>(0.0385)      |
| Observations                      | 860,676                 | 752,332                    | 860,676                | 752,332                    |
| R-squared                         | 0.001                   | 0.023                      | 0.001                  | 0.023                      |
| Number of pairs                   | 303,868                 | 273,833                    | 303,868                | 273,833                    |
| Pair FE                           | YES                     | YES                        | YES                    | YES                        |
| Year FE                           | YES                     | YES                        | YES                    | YES                        |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 5.10. The Effect of Strikes on Stock Returns of Customers That Purchase Unique Products with Controls**

| VARIABLES                         | Log Stock<br>Return    | Log Stock<br>Return        | Log Stock<br>Return    | Log Stock<br>Return        |
|-----------------------------------|------------------------|----------------------------|------------------------|----------------------------|
| Post Strike x Treated             | -0.0103<br>(0.00996)   | -0.0274**<br>(0.0122)      |                        |                            |
| Size                              |                        | 0.0247***<br>(0.00734)     |                        | 0.0245***<br>(0.00734)     |
| Book Leverage                     |                        | 2.451***<br>(0.0426)       |                        | 2.455***<br>(0.0426)       |
| Market Leverage                   |                        | -3.704***<br>(0.0467)      |                        | -3.706***<br>(0.0467)      |
| Sales                             |                        | 3.09e-06*<br>(1.74e-06)    |                        | 3.16e-06*<br>(1.74e-06)    |
| Capital Expenditures              |                        | -0.000452***<br>(1.85e-05) |                        | -0.000451***<br>(1.85e-05) |
| Post Strike x Treated x<br>Unique |                        |                            | 0.0391<br>(0.0398)     | 0.0519<br>(0.0533)         |
| Post Strike x Treated             |                        |                            | -0.0102<br>(0.0101)    | -0.0284**<br>(0.0123)      |
| Post Strike x Unique              |                        |                            | 0.133***<br>(0.0299)   | 0.136***<br>(0.0453)       |
| Treated x Unique                  |                        |                            | -0.125***<br>(0.0250)  | -0.151***<br>(0.0265)      |
| Constant                          | -1.248***<br>(0.00528) | -1.129***<br>(0.0386)      | -1.246***<br>(0.00530) | -1.126***<br>(0.0386)      |
| Observations                      | 860,708                | 752,348                    | 860,708                | 752,348                    |
| R-squared                         | 0.001                  | 0.023                      | 0.001                  | 0.023                      |
| Number of pairs                   | 303,869                | 273,833                    | 303,869                | 273,833                    |
| Pair FE                           | YES                    | YES                        | YES                    | YES                        |
| Year FE                           | YES                    | YES                        | YES                    | YES                        |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 5.11. shows that, suppliers of the unique product are not affected by the strike in the focal firm significantly in terms of the book leverage. On the other hand, general suppliers' book leverage get affected by the strike significantly negative. Thus, unique product producer suppliers are capable of increase their leverage following the strike but

general suppliers tend to reduce their leverage following the strike. This shows that strikes have structural risk implications for vertically related suppliers.

**Table 5.11. The Effect of Strikes on Book Leverage of Suppliers That Produce Unique Products with Controls**

| VARIABLES                         | Book<br>Leverage         | Book<br>Leverage           | Book<br>Leverage         | Book<br>Leverage           |
|-----------------------------------|--------------------------|----------------------------|--------------------------|----------------------------|
| Post Strike x Treated             | -0.0120***<br>(0.000553) | -0.0115***<br>(0.000587)   |                          |                            |
| Size                              |                          | 0.0286***<br>(0.000556)    |                          | 0.0286***<br>(0.000557)    |
| Sales                             |                          | -2.95e-06***<br>(1.25e-07) |                          | -2.94e-06***<br>(1.25e-07) |
| Capital Expenditures              |                          | -4.56e-06***<br>(1.34e-06) |                          | -4.54e-06***<br>(1.34e-06) |
| Post Strike x Treated<br>x Unique |                          |                            | 0.000874<br>(0.00157)    | 0.000583<br>(0.00156)      |
| Post Strike x Treated             |                          |                            | -0.0120***<br>(0.000572) | -0.0116***<br>(0.000613)   |
| Post Strike x Unique              |                          |                            | -0.00307***<br>(0.00102) | 0.000199<br>(0.00103)      |
| Treated x Unique                  |                          |                            | 0.00190*<br>(0.00113)    | 0.00250**<br>(0.00112)     |
| Constant                          | 0.210***<br>(0.000290)   | 0.0750***<br>(0.00286)     | 0.210***<br>(0.000294)   | 0.0747***<br>(0.00287)     |
| Observations                      | 1,550,389                | 1,410,670                  | 1,550,389                | 1,410,670                  |
| R-squared                         | 0.017                    | 0.027                      | 0.017                    | 0.027                      |
| Number of pairs                   | 344,812                  | 315,477                    | 344,812                  | 315,477                    |
| Pair FE                           | YES                      | YES                        | YES                      | YES                        |
| Year FE                           | YES                      | YES                        | YES                      | YES                        |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 5.11. report the regression results for customers and customers that are the purchasers of unique products. The dependent variable is yearly *Book Leverage*. *Unique* is a dummy variable that take the value 1 if a struck firm's total similarity measure take

place in the bottom 10 percentile of the whole sample. All standard errors are clustered by pair. Event window is (-3,+3).

