

What Do Unions Do? Incentives and Investments*

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Abstract

Using plant-level Census data, we show that unionized U.S. manufacturing plants offer weaker and less effective incentives to non-managerial workers. The usual positive link between incentives and investment or performance disappears in unionized plants, explaining three-quarters of the union–non-union gap. Capital intensity rises as a substitute for high labor costs and diluted incentives. These effects spill over to non-union plants within the same firm, suggesting that non-managerial workers prefer weaker incentive schemes. Leveraging recent changes in Right-to-Work laws as quasi-experiments, we find that reduced union bargaining power leads to higher marginal investment and faster firm growth.

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I have nothing to disclose.

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1 Introduction

Most of the discussion of unionization has focused on the effect of unions on the division of the firm’s cash flows between unionized labor and the firm’s shareholders and the financial policies that can maximize the shareholders’ portion. However, there is another critically important determinant of firm outcomes: the effective use of workforce incentives.

In this paper, we use granular plant-level data from the Census of Manufacturers and the recent Management and Organizational Practices Survey (MOPS) to analyze the effect of unions on firm outcomes in approximately 30,000 manufacturing plants across the U.S. In contrast to previous studies that primarily focus on industry-level unionization rates, we can measure unionization rates at the plant level. This distinction is crucial as it eliminates potential confounding factors stemming from industry-wide effects (as seen in studies relying on industry-level unionization data) or locational effects (as seen in studies relying on geographic estimates of unionization). We can examine how unionization is linked to plant-level metrics, including key elements of incentive structures, as well as labor costs, investment levels, plant exits, and productivity. This granularity also allows us to compare unionized and non-unionized plants within the same firm, locality, and industry.

As we show below, unionized firms use incentives differently, and their outcomes are correspondingly worse. We have five main findings. First, we show that unionized plants score significantly lower on all three of our measures of non-managerial incentives than non-unionized plants. For example, unionized plants are 26% less likely to have performance-based bonuses, 11% less likely to promote a worker based on performance, and 13% less likely to dismiss a worker shortly following poor performance. Furthermore, the sensitivity to pay-for-performance in these unionized plants is diminished by approximately 30%. In parallel, albeit with a more modest disparity, we also find a reduction in managerial incentives between unionized and non-unionized plants. This spillover effect from unionization onto managerial incentives is consistent with a shift in the breadth of managerial responsibilities, given the alterations in worker incentives.

Second, we find that the performance of manufacturing plants in the U.S. is strongly related to both managerial and non-managerial incentives. In particular, plants where workers receive performance-based bonuses and are promoted or dismissed based on their own performance invest more and grow faster. One standard deviation increase in the usage of incentives is related to a 39% rise in employment and a 22% increase in sales. However, this relationship breaks down for unionized plants. Unionized plants not only have fewer incentives in place, but the incentives they do have are also not linked with positive outcomes on investment and growth observed in non-unionized plants. This lack of effectiveness in incentives further reduces investment levels and growth in unionized plants. We show that differences in incentives, both in terms of level and effectiveness, account for about three-quarters of the gap between unionized and non-unionized plants on these metrics.

Third, we show that incentive systems spill over from unionized plants to non-unionized plants within the same firm. Nonunion plants in the same firm as union plants also have lower wages, fewer incentives, higher exit rates, and lower investments and growth. These spillover effects are large and most pronounced for plants in the same industry or located in the same commuting zone. While the effects are most evident for non-managerial workers, both categories of workers are affected. These spillovers have important implications for the boundaries of the firm, including acquisitions and sales of plants and divisions, as well as the locations of new investments.

Fourth, our analysis of incentive spillovers within a firm allows us to estimate the maximum incentive reduction that can be attributed to the union's strategy to enhance its bargaining power by limiting the employer's ability to influence worker behavior. We find that within a firm with some union representation, the reduction of non-managerial incentives in non-unionized plants is about 43% of the reduction observed in unionized plants. Assuming that firms generally prefer to avoid unionization, the fact that incentives are lower in non-unionized plants without an on-site union acting as a bargaining agent suggests that the median worker prefers at least this level of incentive reduction. Therefore, we can infer

that union strategies aimed at enhancing their bargaining power can account for at most 57% of the observed incentive reduction in unionized plants.

Lastly, we leverage the passage of Right-to-Work laws in Indiana and Michigan in 2012 to establish causal links between unionization and investments. Right-to-work laws grant employees the freedom to decide whether to join or financially support a union, thereby weakening the union’s ability to negotiate and enforce collective bargaining agreements with the firm. We find that employment and capital expenditure on equipment increase immediately following the enactment of Right-to-Work laws. To the extent that the passage of Right-to-Work laws is exogenous at the plant level and that the laws’ only effect is through their effect on the union’s bargaining power, our results suggest that unions have a causal effect on employment and investment.

Overall, we document substantial direct and indirect effects of unionization on firm outcomes. Lee and Mas (2012) report a 10% decline in market value over the next 18 months. Our findings point to two channels behind this effect. First, a *transfer* effect: unionized plants pay higher wages and benefits, raising the labor share by 1.9%, accounting for over 30% of the total operating income, leading to lower investor returns.¹ More importantly, a *growth* effect: weaker incentives in unionized plants, especially for non-managers, are linked to higher disclosure rates, reduced capital expenditure, and slower growth in employment and sales, ultimately diminishing long-term firm value.

We find that unionized plants reduce incentives and investment in non-unionized plants within the same firm, creating spillovers with important corporate governance implications, particularly in the takeover markets. Due to the spillover effects, unionized targets may be less attractive to non-unionized buyers. As a result, unions can limit firms’ access to value-enhancing acquisitions and generate broader industry-level distortions.² Empirical support for this mechanism is provided by Fallick and Hasset (1999) and Tian and Wang (2021),

¹The median EBIT margin in manufacturing industries (Compustat) is about 6 – 7%.

²Maksimovic and Phillips (2001) and Maksimovic, Phillips, and Yang (2013) analyze the role of the takeover market on firm productivity.

who show that non-unionized firms are less likely to acquire unionized plants.

Our research is closely related to the finance literature examining the role of unions in counteracting product market concentration (Benmelech, Bergman, and Kim (2022); Falato, Gallego, Kim, and von Wachter (2023)), shaping firms’ financial policies (Matsa (2010); Klasa, Maxwell, and Ortiz-Molina (2009)), influencing investment decisions (Chava, Danis, and Hsu (2020); Tian and Wang (2021)), and affecting asset prices (Chen, Kacperczyk, and Ortiz-Molina (2011)). We contribute to this literature by focusing on how unionization alters internal incentive structures and, in turn, impacts firms’ investment decisions.

The remainder of the paper is organized as follows. Section 2 outlines the conceptual framework of our analysis. Section 3 describes the data and presents summary statistics. Section 4 reports our main findings on the direct effects of unionization and Section 5 investigates the spillover effects on non-unionized plants within the same firm. Section 6 leverages changes in Right-to-Work laws as an exogenous shock at the plant level to draw causal inferences on the relationship between unionization and firm investment, and Section 7 concludes.

2 Literature Review and Discussion

In finance research, a central question evolves around how unions, with their ability to negotiate wages above the market rate and exploit sunk fixed capital, shape the firm’s investment decisions (Baldwin (1983), Bronars and Deere (1993)) and their strategic implementation of financial policies to strengthen future bargaining power (Bronars and Deere (1991), Klasa, Maxwell, and Ortiz-Molina (2009), Matsa (2010)).

Beyond potentially altering the division of cash flows, unions may also influence the internal structure of a firm, particularly its incentive system (Jensen and Meckling (1976), Lazear (2000), and Bloom and Van Reenen (2011)). A large body of research has highlighted the role of optimal incentive contracts and worker monitoring in driving a firm’s value creation process (Bloom and Van Reenen (2007); Bloom, Brynjolfsson, Foster, Jarmin, Saporta Ek-

sten, and Van Reenen (2013); Benders, Van Grinsven, and Ingvaldsen (2019)). Unions may negotiate contractual provisions that limit management’s authority to provide incentives and monitor employees without union oversight. The reduction in management discretion in rewarding or punishing workers makes it harder for the firm to implement incentive structures that could weaken the union’s bargaining power, albeit indirectly reducing firm value. This can be seen as the union equivalent of management strategies to diminish union bargaining power, as discussed in Baldwin (1983) and Matsa (2010), among others.

Specifically, in unionized firms, formal incentive plans are often constrained by collective bargaining agreements and procedural rules. Unionized workplaces tend to enforce promotion by seniority (Abraham and Farber (1988)). Thus, union collective-bargaining agreements frequently make advancement contingent on tenure rather than measured performance, directly weakening promotion incentives for rank-and-file workers. For example, the 2014 Learjet–IAM Local 639 contract states that “in making promotion and transfer decisions, length of service will govern if ability is sufficient” (Art. 11). Likewise, the 2021 Waterloo plant agreement between Tyson Fresh Meats and UFCW Local 431 provides that “full-time employees with the greatest seniority shall have preference in layoffs, callbacks, promotions, demotions and transfers to available permanent vacancies” (Art. 18 §1).³

Hypothesis 1: *Unionized plants will have a lower use of incentives for both managers and non-managers.*

Bloom et al. (2019) find a positive effect on employment following the enactment of right-to-work using the MOPS data. Our goal is to offer insights into the channels that lead to these changes. If union contracts reduce managers’ ability to supervise and implement

³Similar “line-of-progression” clauses appear in Midwest Generation–IBEW 15 and Anchor Hocking–USW 512T CBAs, each assigning higher-rated vacancies strictly by departmental seniority. These examples illustrate how union rules attenuate promotion incentives. Moreover, the same formal incentives associated with positive plant outcome metrics in non-unionized establishments may not yield similar outcomes in unionized establishments. For example, the enforcement of the Weingarten Rules (NLRB vs. Weingarten, Inc. 420 U.S. 251, 88 LRRM 2689) poses significant challenges for management in unionized plants in linking performance to behavior that is observable but legally unverifiable. For parallel reasons, the relation between managers’ incentives and plant performance will also be attenuated in unionized plants.

performance-based systems, they reduce managerial initiatives and the scope of monitoring. This can, in turn, lead to a predicted decline in incentive payments to managers. We therefore expect unionized plants to exhibit lower use of incentives across organizational levels. We hypothesize that both of these consequences of unionization, higher wages and less effective use of incentives, have implications for plant performance.

Hypothesis 2: *The positive relationship between incentives, investment, and growth is weaker in unionized plants.*

Chava, Danis, and Hsu (2020) document these investment and employment gains at the firm level, but they don't observe whether incentive schemes themselves become less effective once collective bargaining applies. Our plant-level MOPS data allow us to test that incentive–performance sensitivity directly and to quantify how its attenuation explains the bulk of the post-union investment and growth gap. This mechanism-level evidence is new.