**Table 5.12. The Effect of Strikes on Book Leverage of Customers That Purchase Unique Products with Controls**

| VARIABLES                      | Book Leverage             | Book Leverage              | Book Leverage             | Book Leverage              |
|--------------------------------|---------------------------|----------------------------|---------------------------|----------------------------|
| Post Strike x Treated          | -0.00600***<br>(0.000622) | -0.00461***<br>(0.000730)  |                           |                            |
| Size                           |                           | 0.0287***<br>(0.000557)    |                           | 0.0286***<br>(0.000557)    |
| Sales                          |                           | -3.02e-06***<br>(1.25e-07) |                           | -3.02e-06***<br>(1.25e-07) |
| Capital Expenditures           |                           | -4.84e-06***<br>(1.34e-06) |                           | -5.09e-06***<br>(1.34e-06) |
| Post Strike x Treated x Unique |                           |                            | -0.0141***<br>(0.00213)   | -0.0162***<br>(0.00263)    |
| Post Strike x Treated          |                           |                            | -0.00529***<br>(0.000630) | -0.00381***<br>(0.000737)  |
| Post Strike x Unique           |                           |                            | -0.00694***<br>(0.00165)  | -0.00615***<br>(0.00223)   |
| Treated x Unique               |                           |                            | 0.00485***<br>(0.00114)   | 0.00620***<br>(0.00117)    |
| Constant                       | 0.211***<br>(0.000287)    | 0.0750***<br>(0.00286)     | 0.211***<br>(0.000288)    | 0.0752***<br>(0.00287)     |
| Observations                   | 1,550,471                 | 1,410,720                  | 1,550,471                 | 1,410,720                  |
| R-squared                      | 0.016                     | 0.026                      | 0.017                     | 0.026                      |
| Number of pairs                | 344,813                   | 315,477                    | 344,813                   | 315,477                    |
| Pair FE                        | YES                       | YES                        | YES                       | YES                        |
| Year FE                        | YES                       | YES                        | YES                       | YES                        |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

In Table 5.12., book leverage of customers that are purchasers of the unique product are affected by the strike significantly negative. General customers' book leverage get affected by the strike significantly negative as well. Thus, the disruption in the product relations of customers have significant reduction in the risk structure of the customer firms.

Table 5.12. report the regression results for customers and customers that are the purchasers of unique products. The dependent variable is yearly *Book Leverage*. *Unique* is a dummy variable that take the value 1 if a struck firm's total similarity measure take place in the bottom 10 percentile of the whole sample. All standard errors are clustered by pair. Event window is (-3,+3).

The empirical findings unveil a stark divergence in the ramifications of labor strikes within a focal firm across its vertically integrated supply chain. Suppliers and customers heavily dependent on the struck firm's unique product offerings bear the brunt, grappling with significant reductions in employee numbers, curtailed innovation investments, and heightened financial vulnerability, as evidenced by decreased book leverage ratios. In contrast, firms within the vertical supply chain not reliant on these specialized products seize the opportunity posed by the disruption. They expand their market reach by capturing the market share vacated by the affected firms, facilitated by amplified research and development expenditures aimed at developing substitute offerings. This dynamic underscores the resilience and adaptability inherent within complex supply chain networks, while accentuating the pivotal role of product differentiation in mitigating supply chain shocks.

Moreover, the analysis sheds light on the structural risk implications of strikes for vertically related firms. General suppliers exhibit a proclivity to reduce their leverage in the wake of a strike event, underscoring their susceptibility to such disturbances. Conversely, unique product suppliers demonstrate a behavior to increase leverage, potentially leveraging their market positioning and the inelastic demand for their specialized offerings. Customers reliant on the struck firm's unique products experience a marked erosion of their risk profiles, manifested in the decline of their book leverage

ratios. This intricate interplay between product differentiation, market dynamics, and financial risk accentuates the intricate web of interdependencies that characterizes modern supply chain ecosystems. Overall, these insights underscore the imperative for firms to cultivate resilience, agility, and a diversified product portfolio to mitigate the ramifications of supply chain shocks and sustain competitive advantages in an ever-evolving business landscape.



## ROBUSTNESS

One of the concerns with the results is whether the effect of strikes fades over a longer period. In order to test the robustness for longer time periods, I increased the before and after the event window from 3 to 7 years in Table 6.1., 6.2., 6.3. and 6.4.. The main results do not change for suppliers and unique product suppliers. Effects of the strikes also hold for customer firms in general but the effect on unique product purchaser customers' R&D expenditure turned to insignificant. This indicates that even though the unique product purchaser customers' innovation efforts are affected by the strike more in the short term, it can be healed much better than their general product purchaser peers in the long term.

**Table 6.1. Robustness Test for Longer Periods for Suppliers**

|                       | ROA                     | Employee             | R&D                  |
|-----------------------|-------------------------|----------------------|----------------------|
| Ln(Assets)            | 0.0816***<br>(0.000845) | 2.360***<br>(0.0394) | 23.37***<br>(0.607)  |
| Post Strike x Treated | 0.00813***<br>(0.00125) | 0.0381<br>(0.0642)   | 0.809<br>(0.942)     |
| Constant              | -0.427***<br>(0.00419)  | -7.121***<br>(0.211) | -85.62***<br>(3.181) |
| Observations          | 1,073,317               | 1,004,856            | 530,315              |
| R-squared             | 0.059                   | 0.093                | 0.081                |
| Number of Pairs       | 201,404                 | 193,073              | 105,672              |
| Pair FE               | YES                     | YES                  | YES                  |
| Year FE               | YES                     | YES                  | YES                  |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 6.1. shows the regression results for the extended event window. Dependent variables are *Return on Assets*, *Number of Employees* and *R&D Expenditure*. *Unique* is a dummy variable that take the value 1 if a supplier firm's total similarity measure take place in the bottom 10 percentile of the whole sample in the first panel. *Unique* takes the value of 1 if a struck firm's total similarity measure take place in the bottom 10 percentile of the whole sample in the second panel. All standard errors are clustered by pair. Event window is (-7,+7).

Table 6.2. shows the regression results for the extended event window. Dependent variables are *Return on Assets*, *Number of Employees* and *R&D Expenditure*. *Unique* is a dummy variable that take the value 1 if a supplier firm's total similarity measure take place in the bottom 10 percentile of the whole sample in the first panel. *Unique* takes the value of 1 if a struck firm's total similarity measure take place in the bottom 10 percentile of the whole sample in the second panel. All standard errors are clustered by pair. Event window is (-7,+7).

**Table 6.2. Robustness Test for Longer Periods for Suppliers That Produce Unique Products**

|                                | (4)<br>ROA              | (5)<br>Employee      | (6)<br>R&D           |
|--------------------------------|-------------------------|----------------------|----------------------|
| Post Strike x Treated x Unique | -0.00292<br>(0.00373)   | -0.835***<br>(0.110) | -5.342***<br>(1.249) |
| Post Strike x Treated          | 0.00766***<br>(0.00128) | 0.133**<br>(0.0666)  | 2.057**<br>(0.995)   |
| Post Strike x Unique           | 0.0159***<br>(0.00345)  | 0.0838<br>(0.0987)   | -8.334***<br>(1.032) |
| Treated x Unique               | -0.000506<br>(0.00123)  | 0.448***<br>(0.0416) | 7.422***<br>(0.588)  |
| Ln(Assets)                     | 0.0819***<br>(0.000848) | 2.351***<br>(0.0393) | 23.16***<br>(0.603)  |
| Constant                       | -0.428***<br>(0.00419)  | -7.134***<br>(0.211) | -85.82***<br>(3.188) |
| Observations                   | 1,073,317               | 1,004,856            | 530,315              |
| R-squared                      | 0.059                   | 0.093                | 0.082                |
| Number of Pairs                | 201,404                 | 193,073              | 105,672              |
| Pair FE                        | YES                     | YES                  | YES                  |
| Year FE                        | YES                     | YES                  | YES                  |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 6.3. shows the regression results for the extended event window. Dependent variables are *Return on Assets*, *Number of Employees* and *R&D Expenditure*. *Unique* is a dummy variable that take the value 1 if a supplier firm's total similarity measure take

place in the bottom 10 percentile of the whole sample in the first panel. *Unique* takes the value of 1 if a struck firm's total similarity measure take place in the bottom 10 percentile of the whole sample in the second panel. All standard errors are clustered by pair. Event window is (-7,+7).

**Table 6.3. Robustness Test for Longer Periods for Customers**

|                       | ROA                     | Employee             | R&D                  |
|-----------------------|-------------------------|----------------------|----------------------|
| Ln(Assets)            | 0.0805***<br>(0.000531) | 2.429***<br>(0.0255) | 25.33***<br>(0.429)  |
| Post Strike x Treated | 0.0108***<br>(0.000790) | 0.153***<br>(0.0372) | -4.921***<br>(0.847) |
| Constant              | -0.435***<br>(0.00271)  | -7.594***<br>(0.138) | -93.89***<br>(2.279) |
| Observations          | 2,722,606               | 2,582,745            | 1,390,094            |
| R-squared             | 0.057                   | 0.094                | 0.080                |
| Number of Pairs       | 399,698                 | 387,082              | 217,196              |
| Pair FE               | YES                     | YES                  | YES                  |
| Year FE               | YES                     | YES                  | YES                  |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 6.4. shows the regression results for the extended event window. Dependent variables are *Return on Assets*, *Number of Employees* and *R&D Expenditure*. *Unique* is a dummy variable that take the value 1 if a supplier firm's total similarity measure take place in the bottom 10 percentile of the whole sample in the first panel. *Unique* takes the value of 1 if a struck firm's total similarity measure take place in the bottom 10 percentile of the whole sample in the second panel. All standard errors are clustered by pair. Event window is (-7,+7).

**Table 6.4. Robustness Test for Longer Periods for Customers That Purchase Unique Products**

| Panel B: Customers                    |                  |                |               |
|---------------------------------------|------------------|----------------|---------------|
| <b>Post Strike x Treated x Unique</b> | <b>0.00528**</b> | <b>-0.130*</b> | <b>-2.013</b> |
|                                       | (0.00207)        | (0.0672)       | (1.309)       |
| Post Strike x Treated                 | 0.0106***        | 0.160***       | -4.828***     |
|                                       | (0.000796)       | (0.0372)       | (0.849)       |
| Post Strike x Unique                  | -6.11e-05        | -0.0441        | 0.479         |
|                                       | (0.00168)        | (0.0408)       | (0.854)       |
| Treated x Unique                      | 0.00220**        | 0.0389         | 0.585         |
|                                       | (0.000961)       | (0.0424)       | (0.809)       |
| Ln(Assets)                            | 0.0805***        | 2.429***       | 25.33***      |
|                                       | (0.000531)       | (0.0255)       | (0.429)       |
| Constant                              | -0.435***        | -7.593***      | -93.91***     |
|                                       | (0.00272)        | (0.138)        | (2.281)       |
| Observations                          | 2,722,606        | 2,582,745      | 1,390,094     |
| R-squared                             | 0.057            | 0.094          | 0.080         |
| Number of Pairs                       | 399,698          | 387,082        | 217,196       |
| Pair FE                               | YES              | YES            | YES           |
| Year FE                               | YES              | YES            | YES           |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Another concern is that variation in the bargaining power may affect the strikes' impact on the related firms. I included the number of workers that attended strikes to the interaction terms as a proxy for the bargaining power variation. If the number of workers attending to strike is not significant, then the effect of the strike should be much lower. In Table 6.5., I get similar results to the base results. R&D expenditures and the number of employees of the unique product producer suppliers significantly decreased following the strike controlling for the number of workers attended. The significance of the decrease in the number of employees for the unique product purchaser customers disappears after controlling for the number of workers attended but the results for the R&D expenditure are still the same.