We posit that these incentive effects are economically significant and that the major differences in outcomes between unionized and non-unionized plants can be explained by two factors: the effectiveness and level of labor incentives and the higher wages in unionized plants.

Hypothesis 3: *Lower incentives account for a substantial portion of the observed reduced investment and growth in unionized plants.*

While unions do not represent workers in non-unionized plants, spillovers from unionized to non-unionized plants may occur if firms attempt to preempt the unionization of their other plants by voluntarily granting partial union benefits to non-unionized employees, thereby reducing their incentives to seek union representation.⁴ This implies that the firm will either increase wages above market levels, vary incentives, or both. Such spillovers are economically

⁴Holmes (2006) argues that union status is an “experience good” and that unionization is “contagious” in the sense that it spreads spatially to nearby establishments within a community. Previous studies have documented within-firm wage spillovers for both managers (Duchin, Goldberg, and Sosyura (2017)) and rank-and-file workers (Gopalan, Hamilton, Kalda, and Sovich (2021)).

important in their own right and can be used to make inferences about the motivation for reduced incentives in unionized plants.

Incentives can influence employee job satisfaction. Some may prefer lower-powered incentives for job stability and predictability, even if it means lower wages and reduced firm value. Conversely, others may favor performance-based pay to increase earnings through greater effort. We consider two hypotheses. The *Homogeneous Outcomes Hypothesis* posits that median non-managerial employees prefer lower-powered incentives due to risk aversion or effort concerns (Lazear (2000)).

To obtain the right to represent workers in an establishment, unions may use their bargaining power to negotiate contracts that reflect these preferences.⁵ Firms that want to preempt the unionization of their non-unionized plants will be motivated to reduce their reliance on incentives voluntarily if they believe that doing so reduces the attractiveness of a union. The extent to which they can reduce incentives is bounded by the preferences of the median worker. Thus, by comparing the level of incentives in non-unionized plants between a non-union firm and a union firm, we can obtain a lower bound for the incentives, and the higher the probability of unionization, the tighter the bound.

Existing research has shown that when employees seek social comparison, particularly with their colleagues, they tend to choose individuals who are physically close to them, with whom they interact regularly, and possess more information (Festinger (1954), Kulik and Ambrose (1992), Luttmer (2005), and Alcácer and Zhao (2012)). As workers are likely to interact more, we expect that the spillover effects from unionization will be stronger when the unionized and non-unionized plants are more similar and physically closer to each other.

In contrast, the *Entrenchment Hypothesis* suggests that unions intentionally restrict management's discretion over rewards and penalties to foster unity and strengthen their bargaining position, even if such restrictions go beyond what workers individually prefer (Jensen and Meckling (1976); Baldwin (1983); Matsa (2010)). Since firms do not negotiate with a

⁵DiNardo and Lee (2004) and Dinlersoz et al. (2017) describe the certification process.

union for their non-unionized plants, there is no reason for them to reduce incentives below the incentives. Thus, any differences between the incentive level of the firm’s non-unionized plants and unionized plants provide an upper bound to the economic effect. All other things being equal, smaller spillovers in incentives between unionized and non-unionized plants of the same firm would suggest that the lower incentives of unionized plants are driven mostly by unions’ strategic considerations rather than by worker preferences.

Hypothesis 4: *Spillovers may occur from a firm’s unionized plants to its non-unionized ones, resulting in reduced use of incentives, under the Homogeneous Outcomes Hypothesis. In contrast, the Entrenchment Hypothesis asserts that there should be little spillover from a firm’s unionized plants to its non-unionized plants.*

A further implication of Hypothesis 4 is that markets for corporate acquisitions, both total firms and divisions, will be divided into unionized and non-unionized segments, reducing allocative efficiency. Unionized firms or establishments will be less valuable to non-unionized acquirers than to unionized acquirers. Similarly, acquisitions of non-unionized firms by unionized firms may be less valuable because of potential spillovers to the newly acquired plants. As such, it rationalizes the empirical results that non-unionized firms are less likely to acquire unionized plants Tian and Wang (2021). Consequently, the unionization of the firm or its division can alter the market segment for acquisitions, potentially reducing the firm’s value. This segmentation can influence managerial incentives, as the acquisition market is crucial for motivating CEOs Bertrand and Mullainathan (2000, 2003). A decrease in potential acquirers may harm managerial performance, necessitating alternative motivation methods like concentrated ownership or stronger incentive contracts.

3 Data and Summary Statistics

We construct our sample of manufacturing plants from the Census of Manufacturers (CMF) and the Annual Survey of Manufacturers (ASM) at the Census Bureau. The CMF is taken

every five years, ending in years 2 and 7, and covers all establishments in the manufacturing industries with paid employees. Between the two CMF years, the ASM tracks approximately 50,000 manufacturing plants annually and covers all plants with more than 250 employees. Smaller plants are randomly selected every fifth year to complete a rotating five-year panel. For ASM, reporting is mandatory once a firm is selected to participate. Establishments must report to the government by law, and fines are levied for misreporting. In both datasets, permanent identifiers are assigned at the establishment and the firm level, which allows us to track all establishments under the same firm at each point and follow an establishment over time.

We obtain detailed plant-level data on the value of shipments, production costs (material and energy), and capital stock (in equipment and structures). In addition, information is provided on labor costs, including the number of employees, the total number of hours worked (production workers only), wages (production and non-production workers), and costs of providing various benefits (pension, health, and others). We compute two wage measures - the average wage (Wage), calculated as the total wage bill divided by the total employment, and the hourly wage (Wage_Hr), the ratio between the wage paid to production workers and the total number of hours worked by production workers. The latter is especially useful in our setting, as union membership mainly applies to production workers. We compute the cost per worker to cover health, pension, and other fringe benefits (Ben_Heath, Ben_Pen, and Ben_Other) by dividing the total dollar cost reported for each category by the total number of employees. We also compute the aggregate benefit cost per worker (Ben_Total) by aggregating the cost of three components. We calculate two productivity measures - value added (VA) and total factor productivity (TFP). VA is the difference between the total value of shipments minus production costs (material and energy) and contract work, adjusted for the change in work-in-progress inventories between the beginning and end of the year. TFP is calculated using cost shares of capital input, labor input (hours), and intermediate goods input, following Foster et al. (2001).

We collect information about union status and incentives at the plant from the Management and Organizational Practices Survey (MOPS). MOPS was first delivered as a mandatory supplement to the ASM in 2010 to collect data on management practices (in three main sections: monitoring, targeting, and incentives) and organizational structure. It was sent electronically and by mail to plants included in the ASM, and the Census received responses from approximately 36,000 plants, about 75% of all recipients (see Bloom et al. (2013), and Bloom et al. (2019) for a detailed discussion of MOPS).

Our main sample consists of about 30,000 plants included in the 2010 ASM that report positive employment and value of shipments and have at least ten non-missing responses from MOPS.⁶ We followed these establishments from 2017 to the year of the last available census and used the ASM to fill in information between the two census years (2012 and 2017). Since small firms selected to participate in the 2010 ASM are only required to stay in the panel for five years (i.e., 2010-2014), their information can be limited from 2014 until the next census year (2017). We also supplement our sample with the Longitudinal Business Database (LBD) at the Census. The LBD is a plant-level dataset, constructed based on surveys and administrative records from the IRS, that contains information on business plants and firms with paid employees. It covers all industries in the U.S. We use the LBD to identify other (non-manufacturing) plants owned by the same firms in our sample and to cross-validate the exit status for plants that do not appear in the 2017 CMF. We define our main unionization measure based on the answer to Question 36 in MOPS: “What percentage of all employees at this plant were members of a labor union?” The respondents were given six categories - 0%, 1-20%, 21-40%, 41-60%, 61- 80%, and more than 80%. The variable (Union) takes the median of the category chosen. We also define an indicator variable, D_Union, if at least some workers in the plant belong to a labor union. In our sample, 80.1% of the plants do not have any labor union, and 13.3% of plants have more than 60% of the workers as members of labor unions.⁷ Industries with the highest percentage of union membership are Paper

⁶The same criterion is used in Bloom et al. (2019) to create a clean MOPS sample.

⁷Percentages for the five categories are 80.1%, 1.5%, 1.6%, 3.6%, 7.3%, and 5.9%, respectively.

(37%), Petroleum and Coal (30%), and Primary Metal (26%). Industries such as Computer and Electronics (2%) and Printing (5%) have the lowest percentage. There is also a large heterogeneity across locations. Union membership in manufacturing industries is high in the Midwest (IL, OH, and KY are all at 21%, IN is 20%, and MI and WI are 18%) and low in the south (SC, NC, GA, and FL are also below 6%). Figure 1 presents the distribution of union membership in U.S. manufacturing across industries and locations.

For incentives, we focus on three dimensions - performance-based bonuses, promotion decisions, and dismissal decisions, separately for managers and non-managers. For bonuses, we include answers to two questions: (1) “What percent of non-managers at this plant received performance bonuses?” with answers of 20% or less, 20-40%, 41-60%, 61-80%, or more than 80%, and (2) “What were non-managers’ performance bonuses usually based on?” with choices of own performance, team or shift performance, for example, union’s performance, firm performance, or no performance bonuses. The first question asks about the coverage of performance-based bonuses, and the second question is about the criterion used in determining performance. Similar to the unionization measure, we take the median of each category chosen for the first question. For the second question, we normalize each response to a score between zero and one, with the responses associated with the most structured management practices receiving a value of one, and translate five categories into the following values (1, 3/4, 1/2, 1/4, and 0), following prior work (Bloom et al. (2013), Bloom et al. (2019)). The average score of these two questions is defined as the bonus measure for non-managers (Bonus_NM). Plants with more than 80% non-managers receiving performance bonuses based on workers’ own performance have the highest value.

Two of the questions in MOPS center around promotion and dismissal decisions. Respondents are asked about the primary way non-managers were promoted - solely based on performance, mainly based on performance, marginally based on performance, or no promotion, and the consequence of under-performance for non-managers - dismissed within 6 months, dismissed after 6 months, or rarely or never dismissed. Again, we normalize each

response to a score between zero and one, with the strongest incentives receiving a value of one (Promotion_NM, Dismissal_NM).⁸ The same set of questions was asked about managers, which allows us to compute the corresponding incentive scores on the manager side (Bonus_M, Promotion_M, and Dismissal_M).

MOPS includes several questions about how decisions are made within the firm and decision authorities about new product introduction, product pricing, advertising, and capital investments. For example, whether a specific decision is made at the plant level, at the headquarters, or a combination of the two. We normalize the response for each decision into a score between zero and one, with the most decentralized (centralized) response receiving a value of one (zero). We then average the scores of all five questions for the level of decentralized decision (Decision). Appendix A provides a detailed description of the mapping between responses and the translated numerical score for all variables used in the paper. The exact mapping is used in Buffington et al. (2017).