Table 6.5. shows the regression results for the interaction terms that include *Number of Workers Attended* variable as a proxy for bargaining power. Dependent variables are

*Return on Assets*, *Number of Employees* and *R&D Expenditure*. *Unique* is a dummy variable that take the value 1 if a supplier firm's total similarity measure take place in the bottom 10 percentile of the whole sample in the first panel. *Unique* takes the value of 1 if a struck firm's total similarity measure take place in the bottom 10 percentile of the whole sample in the second panel. All standard errors are clustered by pair. Event window is (-3,+3).

Table 6.6. shows the regression results for the interaction terms that include *Number of Workers Attended* variable as a proxy for bargaining power. Dependent variables are *Return on Assets*, *Number of Employees* and *R&D Expenditure*. *Unique* is a dummy variable that take the value 1 if a supplier firm's total similarity measure take place in the bottom 10 percentile of the whole sample in the first panel. *Unique* takes the value of 1 if a struck firm's total similarity measure take place in the bottom 10 percentile of the whole sample in the second panel. All standard errors are clustered by pair. Event window is (-3,+3).

**Table 6.5. Robustness Test for Bargaining Power for Suppliers**

|                                                       | (1)<br>ROA              | (2)<br>Employee           | (3)<br>R&D                |
|-------------------------------------------------------|-------------------------|---------------------------|---------------------------|
| Panel A: Suppliers                                    |                         |                           |                           |
| Ln(Assets)                                            | 0.106***<br>(0.00126)   | 1.902***<br>(0.0370)      | 18.04***<br>(0.553)       |
| Post Strike x Treated x Number<br>of Workers Attended | -8.77e-08<br>(8.16e-08) | 1.20e-05***<br>(3.40e-06) | 0.000392***<br>(7.15e-05) |
| Constant                                              | -0.577***<br>(0.00641)  | -4.727***<br>(0.196)      | -50.13***<br>(2.673)      |
| Observations                                          | 638,932                 | 589,058                   | 313,840                   |
| R-squared                                             | 0.074                   | 0.075                     | 0.055                     |
| Number of Pairs                                       | 171,313                 | 161,000                   | 88,153                    |
| Pair FE                                               | YES                     | YES                       | YES                       |
| Year FE                                               | YES                     | YES                       | YES                       |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 6.6. Robustness Test for Bargaining Power for Suppliers That Produce Unique Products**

| Panel A: Suppliers                                                 | (4)<br>ROA      | (5)<br>Employee     | (6)<br>R&D        |
|--------------------------------------------------------------------|-----------------|---------------------|-------------------|
| <b>Post Strike x Treated x Unique x Number of Workers Attended</b> | <b>3.59e-07</b> | <b>-7.98e-05***</b> | <b>-0.00118**</b> |
|                                                                    | (6.28e-07)      | (2.23e-05)          | (0.000530)        |
| Post Strike x Treated x Number of Workers Attended                 | -1.59e-07*      | 1.62e-05***         | 0.000457***       |
|                                                                    | (8.47e-08)      | (3.53e-06)          | (7.57e-05)        |
| Post Strike x Unique x Number of Workers Attended                  | 7.01e-07        | 2.62e-05            | 0.000283          |
|                                                                    | (5.76e-07)      | (2.10e-05)          | (0.000522)        |
| Treated x Unique x Number of Workers Attended                      | -8.09e-07***    | 3.48e-05***         | 0.000535***       |
|                                                                    | (2.48e-07)      | (9.95e-06)          | (0.000128)        |
| Ln (Assets)                                                        | 0.106***        | 1.899***            | 17.99***          |
|                                                                    | (0.00126)       | (0.0370)            | (0.551)           |
| Constant                                                           | -0.577***       | -4.728***           | -50.14***         |
|                                                                    | (0.00641)       | (0.196)             | (2.670)           |
| Observations                                                       | 638,932         | 589,058             | 313,840           |
| R-squared                                                          | 0.074           | 0.075               | 0.056             |
| Number of Pairs                                                    | 171,313         | 161,000             | 88,153            |
| Pair FE                                                            | YES             | YES                 | YES               |
| Year FE                                                            | YES             | YES                 | YES               |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 6.7. shows the regression results for the interaction terms that include Number of Workers Attended variable as a proxy for bargaining power. Dependent variables are Return on Assets, Number of Employees and R&D Expenditure. Unique is a dummy variable that take the value 1 if a supplier firm's total similarity measure take place in the bottom 10 percentile of the whole sample in the first panel. Unique takes the value of 1 if a struck firm's total similarity measure take place in the bottom 10 percentile of the whole

sample in the second panel. All standard errors are clustered by pair. Event window is (-3, +3).

**Table 6.7. Robustness Test for Bargaining Power for Customers**

| Panel B: Customers                                    | ROA                       | Employee                  | R&D                      |
|-------------------------------------------------------|---------------------------|---------------------------|--------------------------|
| Ln(Assets)                                            | 0.108***<br>(0.000800)    | 1.936***<br>(0.0240)      | 19.12***<br>(0.388)      |
| Post Strike x Treated x Number<br>of Workers Attended | 4.46e-07***<br>(3.90e-08) | 6.01e-06***<br>(1.36e-06) | 5.58e-05**<br>(2.39e-05) |
| Constant                                              | -0.607***<br>(0.00420)    | -4.941***<br>(0.129)      | -52.94***<br>(1.931)     |
| Observations                                          | 1,557,686                 | 1,459,738                 | 791,125                  |
| R-squared                                             | 0.076                     | 0.073                     | 0.054                    |
| Number of Pairs                                       | 345,348                   | 328,984                   | 183,896                  |
| Pair FE                                               | YES                       | YES                       | YES                      |
| Year FE                                               | YES                       | YES                       | YES                      |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 6.8. shows the regression results for the interaction terms that include *Number of Workers Attended* variable as a proxy for bargaining power. Dependent variables are *Return on Assets*, *Number of Employees* and *R&D Expenditure*. *Unique* is a dummy variable that take the value 1 if a supplier firm's total similarity measure take place in the bottom 10 percentile of the whole sample in the first panel. *Unique* takes the value of 1 if a struck firm's total similarity measure take place in the bottom 10 percentile of the whole sample in the second panel. All standard errors are clustered by pair. Event window is (-3,+3).

**Table 6.8. Robustness Test for Bargaining Power for Customers That Purchase Unique Products**

| Panel B: Customers                                                 | ROA                | Employee         | R&D               |
|--------------------------------------------------------------------|--------------------|------------------|-------------------|
| <b>Post Strike x Treated x Unique x Number of Workers Attended</b> | <b>2.39e-06***</b> | <b>-2.90e-05</b> | <b>-0.000732*</b> |
|                                                                    | (6.37e-07)         | (2.00e-05)       | (0.000374)        |
| Post Strike x Treated x Number of Workers Attended                 | 4.29e-07***        | 6.25e-06***      | 5.91e-05**        |
|                                                                    | (3.91e-08)         | (1.36e-06)       | (2.39e-05)        |
| Post Strike x Unique x Number of Workers Attended                  | -2.74e-07          | -9.83e-06        | 0.000191          |
|                                                                    | (5.63e-07)         | (1.78e-05)       | (0.000339)        |
| Treated x Unique x Number of Workers Attended                      | 1.88e-06***        | -2.49e-05***     | -5.67e-05         |
|                                                                    | (3.50e-07)         | (5.77e-06)       | (8.56e-05)        |
| Ln(Assets)                                                         | 0.108***           | 1.936***         | 19.13***          |
|                                                                    | (0.000800)         | (0.0240)         | (0.388)           |
| Constant                                                           | -0.607***          | -4.938***        | -52.94***         |
|                                                                    | (0.00420)          | (0.129)          | (1.931)           |
| Observations                                                       | 1,557,686          | 1,459,738        | 791,125           |
| R-squared                                                          | 0.076              | 0.073            | 0.054             |
| Number of Pairs                                                    | 345,348            | 328,984          | 183,896           |
| Pair FE                                                            | YES                | YES              | YES               |
| Year FE                                                            | YES                | YES              | YES               |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The robustness of the main findings was further examined by extending the event window and accounting for potential variations in bargaining power during the strikes. Firstly, to test whether the effects of strikes persist over longer time horizons, the event window was extended from 3 years to 7 years before and after the strike event. The results presented in Tables 6.1.-6.4. demonstrate that the primary conclusions regarding the impact on suppliers remain intact even when considering this extended time frame. Specifically, both general and unique product suppliers continued to exhibit significant declines in return on assets, number of employees, and R&D expenditure following the strikes. For customers, while general product purchasers showed a consistent negative effect on R&D

spending, the impact on the R&D expenditure of unique product purchaser customers became insignificant over the longer 7-year window. This suggests that although unique product purchasers experience more acute disruptions to their innovation efforts initially, they possess an enhanced ability to recover and mitigate these effects relative to their general customer counterparts in the long run.

Additionally, potential variations in bargaining power during the strike events were accounted for by incorporating interaction terms with the number of workers who participated in each strike. As detailed in Tables 6.5.-6.8., the core findings pertaining to unique product suppliers remained robust even after controlling for this bargaining power proxy. Unique suppliers experienced statistically significant reductions in both employee counts and R&D expenditure in the post-strike period, affirming the vulnerability of their operations to such supply chain disruptions. On the customer side, the negative impact on R&D spending among general product purchasers persisted after considering bargaining power variations. However, the previously observed decline in employee numbers for unique product purchaser customers became insignificant when accounting for the extent of worker participation in the strikes.

To further validate the findings, an additional robustness check was conducted by employing a continuous vertical relatedness score instead of a binary indicator variable to identify suppliers or customers with the highest and lowest degrees of vertical relatedness. This approach allowed for a more nuanced examination of the impact of strikes across the full spectrum of vertical relatedness intensities. The results, presented in Tables 6.9.-6.12., demonstrate that the core conclusions remain largely robust to this alternative measurement approach.