Table 1 compares plants with or without union membership. Union plants have a higher value of shipments and more employment, and they also pay higher wages and provide more generous benefits. For example, the average wage per worker is 11% higher, and the hourly wage for production workers is 19% higher in unionized plants. In the meantime, the average benefits per worker are 45% higher in union plants. The difference in pension benefits is most substantial - union workers receive almost twice the amount of pension benefits relative to non-union workers. Incentives are weaker in union plants for non-managers across all three dimensions - they are less likely to receive performance-based bonuses, be promoted based on performance, or be dismissed due to underperformance. Interestingly, unconditional summary statistics show that managers in union plants receive stronger incentives.⁹ As shown in Figure 1, union membership varies widely across industries and locations. To better

⁸The scores are constructed as follows: promotion decisions solely based on performance (1), mainly based on performance (2/3), marginally based on performance (1/3), or no promotion (0), and underperforming non-managers will be dismissed within 6 months (1), dismissed after 6 months (1/2), or rarely or never dismissed (0).

⁹As we will demonstrate later, this effect primarily results from the size of unionized plants. The results change direction when we account for plant characteristics.

understand the association between union membership and wages, benefits, and incentives, one needs to control for industry and location effects.

4 Baseline Results

4.1 Union, Labor Costs, and Incentives

First, we document the general pattern between union status and labor costs, controlling for industry, location, and firm characteristics.

4.1.1 Unions and Labor Costs

We consider both wages and benefits when calculating labor costs. Specifically, we focus on the hourly wage for production workers as the primary wage measure, considering their higher likelihood of union membership. Our results remain qualitatively consistent when using the average wage for all workers, albeit with a smaller magnitude. For benefits, we use the total benefits provided per worker (including health, pension, and other fringe benefits) as our primary measure.¹⁰ To capture the level of unionization, we use an indicator variable, `D_Union`, which takes the value of one if workers in the plant have union membership and zero otherwise. In addition, we control for the plant size by including the total value of shipments ($\text{Log}(\text{TVS})$) and the plant age by using the number of years since it first appeared in the LBD ($\text{Log}(\text{Age})$).¹¹ As wages and benefits can be set at the firm level, we control for the total firm employment ($\text{Log}(\text{Firm Emp})$) by identifying all plants within or outside the manufacturing sector under the firm identifier using the LBD. Labor costs may be related to productivity, so we include the plant-level total factor productivity (TFP) estimated based on cost shares of capital, labor, and intermediate goods (TFP).¹² We also control for workers' education levels by including the percentage of individuals with at least a Bachelor's degree among managers

¹⁰We find similar patterns when examining each benefit component.

¹¹Since the LBD started in 1976, the age variable is truncated.

¹²TFP is estimated using the number of production hours rather than the dollar cost.

and non-managers (% BA_M, %BA_NM). We include fixed effects to account for variations of unionization status across industries (4-digit NAICS) and locations (commuting zones). Table 2 presents our findings.

Union plants, on average, pay 7.5% more in hourly wages to production workers and have 17.8% higher benefit costs after controlling for (Industry $\times$ Commuting Zone) fixed effects (columns 1 and 3) and other firm characteristics. Our finding on wages aligns with the well-documented union wage premium (Freeman and Medoff (1984)). However, very few studies, if any, have looked at the gap in benefits between unionized and non-unionized firms. In our sample of plants, on average, benefit costs constitute approximately one-third of the wage costs, and accounting for benefit differences further widens the gap in labor costs attributable to unionization. Additionally, we find that larger plants belonging to larger firms and older plants offer higher wages and benefits. Furthermore, there is a positive relation between plant productivity and both wages and benefits, indicating a strong link between productivity and compensation (Stansbury and Summers (2018)). Education positively correlates to wages and benefits for both managers and non-managers.

In several instances, the estimates from regressions differ from those reported in the summary statistics of Table 1 (11% and 49%, respectively). This implies that a considerable portion of the gap between unionized and non-unionized plants can be explained by industry, location, and plant characteristics. Our findings remain consistent when using the average wage for all workers (column 2), albeit with a smaller effect size, and hold across various benefit types. When we include additional firm fixed effects in columns 4 to 6, the estimated union premium drops to about half the level in columns 1 and 3 but remains statistically and economically significant. Our findings suggest that even within the same firm, union plants pay 4.2% higher wages and 9.9% higher benefits, controlling for industry and location fixed effects.

A common explanation for the union wage premium is that unionized plants are more productive, with collective bargaining enabling workers to capture a share of the resulting

rents. For instance, Freeman and Medoff (1984) argue that improved personnel practices and lower employee turnover contribute to productivity gains in unionized settings. Similarly, the influential study by Brown and Medoff (1978) reports a positive effect of unions on productivity. However, subsequent research offers a more nuanced picture. Studies using larger and more representative samples have generally found that unionization is associated with lower productivity, though the magnitude and direction of the effect vary by industry (Clark 1980; Hirsch 1992; Black and Lynch 2001). Evidence also suggests that any positive productivity effects are more likely to emerge in private, for-profit sectors where firms face stronger competitive pressures (Hirsch 2017).

We construct two plant-level productivity measures: total factor productivity (TFP), estimated following Foster et al. (2001), and value-added productivity, based on the approach of Bloom et al. (2013). In Table 2, we show that unionized plants pay higher wages and offer more generous benefits than non-union plants even after controlling for TFP, indicating that productivity differences alone cannot account for the union wage premium. Table 3 further reveals a robust negative correlation between unionization and productivity. We estimate that unionized plants exhibit 3% to 8% lower productivity compared to their non-unionized counterparts, controlling for industry and location fixed effects and firm characteristics. These results are consistent even when accounting for firm fixed effects, suggesting that unionized plants are less productive than other plants within the same firm. These results challenge the notion that the wage premium associated with unions can be attributed to higher productivity in unionized plants.

4.1.2 Unions and Incentives

Next, we test Hypothesis 1 on the differences in incentives between unionized and non-unionized firms. To do so, we use both survey data from the MOPS and estimate the pay-for-performance sensitivity based on realized wages and plant productivity.

Performance-Based Measures from MOPS

We examine incentive measures across three dimensions using information from the MOPS, each separately for managers and non-managers. First, we examine the prevalence of performance-based bonuses (Bonus_M, Bonus_NM). A higher score indicates a larger portion of workers in the plant receiving performance-based bonuses directly linked to their individual performance. Second, we explore the extent to which firms promote their employees based on their own performances (Promotion_M, Promotion_NM). A higher score indicates that managers or non-managers are primarily promoted based on their performance rather than other factors such as tenure or personal connections. Lastly, we assess whether employees face consequences for poor performance (Dismissal_M, Dismissal_NM). A higher score suggests that managers or non-managers with subpar performance are more likely to be dismissed or reassigned within 6 months. The detailed definitions for these variables are described in Section 3 and Appendix A.

Table 4 presents our findings comparing incentive measures between unionized and non-unionized plants. Unionized plants show significantly lower scores in all incentive dimensions, particularly for non-managerial positions. Specifically, non-managers in unionized plants are 26% less likely to receive performance-based bonuses, 11% less likely to be promoted based on their performance, and 13% less likely to face dismissal for underperformance. In contrast, while unionization negatively impacts manager incentives as well, the effect is notably smaller, ranging from 15% to 33% compared to non-managers.

A possible reason for the lower incentives among managers, who are usually not union members, is that the absence of incentives for non-managerial employees reduces the need for monitoring and oversight of managers. In other words, when non-managers lack incentives, it can have a spillover effect, leading to lower incentives for managers as well.

Regarding the control variables, we find that larger and more productive plants tend to offer more performance-based incentives. Additionally, there is a positive correlation between worker education and the implementation of performance-based incentives. Notably,

the impact of education on incentive measures is more significant for non-managers than for managers. Lastly, performance-based incentives are more frequently implemented in plants associated with larger firms. Due to the consistency of these effects, we will create a composite index for incentives in the following sections. This index will average the results across all three dimensions, distinguishing between managers and non-managers. Columns 7 and 8 demonstrate that the outcomes from using the composite index are qualitatively similar to those obtained from considering each component.

Pay-for-Performance Sensitivity

Using survey data from the MOPS, we find that unionized plants are less likely to implement incentive measures, such as performance-based bonuses, promotions, or dismissals. In this section, we complement the survey evidence to examine incentives by analyzing the dynamic relationship between realized wages and productivity at the plant level using the administrative data. Specifically, we investigate how wages respond to changes in productivity, which is similar to the concept of pay-for-performance sensitivity used in the literature to assess managerial incentives (Core and Guay (1999)). A higher sensitivity in this context indicates stronger incentives for employees.

In our sample, small firms are observed in a five-year rotating panel, with the final year available for those in the 2010 ASM panel being 2014, allowing us to observe the complete time series for these plants. However, given that wages are typically sticky in the short run (Hall, 2005), this short panel may not capture sufficient variation for meaningful wage adjustments to emerge. To better assess wage-productivity sensitivity, we compare data from 2010 (the initial year of the ASM panel) to 2017 (the next Economic Census year, which includes all firms by mandate). This comparison enables us to capture longer-run wage adjustments. To account for plant-specific effects, we construct a two-period panel for the plants included in the 2010 sample and estimate the following specifications with plant

fixed effects:

$$Y_{pil,t} = \beta_0 + \beta_1 \times PROD_{pil,t} + \beta_2 \times (Union_p \times PROD_{pil,t}) + f_p + \gamma_i + \alpha_l + \epsilon_{pil,t} \quad (1)$$

where $Y_{pil,t}$ measures the average compensation for plant p in industry i commuting zone l at time t and $PROD_{pil,t}$ is the corresponding labor productivity. f_p , γ_i , and α_l reflect plant, industry, and location fixed effects, respectively.

In our setup, β_1 is the estimate of the pay-for-performance sensitivity for all plants, and β_2 estimates the differential effect by unionization status. The unionization indicator is suppressed due to the plant fixed effects. We use two compensation measures: the logarithm of the hourly wage for production workers and the logarithm of average wages. Since union membership is more prevalent among production workers, the effect of unionization is expected to be more pronounced for production workers. However, using the total compensation is more appropriate if performance-based bonuses are paid out separately from hourly wages. We use value-added normalized by labor input—either total production hours (VA/TH) or total employment (VA/TE) as a proxy for labor productivity.

The results are reported in Table 5. Compensation is strongly related to productivity in all specifications. Plants with rising productivity are associated with higher compensation ($\beta_1 > 0$). However, the sensitivity is smaller ($\beta_2 < 0$) and about two-thirds in magnitude for unionized plants relative to non-unionized plants. This finding further confirms the survey evidence that unionized plants are less likely to adopt performance-based bonuses. Our finding is consistent with findings in Chen et al. (2011) that unionized firms have lower operating flexibility due to a fixed wage structure.