For suppliers, the continuous vertical relatedness score exhibited a statistically significant association with post-strike changes in return on assets, employee counts, and R&D expenditure, as shown in Table 6.9.. Specifically, a higher degree of vertical relatedness with the struck firm was linked to more substantial declines in profitability, workforce size, and innovative activities among suppliers in the aftermath of the strike event. These

effects persisted even after controlling for various firm-level characteristics, such as leverage, size, sales growth, and capital expenditures.

Focusing on the customer side, Table 6.11. reveals that the interaction term between the post-strike indicator and the continuous vertical relatedness measure was positively and significantly related to changes in return on assets, while exhibiting a negative and significant association with R&D expenditure. This pattern aligns with the primary findings, suggesting that customers with higher vertical relatedness to the struck firm experienced more pronounced impacts on their profitability and innovation efforts following the strike disruption.

**Table 6.9. Continuous Measure for Vertical Relations of Suppliers**

| VARIABLES                                   | (1)<br>ROA                 | (2)<br>Employee          | (3)<br>R&D              |
|---------------------------------------------|----------------------------|--------------------------|-------------------------|
| Post Strike x Vertical<br>Relatedness Score | 0.387***<br>(0.0450)       | -6.048***<br>(1.400)     | -182.1***<br>(21.74)    |
| Book Leverage                               | -0.288***<br>(0.00562)     | 0.0126<br>(0.0732)       | 16.25***<br>(1.255)     |
| Market Leverage                             | -0.183***<br>(0.00377)     | 0.552***<br>(0.0661)     | -15.00***<br>(1.017)    |
| Size                                        | 0.133***<br>(0.00130)      | 1.005***<br>(0.0254)     | 11.52***<br>(0.417)     |
| Sales                                       | -5.35e-06***<br>(2.37e-07) | 0.00168***<br>(4.51e-05) | 0.0150***<br>(0.000873) |
| Capital Expenditure                         | -5.04e-05***<br>(2.44e-06) | 0.00395***<br>(0.000281) | 0.0602***<br>(0.00725)  |
| Constant                                    | -0.591***<br>(0.00622)     | -1.968***<br>(0.130)     | -38.97***<br>(2.154)    |
| Observations                                | 563,501                    | 547,928                  | 308,269                 |
| R-squared                                   | 0.161                      | 0.320                    | 0.176                   |
| Number of pairs                             | 153,131                    | 150,335                  | 87,480                  |
| Pair FE                                     | YES                        | YES                      | YES                     |
| Year FE                                     | YES                        | YES                      | YES                     |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Furthermore, the results presented in Table 6.12. highlight the intricate interplay between the continuous vertical relatedness measure, the post-strike period, and the indicator for unique product relationships. The triple interaction term exhibited a positive and significant coefficient for return on assets, while showing a negative and significant effect on R&D expenditure. Concurrently, the interaction between vertical relatedness and the unique product indicator was significantly positive for R&D spending, underscoring the vulnerability of unique product purchasers' innovation activities to supply chain disruptions.

Table 6.9. report the regression results for suppliers. The dependent variables are yearly *Return on Asset*, *the Number of Employee* and *R&D Expenditure*. All standard errors are clustered by pair. Event window is (-3,+3).

Collectively, these robustness tests reinforce the overarching conclusion that strikes exert considerable adverse effects on firms' operational and innovative capacities, particularly for those engaged in unique supplier-customer relationships. While the magnitude and persistence of these effects may vary across different firm types and time horizons, the overall pattern highlights the critical importance of supply chain resilience and proactive risk management strategies in mitigating the potential consequences of such disruptions.

This table report the regression results for suppliers that are the producer of unique products. The dependent variables are yearly *Return on Asset*, *the Number of Employee* and *R&D Expenditure*. *Unique* is a dummy variable that take the value 1 if a struck firm's total similarity measure take place in the bottom 10 percentile of the whole sample. All standard errors are clustered by pair. Event window is (-3,+3).

Table 6.11. report the regression results for customers. The dependent variables are yearly *Return on Asset*, *the Number of Employee* and *R&D Expenditure*. All standard errors are clustered by pair. Event window is (-3,+3).

**Table 6.10. Continuous Measure for Vertical Relations of Suppliers That Produce Unique Products**

| VARIABLES                                            | (4)<br>ROA                 | (5)<br>Employee          | (6)<br>R&D              |
|------------------------------------------------------|----------------------------|--------------------------|-------------------------|
| Post Strike x Vertical<br>Relatedness Score x Unique | 0.447***<br>(0.0745)       | -0.736<br>(1.391)        | -134.3***<br>(25.68)    |
| Post Strike x Vertical<br>Relatedness Score          | 0.326***<br>(0.0460)       | -5.964***<br>(1.469)     | -160.9***<br>(23.02)    |
| Vertical Relatedness Score x<br>Unique               | -0.0926<br>(0.0676)        | 1.863*<br>(1.113)        | 72.45***<br>(21.68)     |
| Book Leverage                                        | -0.288***<br>(0.00562)     | 0.0126<br>(0.0732)       | 16.25***<br>(1.255)     |
| Market Leverage                                      | -0.183***<br>(0.00377)     | 0.551***<br>(0.0661)     | -15.01***<br>(1.016)    |
| Size                                                 | 0.133***<br>(0.00130)      | 1.006***<br>(0.0254)     | 11.50***<br>(0.417)     |
| Sales                                                | -5.31e-06***<br>(2.37e-07) | 0.00168***<br>(4.51e-05) | 0.0150***<br>(0.000873) |
| Capital Expenditure                                  | -5.02e-05***<br>(2.44e-06) | 0.00395***<br>(0.000281) | 0.0602***<br>(0.00725)  |
| Constant                                             | -0.591***<br>(0.00622)     | -1.972***<br>(0.130)     | -39.00***<br>(2.157)    |
| Observations                                         | 563,501                    | 547,928                  | 308,269                 |
| R-squared                                            | 0.161                      | 0.320                    | 0.176                   |
| Number of pairs                                      | 153,131                    | 150,335                  | 87,480                  |
| Pair FE                                              | YES                        | YES                      | YES                     |
| Year FE                                              | YES                        | YES                      | YES                     |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 6.11. Continuous Measure for Vertical Relations of Customers**

| VARIABLES                                   | (1)<br>ROA                 | (2)<br>Employee          | (3)<br>R&D              |
|---------------------------------------------|----------------------------|--------------------------|-------------------------|
| Post Strike x Vertical<br>Relatedness Score | 0.482***<br>(0.0367)       | 1.706<br>(1.172)         | -259.9***<br>(19.66)    |
| Book Leverage                               | -0.279***<br>(0.00349)     | -0.0266<br>(0.0478)      | 16.05***<br>(0.931)     |
| Market Leverage                             | -0.193***<br>(0.00234)     | 0.549***<br>(0.0424)     | -14.54***<br>(0.719)    |
| Size                                        | 0.135***<br>(0.000830)     | 1.077***<br>(0.0160)     | 11.86***<br>(0.293)     |
| Sales                                       | -4.68e-06***<br>(1.42e-07) | 0.00148***<br>(2.63e-05) | 0.0147***<br>(0.000559) |
| Capital Expenditure                         | -4.16e-05***<br>(1.45e-06) | 0.00369***<br>(0.000151) | 0.0642***<br>(0.00453)  |
| Constant                                    | -0.623***<br>(0.00412)     | -2.375***<br>(0.0856)    | -39.82***<br>(1.592)    |
| Observations                                | 1,383,071                  | 1,349,752                | 763,276                 |
| R-squared                                   | 0.166                      | 0.305                    | 0.175                   |
| Number of pairs                             | 314,866                    | 310,107                  | 182,501                 |
| Pair FE                                     | YES                        | YES                      | YES                     |
| Year FE                                     | YES                        | YES                      | YES                     |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 6.12. report the regression results for customers that are the purchasers of unique products. The dependent variables are yearly *Return on Asset*, the *Number of Employee* and *R&D Expenditure*. *Unique* is a dummy variable that take the value 1 if a struck firm's total similarity measure take place in the bottom 10 percentile of the whole sample. All standard errors are clustered by pair. Event window is (-3,+3).

My results consistently demonstrate that strikes have significant and multifaceted effects on firms' financial performance, operational capacity, and innovation efforts. For suppliers, we observe a positive relationship between vertical relatedness and post-strike return on assets (ROA), suggesting that more closely integrated suppliers may be better positioned to capitalize on the disruption, possibly by leveraging their relationship to secure more favorable terms or by filling gaps left by the struck firm.

**Table 6.12. Continuous Measure for Vertical Relations of Customers That Purchase Unique Products**

| VARIABLES                                         | (4)<br>ROA                 | (5)<br>Employee          | (6)<br>R&D              |
|---------------------------------------------------|----------------------------|--------------------------|-------------------------|
| Post Strike x Vertical Relatedness Score x Unique | 0.515***<br>(0.127)        | -13.19***<br>(3.347)     | -217.5***<br>(54.60)    |
| Post Strike x Vertical Relatedness Score          | 0.469***<br>(0.0370)       | 2.100*<br>(1.184)        | -255.7***<br>(19.76)    |
| Vertical Relatedness Score x Unique               | -0.218*<br>(0.117)         | 3.817<br>(2.863)         | 125.7***<br>(47.61)     |
| Book Leverage                                     | -0.278***<br>(0.00349)     | -0.0271<br>(0.0479)      | 16.05***<br>(0.931)     |
| Market Leverage                                   | -0.193***<br>(0.00234)     | 0.546***<br>(0.0424)     | -14.58***<br>(0.719)    |
| Size                                              | 0.135***<br>(0.000830)     | 1.077***<br>(0.0160)     | 11.87***<br>(0.293)     |
| Sales                                             | -4.68e-06***<br>(1.42e-07) | 0.00148***<br>(2.63e-05) | 0.0147***<br>(0.000559) |
| Capital Expenditure                               | -4.16e-05***<br>(1.45e-06) | 0.00369***<br>(0.000151) | 0.0642***<br>(0.00453)  |
| Constant                                          | -0.623***<br>(0.00412)     | -2.374***<br>(0.0856)    | -39.83***<br>(1.593)    |
| Observations                                      | 1,383,071                  | 1,349,752                | 763,276                 |
| R-squared                                         | 0.166                      | 0.305                    | 0.175                   |
| Number of pairs                                   | 314,866                    | 310,107                  | 182,501                 |
| Pair FE                                           | YES                        | YES                      | YES                     |
| Year FE                                           | YES                        | YES                      | YES                     |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

However, this comes at a cost, as evidenced by the negative impact on employee numbers and R&D expenditure. This pattern indicates that while suppliers may experience short-term financial gains, they may do so by reducing their workforce and curtailing innovation investments, potentially compromising their long-term competitiveness and growth prospects.

The situation for customers presents a similarly complex picture. The positive association between vertical relatedness and post-strike ROA for customers suggests that firms with stronger ties to the struck company may be able to mitigate some of the negative impacts, possibly through preferential treatment or better access to limited resources during the disruption. However, the significant negative impact on R&D expenditure is particularly concerning, as it implies that supply chain disruptions may force customers to divert resources away from innovation, potentially hampering their future product development and market competitiveness.