4.1.3 Unions and Monopsony Power

Previous research suggests that while greater employer monopsony power is associated with lower wages (e.g., Azar, Marinescu, Steinbaum, and Taska (2020)), unions can offset this effect by strengthening workers' bargaining positions. Benmelech, Bergman, and Kim (2022)

find that the negative relationship between employer concentration and wages is less pronounced in industries with higher unionization rates. A key advantage of our data is that we observe unionization status at the plant level, whereas their study relies on industry-level unionization measures.

We construct three commuting zone-level concentration measures. First, we compute the Herfindahl–Hirschman Index (HHI) within each industry. Second, we define an indicator variable, `D_CONC`, equal to one if the industry-commuting-zone HHI is in the top quartile nationally. Third, we define `D_Dom`, equal to one if the industry employs more than 10% of all workers in the commuting zone. Industries are classified at the 3-digit NAICS level to reflect broader job search patterns, though results are similar using 4-digit NAICS definitions.

We find that wages are lower in areas where employers hold greater monopsony power. Within the same industry, plants located in commuting zones with top-quartile HHI (`D_CONC`) exhibit an average wage reduction of 1.5–1.7%. Plants operating in locally dominant industries (`D_DOM`) experience even larger wage reductions, ranging from 4.2% to 6.3%. However, the presence of unions substantially mitigates these effects. In top-quartile HHI commuting zones, unionization is associated with an additional 3% wage premium, beyond the general 8% union wage premium. In locally dominant industries, the union premium increases by 4%. As a result, we do not observe lower wages among unionized plants in concentrated labor markets. Using plant-level unionization data, our results closely align with the findings of Benmelech, Bergman, and Kim (2022).

Following the framework outlined in Section 4.1.2, we extend our analysis to examine performance-based incentive measures—bonuses, promotions, and dismissals—separately for managers and non-managers. For brevity, we present results using `D_CONC`, though findings are qualitatively consistent when using the other concentration measures (HHI and `D_DOM`). We find no significant relationship between monopsony power and incentives overall. However, there is some evidence that unionized plants adopt even fewer performance-based incentives in more concentrated labor markets, particularly in promotion and dismissal practices.

This pattern is especially pronounced for non-managers: unionized plants are less likely to promote or dismiss non-managers based on performance, and the likelihood declines further in more concentrated areas. Our findings are presented in Table [IA1](#).

4.2 Union and Firm Performance

So far, we have shown that unionization is positively linked with wages but negatively associated with incentives. As labor costs and incentives are important considerations to firms' investment decisions, how do these differences affect firms' investment decisions and, ultimately, survival and growth? In this section, we set out to investigate these outcomes and test Hypotheses [2](#) and [3](#).

4.2.1 Unions and Investments

We merge information from two sources: the 2010 Annual Survey of Manufacturers (ASM) and the 2017 Census of Manufacturers (CMF). Since 2017 is the next Economic Census year following 2010 and includes all firms by mandate, linking these datasets allows us to track plants surveyed in the 2010 ASM through 2017 to examine investment, survival, and growth outcomes. We define investments as the change in capital stock between 2010 and 2017. In addition, we disaggregate capital expenditures into two categories: structures and equipment. We construct a composite incentive score, calculated as the average of three individual components: performance-based bonuses, promotions, and dismissals. We measure this score separately for managers and non-managers, denoted as *Incentives_M* and *Incentives_NM*, respectively. Our findings are robust when we use each component individually.

To estimate the relationship between unionization and investments and test our Hypothesis [\(1\)](#), we estimate the following specifications:

$$CAPEX_{pil} = \beta_0 + \beta_1 \times Union_p + \phi X_p + \gamma_i + \alpha_l + \epsilon_{pil} \quad (2)$$

where $CAPEX_{pil}$ is the capital expenditure (total, structure, or equipment) for plant p in industry i and location l . $Union_p$ is an indicator variable for whether plant p has union representation, and X_{pil} is a set of firm characteristics that we control.

Our variable of interest, β_1 , captures the effect of unionization on investment. Table 6 columns 1, 3, and 5 present our findings. Unionized plants have lower capital expenditures ($\beta_1 < 0$) in both equipment and structures. Controlling for industry, location, and other observable firm characteristics such as size, age, and human capital, unionized plants invest 3% less relative to non-unionized plants during the same period. The difference is significant at a one percent level. The lower investments observed in unionized plants can be attributed to various factors. Hirsch (1991) argue that unions have direct and indirect effects on investment. The direct effect arises from the “union tax” imposed on the returns to long-lived capital, while the indirect effect is linked to higher financing costs due to reduced profitability for unionized firms. Bradley et al. (2017) shows that passing a union election results in declines in patent quantity (quality) three years after the election. We show that unionized plants also have higher wages, weaker incentives, and lower productivity, all of which can lead to adverse effects on investments within the framework of the neoclassical model. This raises the question: To what extent can these differences account for the lower investment levels observed in unionized plants?

To answer this question and test our Hypothesis (3), we re-estimate the investment regressions in Equation (2) but include additional controls of wage, incentives (for both managers and non-managers), and productivity, as well as their interactions with the union indicator variable. The updated specification is as follows:

$$CAPEX_{pil} = \beta_0 + \beta_1 \times Union_p + \beta_2 \times K_p + \beta_3 \times (Union_p \times K_p) + \phi X_p + \gamma_i + \alpha_l + \epsilon_{pil} \quad (3)$$

where $CAPEX_{pil}$ is the capital expenditure for plant p in industry i location l , $Union_p$ is an indicator variable for unionization, and X_p is the set of firm characteristics we control. K_p is

our variable of interest, including wages, incentives, and productivity. Then, the difference in capital expenditures between unionized and non-unionized plants in the same location and industry can be expressed as:

$$CAPEX^u - CAPEX^{nu} = \beta_1 + \beta_2 \times (K^u - K^{nu}) + \beta_3 \times K^u + \phi(X^u - X^{nu}) \quad (4)$$

where β_2 captures the difference in the variable of interest (w) between unionized and non-unionized plants, and β_3 reflects the difference in sensitivity to w between unionized and non-unionized plants. The remaining (unexplained) difference is estimated by β_1 . We include three variables in the set of Y , including wages (Wage), incentive scores (Incentive_NM and Incentive_M), and total factor productivity (TFP).

Results are reported in columns 2, 4, and 6 of Table 6. We find that wages are negatively related to capital expenditure ($\beta_{2,wage} < 0$), indicating that higher labor costs lead to reduced demand for investments, suggesting a complementary relationship between capital and labor. Stronger non-managerial incentives are associated with more investments ($\beta_{2,Incentives_NM} > 0$). This is consistent with the idea that incentives help mitigate agency problems, improve labor productivity, and thus increase the benefit derived from capital investment. Interestingly, we do not observe a significant effect of managerial incentives on capital expenditures ($\beta_{2,Incentives_M} \approx 0$). Furthermore, we also find that more productive plants tend to have higher capital expenditure ($\beta_{2,TFP} > 0$), possibly due to more efficient use of capital stock.

Recall that unionized plants have higher wages, weaker incentives (especially for non-managers), and lower TFP, all of which are associated with lower levels of capital expenditures. In addition, we find that the effect of non-managerial incentives on investment is less important in unionized plants ($\beta_{3,Incentives_NM} < 0$), which further widens the investment gap between unionized and non-unionized plants as indicated in Equation (3). However, we do not observe significant differential effects on wage, incentives to managers, or productivity ($\beta_{3,wage} \approx 0$, $\beta_{3,Incentives_M} \approx 0$, $\beta_{3,TFP} \approx 0$). When explicitly controlling for differences

in wage, incentives, and productivity, the coefficient for the union indicator, β_1 , becomes slightly positive and insignificant from zero. This finding suggests that the lower investment rates observed in unionized plants can primarily be attributed to the differences in wages, incentives, and productivity. There exists both a level effect and a sensitivity effect. Previous studies have also documented a negative association between unionization and investments. Fallick and Hassett (1999) find a substantial reduction in capital investment when unions win in certification elections. However, to the best of our knowledge, our study is the first to examine the effect of incentives on investments in unionized plants. We show that not only are lower levels of incentives in unionized plants associated with lower investments, but also that investment is less sensitive to incentives in unionized plants.

4.2.2 Unions, Survival, and Employment Growth

If unionized plants invest less, do they also grow their labor force at a slower rate? Are wage and incentive differences also associated with survival and employment growth? Existing literature has shown that growth is lower in unionized plants (Dunne and Macpherson (1994), Freeman and Kleiner (1999)). However, the evidence regarding the impact of unionization on survival remains inconclusive. Using a regression discontinuity design (RDD) to compare plants that have narrowly passed or failed in union elections, DiNardo and Lee (2004) found no evidence that successful union organizing drives subsequent survival rates. Their study provides a convincing case of causality. However, since union elections often involve only a small portion of workers in large firms, there are concerns about the generalizability of their findings to the broader sample of existing unionized plants. One significant advantage of our data is the ability to clearly identify the percentage of workers with union membership at the plant level, enabling us to investigate cases when unions represent a large portion of workers.

We classify an “exit” as cases where a plant is present in the 2010 ASM but absent from the 2017 CMF. In addition, we cross-validate our definitions using the Longitudinal Business

Database (LBD) to ensure that the identified exits are not merely the result of administrative record change or non-response to the census. The LBD, created by the Census Bureau, incorporates survey data collected from businesses and administrative records from business tax filings obtained from the Internal Revenue Service (IRS). It covers all private non-farm employee businesses across the U.S. The exit rate in our sample of plants from 2010 to 2017 is about 17%.

We estimate similar specifications as those in Equation (2) and (3), with or without controlling for wages, incentives, and productivity. Table 7 reports the estimates. Column 1 shows that union plants are 3.7 percentage points more likely to exit after controlling for firm characteristics, industry, and location fixed effects. The effect is about 21%, given the sample mean. Among the control variables, smaller and younger plants have higher exit rates, although plants belonging to larger firms are also more likely to exit.

Conditional on survival, we find a significant negative effect of unionization on employment growth (column 3). The employment growth is about 5.5 percentage points lower in unionized plants compared to non-unionized peers during our sample period (about 94% of the sample mean rate). Combined with lower capital expenditure shown in 4.2.1, unionized plants have lower sales growth during this period (column 5). Sales growth in a unionized plant is about 5.2 percentage points lower than its non-unionized counterpart (39% of the sample mean). On the control variables, we find that smaller, younger plants in smaller firms with more educated employees grow more in employment. Interestingly, productivity (TFP) does not affect employment growth.¹³

Next, we examine how differences in wages, incentives, and productivity between unionized and non-unionized plants are linked to their exit rates and growth. In column 2, we observe that non-managerial incentives (Incentives_NM) are strongly associated with the exit rate. A one standard deviation increase in the incentive score is associated with an 8.1% increase in survival. After controlling for non-managerial incentives, the difference in sur-

¹³Our results on incentive variables are robust when we exclude the TFP variable in the regressions.

vival between unionized and non-unionized plants is no longer significant. Column 4 shows that plants that offer higher wages and stronger incentives (especially for non-managers) are more likely to experience workforce growth. This suggests that incentives play a positive role in driving employment growth. In addition, we find a significantly negative coefficient for the interaction between non-managerial incentives and the union indicator, indicating that the positive effect of incentives on employment growth is largely absent in unionized plants. In column 5, we observe similar results regarding sales growth; the sensitivity of sales growth to non-managerial incentives is lower in unionized plants, though the effect is only marginally significant. Interestingly, the sensitivity of sales growth to managerial incentives is significantly lower in unionized plants.

Consistent with the survival analysis results, once we control for wages and incentives, the difference in employment growth between unionized and non-unionized plants is no longer statistically significant. This suggests that the observed gap between unionized and non-unionized plants in exit rates and growth rates is largely driven by differences in compensation structures rather than union status itself, confirming our Hypothesis 3.

Figure 2 provides a visual representation of the estimated impact on outcomes from the level and sensitivity of incentives in unionized plants based on Tables 6 and 7. For all variables examined, including survival, capital expenditure, and employment growth, the primary driver behind the disparity between unionized and non-unionized plants is the lower sensitivity of incentives. In other words, the reduced responsiveness of worker incentives in unionized plants accounts for the majority of the observed differences across these firm outcome measures. Our finding highlights the critical role that incentives play in shaping the performance and dynamics of organizations, particularly in the context of unionization.

Taken together, our findings suggest that bargaining outcomes from union representation, such as higher labor costs and lack of incentives (especially for non-managers), are closely linked to lower survival rates and diminished growth in unionized plants. Thus, the impact of unions extends beyond servicing as a mechanism for improved rent-sharing arrangements

for workers; it also affects the overall size of the pie for all stakeholders involved.

4.2.3 Unions and Capital-Labor Ratio

We show that both capital expenditures and employment growth are lower in unionized plants, and the differential effect is associated with higher wages and weaker incentives. Higher wages raise labor costs, while the lack of incentives may result in lower labor productivity. Given that labor becomes more expensive and less efficient in unionized plants, do firms adapt by changing the composition of capital and labor? On the one hand, firms may substitute labor with capital and adopt more capital-intensive production technology (Arrow, Chenery, Minhas, and Solow (1961)). On the other hand, in industries with long-lived plants and equipment, investors may strategically choose to invest less to discourage wage demands from unions (Baldwin (1983)). In this section, we examine the Hypothesis that unionized plants have higher capital-labor ratios.

We examine the effect of unionization on the capital-labor ratio in two ways. First, we look at the level effect by regressing the capital-labor ratio on a union indicator, controlling for wages, incentives, plant characteristics, and industry and location fixed effects. Table 8 reports the estimates. Column 1 shows that unionized plants have 7.8% higher capital-labor ratios (measured as $\ln(Capital/TotalEmployment)$). This is consistent with the Hypothesis that firms substitute capital-intensive production technology in the presence of unions. We also find that larger, older plants have higher capital-labor ratios, possibly due to their advantage in financial slack. Plants with more educated managers but less educated workers also tend to have higher capital-labor ratios. We include wages and incentives in Column 2. Our coefficient on unionization drops to 4.2%, but remains statistically significant at the 1% level. Higher wages are related to a lower capital-labor ratio, consistent with findings in Bena, Ortiz-Molina, and Simintzi (2022), who show that plants faced with rising labor costs substitute labor with capital. Lower non-managerial incentives are associated with higher capital-labor ratios, suggesting that firms substitute labor with capital when workers are not

well motivated. In contrast, we do not find any significant effect of managerial incentives on capital-labor ratios. Including wages and incentives explains about half of the impact of unionization on capital-labor ratios.

One potential concern with using the plant’s own wage level as an explanatory variable is that wages can be driven by omitted variables that correlate with the technology employed or plant productivity. So, in Column 3, we replace the plant-level wage with the average wage of other plants in the same 4-digit NAICS industry and the same commuting zone (Local Wage). We find qualitatively similar results. Since structures and equipment in manufacturing are likely to have a long life span, it is possible that omitted variables can drive both the unionization status and the level of capital stock. In our second approach, we compare changes in the capital-labor ratio during our sample period (from 2010 to 2017) by unionization status, controlling for changes in labor costs. Despite a higher capital-labor ratio at the beginning of this period, shown in column 1, unionized plants continued to increase capital-labor ratios, resulting in an even higher capital-labor ratio at the end of the period. Consistent with the substitution explanation, we find that plants with rising wages also tend to increase the capital-labor ratio (columns 4 and 5). The result is robust when we use the increase in local wages rather than the actual wages offered at the plant.

4.3 Union and Wages: Revisited

Table 2 column 1 shows that unionized plants pay 7.5% higher wages compared to their non-unionized counterparts. However, union workers experience slower wage growth during our sample period. For example, between 2010 and 2017, the average hourly wage for production workers increased by 16.6%, while union workers experienced an increase that is 2.5% lower, controlling for industry and location fixed effects. In addition, Table 7 demonstrates that unionized plants have a higher likelihood of exiting, which often leads to significant wage losses for workers due to unemployment duration and the loss of firm-specific capital (Jacobson et al. (1993), Farber (2017), Andersson et al. (2018), Lachowska et al. (2020),

Graham et al. (2023)). Given the lower growth rate and the higher expected cost associated with plant closure, what is the adjusted effect of union status on wages?

To assess the effect, we first normalize the wage of the non-unionized worker as one and apply the estimated wage premium to union workers in the initial period. Then, we apply the estimated annual growth rate for union- and non-union workers based on our sample and use a 4% discount rate. The net present value (NPV) of wage income, conditional on survival, is about 5.8% higher for union workers compared to non-union workers over a five-year period. However, the gap shrinks to 1.4% over ten years due to lower wage growth among union workers. Moreover, when we adjust for survival, assuming a 25% long-term wage loss per year following plant closure (Jacobson et al. (1993)) and an unemployment spell of 2 years (Andersson et al. (2018)), the NPV premium for union workers reduces to 3.6% over five years and becomes negative over ten years.¹⁴

Our estimates reinforce the findings that weaker incentives in unionized plants contribute to a decrease in the overall size of the pie, resulting from a higher rate of plant closure and lower growth. As a result, the wage advantage that union workers enjoy gradually may diminish over time despite stronger collective bargaining.

5 Spillover Effects

As discussed in Section 2, if the preferences of marginal workers mainly contribute to lower incentives, we would expect to see spillover effects at non-unionized plants within the same firm. This would happen as the firm strategically aims to dissuade workers from joining unions. On the other hand, if the reduced incentives stem from the union’s desire to promote solidarity among workers to strengthen their bargaining power, we are unlikely to see significant spillover effects in the absence of unions. In this section, we evaluate the indirect impact of unionization on other non-unionized plants within the same firm, in accordance

¹⁴We use the following formula to calculate the adjusted NPV: $NPV_{adj} = NPV_{unadj} \times Prob_{surv} + NPV_{unadj} \times Prob_{exit} \times (1 - \%WageLoss \times (1 - \%Unemp))$.

with Hypothesis 4.

5.1 Spillover Effects: Wages and Incentives

We take advantage of a unique feature of the plant-level census data, which assigns unique and separate identifiers to plants and firms, allowing us to track all plants under the same firm over time. We first classify “union firms” as those with at least one unionized plant. Then, within union firms, we further define “union industries” as industries that contain at least one unionized plant. Based on these definitions, we categorize plants into four groups according to their unionization status: (1) unionized plants (D-Union), (2) non-unionized plants in the union industry (Non-Union & Union Ind), (3) non-unionized plants outside the union industry (Non-Union & Outside Union Ind), and (4) non-unionized plants in non-union firms. We use non-unionized plants in non-union firms as the benchmark group and create three indicator variables for groups (1) through (3).

Similarly, we define “union commuting zone” for union firms as commuting zones that contain at least one unionized plant, and construct an alternative categorization based on plant location: (1) unionized plants (D-Union), (2) non-unionized plants in the union commuting zone (Non-Union & Union CZ), (3) non-unionized plants outside the union commuting zone (Non-Union & Outside Union CZ), and (4) non-unionized plants within non-union firms. Since plants within the same industry or commuting zone are more likely to develop social ties that facilitate information flow, we expect stronger spillover effects among union firms operating within the same union industry or commuting zone.

Our goal is to examine whether higher wages and weaker incentives observed in unionized plants extend to non-unionized plants within the same firm. We use specifications similar to those in Table 6, while also including additional categories for non-unionized plants. Similar to Section 4.2, we use a composite score that captures all three individual incentive scores (performance-based bonuses, promotions, and dismissals) separately for managers and non-managers (Incentives_M and Incentives_NM). Our results are robust when we use each

individual component.

Table 9 reports our findings. Columns 1 to 3 use industry-based categories. We find significant spillover effects: non-unionized plants in union firms pay higher wages and offer lower incentives, with stronger effects for plants operating in the same industry as the unionized plants. Compared to non-unionized plants in non-union firms (the omitted reference group), unionized plants exhibit a 13% wage premium, followed by an 8.1% premium for non-unionized plants in union industries, and a 4.5% premium for plants outside union industries but within union firms. Similar patterns emerge for incentives, with more pronounced effects among non-managers. For instance, among non-unionized plants, those operating in the same industry as a unionized plant experience a 14.5% reduction in non-managerial incentive scores, whereas those outside the union industry exhibit a smaller 9.7% reduction. Columns 4 to 6 of Table 9 use the location-based categorization and show consistent results. We find significant spillover effects from unionized to non-unionized plants within the same firm, particularly among plants located in the same commuting zone. Unionized plants have 33.4% lower non-managerial incentives compared to plants in non-union firms, while non-unionized plants in the same commuting zone experience a 21.7% reduction, and those in different zones show an 8.2% decrease. As discussed in Section 2, these patterns align with the Homogeneous Outcomes Hypothesis, suggesting that workers' preference for lower incentives explains roughly two-thirds of the observed gap between unionized and non-unionized plants. It is worth noting that a significant spillover effect on incentives is also observed among managerial employees. As outlined in Section 4.1.2, the lower levels of managerial incentives can be a result of spillover from non-managerial employees - the absence of incentive systems for non-managerial employees reduces the need for monitoring and oversight of managers, thus contributing to the observed decrease in managerial incentives.

Figure 3 presents the estimated coefficients from Table 9 and highlights persistent and significant spillover effects by industry and location. The presence of spillover effects aligns with the Homogeneous Outcome Hypothesis proposed in Section 2, which suggests that

unions cater to the preferences of marginal workers and use their bargaining power to achieve lower incentives. In addition, our finding that the spillover effects are positively related to the proximity (industry or location) between unionized and non-unionized plants is consistent with the benchmarking channel proposed in Duchin, Goldberg, and Sosyura (2017). Our findings suggest that labor practices in unionized plants can influence practices in non-unionized plants through intra-firm compensation benchmarking. The closer non-unionized plants are to their unionized counterparts, the greater the pressure to maintain conformity, resulting in stronger spillover effects.