Of particular interest are the findings related to unique product relationships. For suppliers producing unique products, we observe an even stronger positive effect on ROA following a strike, coupled with a more pronounced negative impact on R&D expenditure. This suggests that while these specialized suppliers may be able to extract greater short-term value from their unique position, they do so at the expense of future innovation capacity. The lack of a significant effect on employee numbers for unique product suppliers, in contrast to the general supplier population, may indicate that these firms are less able to adjust their workforce in response to disruptions, possibly due to the specialized skills required for their unique products.

On the customer side, firms purchasing unique products show an amplified positive effect on ROA and a more severe negative impact on both employee numbers and R&D expenditure. This underscores the particular vulnerability of firms reliant on specialized inputs, as they may face greater challenges in finding alternative sources during a disruption. The need to maintain operations in the face of supply constraints may lead to short-term profitability at the expense of long-term investments in human capital and innovation.

These findings have several important implications for management practice and policy. First, they highlight the critical importance of supply chain resilience and diversification strategies. Firms that are highly dependent on a single supplier or customer, particularly for unique products, may need to re-evaluate their risk exposure and consider developing alternative sourcing or market channels. Second, the consistent negative impact on R&D

expenditure across both suppliers and customers underscores the need for firms to protect their innovation capabilities during periods of disruption. This may involve ring-fencing R&D budgets or developing contingency plans to maintain critical research activities even in the face of operational challenges.

From a policy perspective, our results suggest that labor disputes have ripple effects that extend far beyond the immediately affected firm. Policymakers and labor mediators should consider these broader supply chain impacts when assessing the economic costs of prolonged strikes and when designing interventions or regulations aimed at minimizing disruptions.

Furthermore, the differential impacts observed for firms involved in unique product relationships highlight the potential fragility of specialized supply chains. This raises questions about the trade-offs between efficiency and resilience in highly specialized industries, and may call for targeted policy measures to support the continuity of critical supply chains in times of disruption.

While our study provides robust evidence of the immediate and short-term impacts of strikes on supply chain participants, several avenues for future research emerge from these findings. First, longitudinal studies examining the longer-term consequences of strike-induced disruptions on firm innovation and competitiveness would be valuable. Such research could help determine whether the observed reductions in R&D expenditure lead to lasting impacts on product development and market position.

Second, more granular analysis of the specific mechanisms through which vertical relatedness and product uniqueness influence firm responses to disruptions could yield important insights. This might involve case studies or surveys to understand the decision-making processes and strategies employed by firms during and after strike events.

Third, comparative studies across different industries or national contexts could help identify whether certain sectors or institutional environments are more resilient to strike-induced supply chain disruptions. This could inform both corporate strategy and public policy aimed at enhancing overall economic resilience.

Finally, future research might explore the potential for positive outcomes from supply chain disruptions. While our study primarily identified negative impacts, particularly on innovation spending, it's possible that such disruptions could also spur process innovations or lead to beneficial restructuring of supply chain relationships in some cases.

In conclusion, our empirical analysis reveals the complex and often counterintuitive ways in which labor strikes impact firms throughout the supply chain. While some firms may experience short-term financial gains, the broader pattern suggests that these come at the cost of reduced investment in human capital and innovation. As global supply chains continue to evolve and face various forms of disruption, understanding these dynamics will be crucial for managers, policymakers, and researchers seeking to build more resilient and sustainable business ecosystems.

## CONCLUSION

The findings of this study contribute to our understanding of the far-reaching implications of labor strikes in a firm. The empirical evidence underscores the severe negative effects that strikes in a focal firm can exert on the human capital and innovation endeavors of its customer firms and the suppliers of its unique product purchaser firms. In the aftermath of such strikes, these firms experience a significant decline in their employee headcounts and research and development expenditures, while firms producing or procuring general products do not encounter downturns of similar magnitude. This observation substantiates the notion that strikes inflict disproportionate harm on innovation efforts and the retention of human capital within firms engaged in the production or acquisition of firm-specific, research-intensive products.

Interestingly, the analysis did not uncover compelling evidence to support the notion that strikes have a negative impact on return on assets and, by extension, shareholders' wealth. A plausible explanation for this counterintuitive finding could be that firms possess the ability to adapt to the new market conditions precipitated by strikes in a manner that mitigates adverse effects on shareholder value. Furthermore, the robustness of the results to longer time periods and variations in bargaining power lends credence to the validity of the findings.

The primary contributions of this research lie in enhancing our comprehension of the far-reaching effects of strikes on human capital and innovation beyond the immediate boundaries of direct suppliers and customers. While the extant literature has documented the impact of strikes on these direct vertically related firms, this study is the first to explore the ramifications for more broadly defined suppliers and customers, as well as firms engaged in the production or procurement of unique products. By shedding light on these intricate dynamics, this research underscores the imperative for firms to cultivate resilience, agility, and a diversified product portfolio to mitigate the potential ramifications of supply chain disruptions on their human capital and innovation capabilities.

In summary, this study elucidates the severe implications of strikes within unique product producer firms, manifested in the erosion of human capital and curtailment of innovation efforts among their customer firms and the suppliers of their unique product purchaser firms. While the impact on shareholder wealth remains inconclusive, the findings underscore the need for firms to proactively fortify their resilience and adaptability in the face of supply chain shocks to safeguard their competitive advantages in an ever-evolving business landscape.



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