The spillovers documented here imply that unionization status can be a significant consideration in mergers and acquisitions. Acquiring a target firm with unionized plants could introduce significant costs to the acquiring firm’s existing plants. The potential spillover costs associated with acquiring a unionized firm are also consistent with findings in Tian and Wang (2021), which show that unionized firms are less likely to be targeted for takeovers, and when they are, tend to receive lower takeover premiums.

5.2 Spillover Effects: Firm Performance

We show that non-unionized plants within the same company as unionized plants tend to offer higher wages and have weaker incentives. If these higher labor costs and diminished incentives lead to negative outcomes in terms of survival, investment, and growth, as discussed in Section 4.2.1, we would expect similar effects on non-unionized plants in firms with unions due to spillover effects.

To estimate the spillover effect on firm performance, we adopt a similar approach to that used in Equation 4 and examine three outcome variables: survival, capital expenditure, and sales growth. The results are summarized in Table 10.

Columns 1 to 3 focus on spillovers categorized by industry, while columns 4 to 6 use location-based categories. Our findings indicate that non-unionized plants within the same firm as unionized plants experience higher exit rates, lower levels of capital expenditure,

and reduced employment growth. Furthermore, regarding the location effect, non-unionized plants situated in the same commuting zone as unionized plants tend to have higher exit rates and lower employment growth compared to those located outside unionized commuting zones. Additionally, non-unionized plants operating within unionized industries are more likely to experience lower employment growth than those in non-unionized industries. Interestingly, unlike wage and incentive effects, we do not see significant differential effects on exit rate and capital expenditure between plants within or outside of the union industry or location. Instead, all non-unionized plants exhibit similar levels of adverse outcomes. Figure 4 presents a visual representation of the estimated coefficients from Table 10.

6 The RTW Status Change

In the previous sections, we have shown strong links between union status and lower survival rates, reduced capital expenditures, and slower growth. We demonstrated that these differences can largely be attributed to higher wages and weaker incentives associated with unionization. In this section, we examine the recent implementation of Right-to-Work (RTW) laws in Midwestern states during our study period. Specifically, in 2012, Indiana and Michigan enacted amendments that prohibited collective bargaining agreements from requiring workers to pay union dues or fees, effectively designating them as right-to-work states. This legislative change significantly reduces union power and can be viewed as an exogenous shock at the plant level.

We employ a difference-in-differences approach by comparing unionized plants in Indiana and Michigan with those in four neighboring states (Wisconsin, Kentucky, Illinois, and Ohio) that remained non-right-to-work states throughout our study period. We chose these neighboring states as our control group due to their similar industry composition and cultural attributes, as well as their geographic proximity to the treated states. By using the change in RTW status as an event, we can isolate the effects of union status and clarify how diminished union power impacts economic outcomes.

6.1 The Main Effect

Our sample consists of manufacturing plants from six neighboring states in the Midwest, as included in the 2010 ASM. Indiana and Michigan are classified as the treated group, while Kentucky, Illinois, and Ohio make up the control group (referred to as the “Midwest” sample). We define the pre-period as the time between the most recent Census of Manufacturing (2007) and the first year of the 2010 ASM panel (2010). The post-period encompasses the years from 2012 (when the relevant law was enacted) to 2014, which is the last year of the 2010 ASM panel. It is important to note that we did not use the 2017 CMF in this analysis because two states in the control group enacted Right-to-Work (RTW) laws in 2015. Given the inherent stickiness of union status over time, we apply the union status identified from the 2010 MOPS to the entire sample period. Additionally, as an alternative approach, we identify unionized plants based on the criterion that at least 60% of their workers are affiliated with a labor union. This method yields qualitatively similar results.

We consider the following specification:

$$Y_{pis} = \beta_0 + \beta_1 \times Union_p + \beta_2 \times (Union_p \times Treated_s) + \phi X_{pis} + f_{is} + \epsilon_{pis} \quad (5)$$

where Y_{pis} is the outcome variable, including employment growth and capital expenditures, for plant p in industry i and state s . $Treated_s$ is an indicator variable for states that became right-to-work states in 2012. X_{pis} measures the plant-level characteristics, and f_{is} is the (Industry $\times$ State) fixed effects. We estimate it for pre- and post-periods separately to allow other coefficients to differ over time. Our main variable of interest is β_2 , which measures the union effect between treated and control states.

Table 11 presents our findings. Panel A examines the post-period. There is a negative effect of unionization on employment growth in general ($\beta_1 < 0$), consistent with what we find from the main sample. However, unionized plants in treated states experience a significant positive employment response following the shock ($\beta_2 > 0$). As a result, unionized

plants in treated states no longer exhibit lower employment growth relative to non-unionized plants. The combined coefficient, $\beta_1 + \beta_2$, is close to zero with a p-value of 0.47. In contrast, we find no evidence of a differential change in wages between unionized plants in treated versus control states, suggesting that the increase in employment is not driven by wage reductions. One possible explanation is that, as unions weaken their influence post-shock, firms are able to introduce stronger incentive structures that enhance worker productivity. Alternatively, the lack of wage adjustment could reflect the relatively short post-shock observation window and the fact that many union workers may still be operating under existing contracts. Turning to capital expenditures, we find a significant increase in investments in equipment and technology among treated unionized plants, offsetting the general negative impact of unionization on investment. However, the effect on investments in structures is only marginally positive. This weaker response may reflect the lumpy nature of structural investments and, again, the limited time frame of our post-shock data, which may not fully capture longer-term adjustments.

The validity of a difference-in-differences model relies on the assumption that there were no significant differences between the treated and control groups prior to the shock. Panel B of Table 11 presents estimates for the pre-shock period. We find no significant differences in employment growth or capital investment among unionized plants between the treated and control groups, suggesting the absence of pre-trends and supporting the validity of our identification strategy.

Two states in our control group implemented similar right-to-work (RTW) laws after our sample period. Specifically, Wisconsin became an RTW state in 2015, and Kentucky adopted RTW laws in 2017. This development provides an opportunity for a placebo test to evaluate the pre-trend assumptions. To conduct this test, we re-estimated our specification in Equation 5, substituting the treated states of Indiana and Michigan with Wisconsin and Kentucky (the pseudo-treated states), which changed their RTW status after our testing period. Panel C presents our estimates. The main coefficient, β_2 , now captures the interaction

effect of unions in the pseudo-treated states. The results are insignificant across all variables, including wages, employment, and capital expenditures. This finding suggests that there is no noticeable pre-trend in unionized plants between the control group and those states that would become treated in the future. In summary, using the RTW shock, we show that exogenous changes that weaken unions’ bargaining power lead to increases in employment and investments, confirming that unionization *causes* underinvestment.

6.2 The Spillover Effects

We show in Section 5 that the effect of unionization extends beyond the unionized plants and affects other non-union plants within the same firms. These non-unionized plants also have lower investments, particularly those in the same industry or commuting zone as the unionized plants, attributed to spillover effects resulting from higher wages and weaker incentives associated with unionization. Therefore, we would expect a similar spillover effect following the shock of the RTW status change. As RTW laws undermine the union’s bargaining power, it would lift its influence on non-union plants, thus changing their investment decisions.

To investigate this Hypothesis, we create a sample of plants that are affiliated with unions. We begin by identifying firms that own at least one unionized plant in the Midwest Sample, categorizing these firms based on whether their unionized plants are located in treated or control states. Next, we collect data on non-unionized plants operated by the same firms but located in other states, forming what we call the “Affiliated Non-Union Sample.” We define an indicator variable, *ANU_Treated*, which is equal to one if the firm that owns the plant has a unionized plant in the treated states and zero otherwise. By design, the Affiliated Non-Union Sample complements the Midwest Union Sample, as both are linked through common ownership. Finally, we construct measures of employment growth and capital expenditure measures for both the pre- and post-shock periods, following the same definition as in Section 6.1. Specifically, we use the time period between 2007(the last Census) and 2010 (the first

year of the 2010 ASM Panel) as the pre-shock period and consider the years between 2012 (the year of the change of RTW status) and 2014 (the last year of the 2010 ASM Panel) as the post-shock period. We consider the following specification:

$$Y_{pis} = \beta_0 + \beta_1 \times ANU_Treated_p + \phi \times X_p + f_{is} + \epsilon_{pis} \quad (6)$$

where Y_{pis} is the outcome variable for plant p in industry i and state s . $ANU_Treated_p$ is an indicator variable that equals one if the union plant affiliated with plant p is in a treated state with RTW status change in 2012 and zero otherwise. X_p measures the plant-level characteristics, and f_{is} is the (Industry $\times$ State) fixed effects. Our main variable of interest is β_1 , which measures the spillover effect from unionization between treated and control states.

Our findings are presented in Table 12. Panel A shows that following the shock, non-unionized plants affiliated with union firms in the treated states also experience higher employment growth (4.2%) and increased investments in equipment and technology (2.03%). Similar to the main effect, there is a marginally positive effect for investments in structures, albeit not statistically significant. Our findings suggest that as the union’s bargaining power weakens after the shock, its influence within the firm also decreases. As a result, non-unionized plants, much like their unionized counterparts, experience a positive change in their investment. This shift may be attributed to a market-adjusted wage-setting process or improved incentives within the firm.

7 Conclusion

Using plant-level Census data linked to detailed incentive scores, we show that unionisation reshapes a firm’s cash-flow distribution not only through higher wages but, by weakening pay-for-performance schemes for non-managers. This attenuation breaks the usual positive mapping from incentives to investment and productivity, explaining about three-quarters of

the union–non-union performance gap.

A one-standard-deviation fall in the incentive index is associated with a 3–5 percent drop in TFP, a 7 percent fall in capital expenditure, and a 5 percent rise in the capital–labour ratio, consistent with firms substituting machines for less effectively motivated labour. A staggered adoption of right-to-work laws confirms causally that relaxing union bargaining power restores incentives and reverses the investment shortfall.

Incentive dilution—and union wage premia—extend to non-union establishments within the same firm, especially when they share an industry or commuting zone with a union plant. Because managers deliberately weaken incentives in non-unionized plants to make unionization less attractive, the resulting contract must raise the expected utility of the pivotal (median) non-managerial employee; otherwise, the deterrence strategy could not succeed. This supports the view that the observed incentive reductions in unionized firms arise because unions implement the preferences of the median worker, not because union leaders are merely entrenching their own bargaining position.

We observe a similar, albeit lesser, reduction in managerial incentives in unionized plants and a corresponding decrease in incentives in non-unionized plants. We hypothesize that these diminished incentives could be a reaction to changes in managerial roles as a result of the lessened effectiveness of incentives for non-managerial workers in unionized plants.

The existence of spillover effects has implications for the firm’s participation in the market for acquisitions. A unionized firm is worth less, net of spillovers, to a non-unionized acquirer. Similarly, a non-unionized target is worth less to a unionized acquirer than to a non-unionized acquirer. Thus, spillovers can partition the market for acquisition, reducing the efficient reallocation of assets. The unionization of a firm makes it more costly for the firm to participate in a very large segment of the market for assets. This affects the firm’s value directly. Moreover, to the extent that the possibility of being acquired acts as an incentive for the firm’s senior managers, the reduction in the number of potential acquirers may have an additional effect on the incentives of top managers.

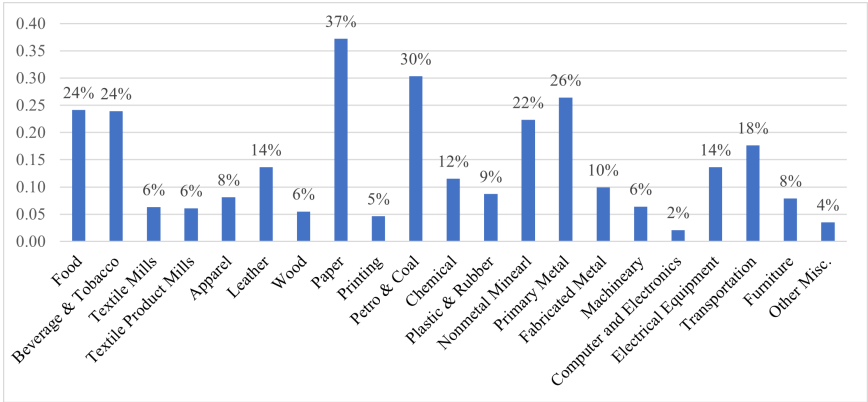
By characterizing a previously overlooked incentive channel, we reconcile mixed evidence on unions and productivity, highlight a new cost of partial unionization for asset reallocation, and raise policy questions about balancing wage insurance with investment-driven growth. Future work should examine whether similar patterns arise in service sectors and under alternative incentive instruments such as profit sharing or Employee Stock Ownership Plans (ESOPs).

Appendix A. Transferring Answers to Scores for MOP Questions

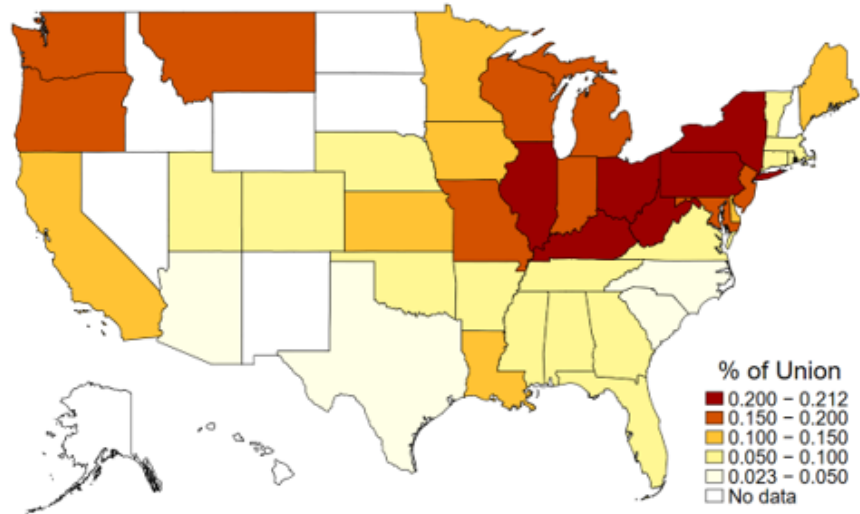
Number	Response		Monotonic Score	Question	Var Name
Section 1: Union Status					
36	0%		0	What percent of all employees at this establishment were members of a labor union?	union, D_Union
36	1–20%		0.1		
36	21–40%		0.3		
36	41–60%		0.5		
36	61–80%		0.7		
36	More than 80%		0.9		
Section 2: Worker Characteristics					
34	20% or less		0.1	What was the percent of managers at this establishment with a bachelor's degree?	BA_M
34	21–40%		0.3		
34	41–60%		0.5		
34	61–80%		0.7		
34	More than 80%		0.9		
35	See question 34		See question 34	What was the percentage of non-managers at this establishment with a bachelor's degree?	BA_NM
Section 3: Incentives					
9	Their own performance as measured by production targets		1	What were non-managers' performance bonuses usually based on?	Bonus_NM
9	Their team or shift performance as measured by production targets		3/4		
9	Their establishment's performance as measured by production targets		1/2		
9	Their company's performance as measured by production targets		1/4		
9	No performance bonuses		0		
10	0%		1/5	What percent of non-managers at this establishment received performance bonuses?	
10	1–33%		2/5		
10	34–66%		3/5		
10	67–99%		4/5		

Number	Response	Monotonic Score	Question	Var Name
10	100%	1		
10	Production targets not met	0		
11	See question 9	See question 9	What were managers' performance bonuses usually based on?	Bonus_M
12	See question 10	See question 10	What percent of managers at this establishment received performance bonuses?	
13	Promotions were based solely on performance and ability	1		
13	Promotions were based partly on performance and ability, and partly on other factors (e.g., tenure or family connections)	2/3	What was the primary way non-managers were promoted at this establishment?	Promotion_NM
13	Promotions were based mainly on factors other than performance and ability (e.g., tenure or family connections)	1/3		
13	Non-managers are normally not promoted	0		
14	See question 13	See question 13	What was the primary way managers were promoted at this establishment?	Promotion_M
15	Within 6 months of identifying non-manager under-performance	1		
15	After 6 months of identifying non-manager under-performance	1/2	When was an under-performing non-manager reassigned or dismissed?	Dismissal_NM
15	Rarely or never	0		
16	See question 15	See question 15	When was an under-performing manager reassigned or dismissed?	Dismissal_M

Figure 1: **Sample Distribution.** The figure below shows the percentage of labor union membership by industry (Panel A) and state (Panel B).



Panel A: Unionization Rate by Industry (3-digit NAICS)



Panel B: Unionization Rate by State

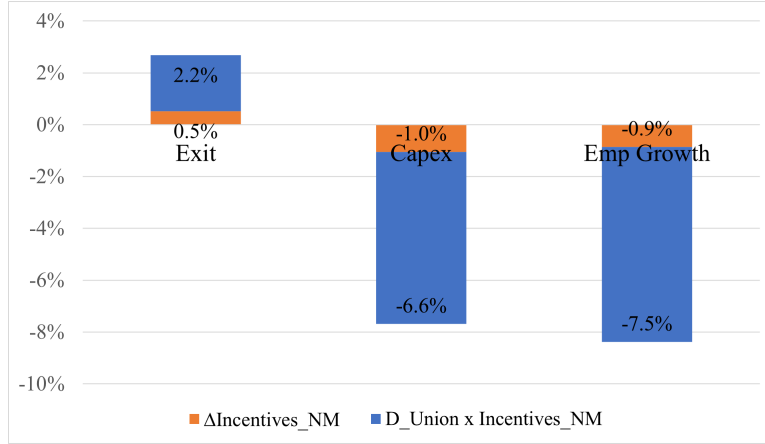


Figure 2: **Decomposition of Effects - Level vs. Sensitivity.** This figure presents the effect of non-managerial incentives on firm outcomes (from left to right): exit rate, capital expenditure, and employment growth based on estimated coefficients from Tables 6 and 7. For each variable, the orange (blue) bar indicates the estimated effect from the differential level (sensitivity) of incentives (β_1 and β_3 in Equation (3), respectively).

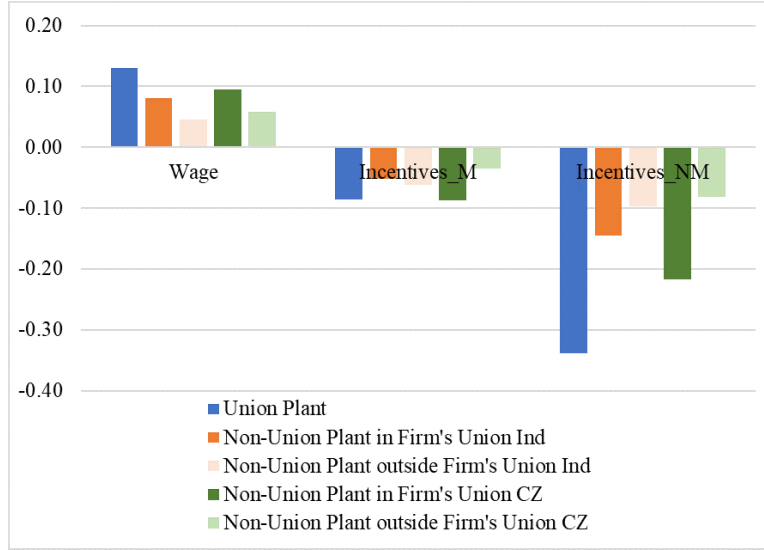


Figure 3: **Spillover Effect - Wages and Incentives.** This figure plots estimated coefficients of the effect of unionization on wages and incentives (for both managers and non-managers) from Table 9. We separate non-unionized plants in union firms based on two mutually exclusive categories - industry and location. The omitted group for each regression is non-unionized plants in non-union firms.

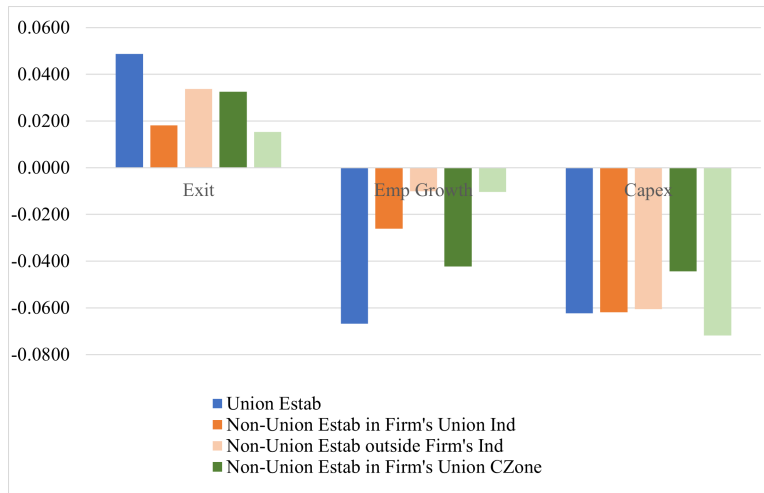


Figure 4: **Spillover Effect - Firm Performance.** This figure plots estimated coefficients of the effect of unionization on firm performance (for both managers and non-managers) from Table 10. We separate non-unionized plants in union firms based on two mutually exclusive categories - industry and location. The omitted group for each regression is non-unionized plants in non-union firms.

Table 1: **Summary Statistics**

This table compares characteristics between unionized and nonunionized establishments. D_Union is an indicator variable that equals zero for establishments without any labor union membership and one otherwise. *, **, and *** represent significance at 10%, 5%, and 1%, respectively. Numbers are rounded to comply with Census's disclosure policy.

VARIABLE	D_Union = 0	D_Union = 1	Diff (1 vs. 0)
Total Value of Shipments (in \$000's)	81500	209700	128200
Employment	151.2	258.6	107.4
Avg Wage (in \$000's)	47.65	52.98	5.33
Hourly Wage	20.01	23.76	3.75
Benefits (Pension) per worker (in \$000's)	1.842	3.645	1.803
Benefits (Health) per worker (in \$000's)	5.802	8.268	2.466
Benefits (Other) per worker (in \$000's)	6.031	7.794	1.763
Benefits (Total) per worker (in \$000's)	13.75	19.97	6.22
Bonus_NM	0.353	0.316	-0.037
Bonus_M	0.456	0.526	0.07
Promotion_NM	0.851	0.8	-0.051
Promotion_M	0.813	0.883	0.07
Dismissal_NM	0.667	0.591	-0.076
Dismissal_M	0.566	0.573	0.007
Decision	0.318	0.243	-0.075
Number of Obs	24000	6000	

Table 2: Union and Labor Costs

This table reports regression results to examine the association between union membership and labor costs using the 2010 ASM. The dependent variables are the logarithm of hourly wage (in columns 1 and 4), the logarithm of average wage (in columns 2 and 5), and the logarithm of total benefits per worker (in columns 3 and 6). D_Union is an indicator variable that equals one if workers at the establishment have membership in labor unions and zero otherwise. Standard errors clustered at the industry (3-digit NAICS) x commuting zone level and are reported in parentheses. *, **, and *** represent significance at 10%, 5%, and 1%, respectively. Numbers are rounded to comply with Census's disclosure policy.

DEP VAR	(1) Hourly_Wage	(2) Avg. Wage	(3) Benefits	(4) Hourly_Wage	(5) Avg. Wage	(6) Benefits
D_Union	0.0750*** (0.008)	0.0248*** (0.007)	0.1780*** (0.010)	0.0421*** (0.010)	0.0135* (0.008)	0.0992*** (0.011)
Log(TVS)	0.0364*** (0.002)	0.0677*** (0.002)	0.0700*** (0.003)	0.0305*** (0.004)	0.0448*** (0.003)	0.0511*** (0.004)
Log(Age)	0.0115*** (0.003)	0.0153*** (0.003)	0.0333*** (0.004)	0.00346 (0.005)	0.00206 (0.004)	0.0258*** (0.006)
Log(Firm Emp)	0.0086*** (0.001)	-0.0065*** (0.001)	0.0231*** (0.002)			
TFP	0.0851*** (0.005)	0.0340*** (0.005)	0.0521*** (0.006)	0.0445*** (0.009)	0.004 (0.007)	0.0098 (0.009)
Pct of BA_Non-Manager	0.339*** (0.009)	0.416*** (0.008)	0.254*** (0.011)	0.244*** (0.014)	0.323*** (0.011)	0.191*** (0.015)
Pct of BA_Manager	0.0390*** (0.009)	0.0814*** (0.008)	0.123*** (0.011)	0.0187 (0.014)	0.0448*** (0.011)	0.0576*** (0.015)
Constant	2.292*** (0.024)	3.005*** (0.022)	1.499*** (0.029)	2.525*** (0.040)	3.313*** (0.033)	1.978*** (0.045)
Number of Obs. (rounded)	30000	30000	30000	30000	30000	30000
R-Square	0.591	0.655	0.64	0.802	0.854	0.871
Ind FE	No	No	No	Yes	Yes	Yes
Czone FE	No	No	No	Yes	Yes	Yes
Ind x Czone FE	Yes	Yes	Yes	No	No	No
Firm FE	No	No	No	Yes	Yes	Yes

Table 3: Union and Productivity

This table reports regression results to examine the association between union membership and pay-for-performance sensitivity using the 2010 ASM. The dependent variables are indicated in the header row. D_Union is an indicator variable that equals one if workers at the establishment have membership in labor unions and zero otherwise. TFP is the total factor productivity estimated based on input shares. VA/TH is the logarithm of value added divided by total production hours. Standard errors clustered at the industry (3-digit NAICS) x commuting zone level and are reported in parentheses. *, **, and *** represent significance at 10%, 5%, and 1%, respectively. Numbers are rounded to comply with Census's disclosure policy.

DEP VAR	(1) TFP	(2) TFP	(3) VA_PH	(4) VA_PH
D_Union	-0.0334*** (0.009)	-0.0295* (0.016)	-0.0511*** (0.014)	-0.0814*** (0.027)
Log(TVS)	-0.00780** (0.003)	0.0148** (0.007)	0.232*** (0.005)	0.232*** (0.011)
Log(Age)	-0.0290*** (0.004)	-0.0289*** (0.009)	-0.0788*** (0.006)	-0.119*** (0.015)
Log(Firm Emp)	0.00473** (0.002)		-0.0110*** (0.003)	
Pct of BA (non-manager)	0.0946* (0.055)	-0.0327 (0.108)	0.522*** (0.088)	0.119 (0.170)
Pct of BA (manager)	0.0232** (0.012)	0.00869 (0.024)	0.134*** (0.018)	-0.00636 (0.038)
Constant	1.988*** (0.029)	1.805*** (0.068)	2.476*** (0.040)	2.628*** (0.105)
Number of Obs. (rounded)	30000	30000	30000	30000
R-Square	0.369	0.798	0.373	0.771
Ind FE	Yes	Yes	Yes	Yes
Czone FE	Yes	Yes	Yes	Yes
Firm FE	No	Yes	No	Yes

Table 4: Union and Performance-Based Incentive Measures (MOPS)

This table reports regression results to examine the association between union membership and performance-based measures using the 2010 MOPS. The dependent variables are indicated in the header row. D_Union is an indicator variable that equals one if workers at the establishment have membership in labor unions and zero otherwise. Standard errors clustered at the industry (3-digit NAICS) x commuting zone level and are reported in parentheses. *, **, and *** represent significance at 10%, 5%, and 1%, respectively. Numbers are rounded to comply with Census's disclosure policy.

DEP VAR	(1) Bonus_M	(2) Bonus_NM	(3) Promotion_M	(4) Promotion_NM	(5) Dismissal_M	(6) Dismissal_NM	(7) Incentives_M	(8) Incentives_NM
D_Union	-0.0177*** (0.006)	-0.0896*** (0.006)	-0.0133** (0.006)	-0.0911*** (0.006)	-0.0238*** (0.007)	-0.0832*** (0.007)	-0.0548*** (0.012)	-0.264*** (0.013)
Log(TVS)	0.0305*** (0.002)	0.0312*** (0.002)	0.0368*** (0.002)	0.0306*** (0.002)	0.0269*** (0.002)	0.0253*** (0.002)	0.0942*** (0.004)	0.0872*** (0.004)
Log(Age)	-0.0104*** (0.003)	-0.0113*** (0.003)	-0.0142*** (0.003)	-0.0161*** (0.002)	-0.0259*** (0.003)	-0.0290*** (0.003)	-0.0505*** (0.006)	-0.0564*** (0.005)
Log(Firm Emp)	0.0126*** (0.004)	0.00739* (0.004)	-0.00804** (0.004)	-0.00473 (0.003)	-0.0178*** (0.005)	-0.0209*** (0.005)	-0.0132 (0.008)	-0.0182** (0.008)
TFP	0.0261*** (0.001)	0.00862*** (0.001)	0.0317*** (0.001)	0.0163*** (0.001)	0.0155*** (0.001)	0.00627*** (0.001)	0.0733*** (0.002)	0.0312*** (0.002)
Pct of BA_NM	0.163*** (0.035)	0.235*** (0.037)	0.256*** (0.035)	0.276*** (0.033)	0.267*** (0.042)	0.137*** (0.042)	0.686*** (0.074)	0.648*** (0.072)
Pct of BA_M	0.0870*** (0.007)	0.0822*** (0.008)	0.0186** (0.008)	-0.00584 (0.007)	0.0447*** (0.009)	0.0335*** (0.009)	0.150*** (0.016)	0.110*** (0.015)
Constant	-0.0447*** (0.017)	-0.0407** (0.018)	0.286*** (0.018)	0.486*** (0.017)	0.274*** (0.021)	0.474*** (0.021)	0.515*** (0.037)	0.920*** (0.036)
N(rounded)	30000	30000	30000	30000	30000	30000	30000	30000
R-Square	0.165	0.0996	0.16	0.103	0.0699	0.0597	0.209	0.134
Ind FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Czone FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 5: **Union and Pay-for-Performance Sensitivity**

This table reports regression results to examine the association between union membership and pay-for-performance sensitivity using the 2010 ASM and 2017 CMF. We include a subsample of establishments that survived to 2017, and each establishment has two observations, one in 2010 and one in 2017. The dependent variables are indicated in the header row. D_Union is an indicator variable that equals one if workers at the establishment have membership in labor unions and zero otherwise. VA/TH is the logarithm of value added divided by total production hours, and VA/TE is the logarithm of value added divided by total employment. Standard errors are clustered at the industry (3-digit NAICS) x commuting zone level and are reported in parentheses. *, **, and *** represent significance at 10%, 5%, and 1%, respectively. Numbers are rounded to comply with Census's disclosure policy.

	(1)	(2)	(3)	(4)
DEP VAR =	Hourly Wage		Average Wage	
VA/TH	0.129*** (0.004)		0.0708*** (0.003)	
VA/TH x D_Union	-0.0392*** (0.010)		-0.0273*** (0.008)	
VA/TE		0.0861*** (0.004)		0.114*** (0.004)
VATE x D_Union		-0.0312*** (0.010)		-0.0324*** (0.009)
Constant	2.471*** (0.017)	2.640*** (0.019)	3.584*** (0.014)	3.351*** (0.017)
N(rounded)	50000	50000	50000	50000
R-Square	0.747	0.734	0.816	0.823
Ind FE	Yes	Yes	Yes	Yes
Czone FE	Yes	Yes	Yes	Yes
Estab FE	Yes	Yes	Yes	Yes

Table 6: Union and Investments

This table reports regression results to examine the association between unionization and capital expenditures using the 2010 ASM and the 2017 CMF. The dependent variables are Capex, Capex(Equipment), and Capex(Structure), which are calculated as the change in total capital stock, change in equipment, and change in structures between 2010 and 2017, respectively. D_Union is an indicator variable that equals one if workers at the establishment have membership in labor unions and zero otherwise. Incentive_M and Incentive_NM are scores for incentives of managers and incentives of non-managers, respectively. Standard errors clustered at the industry (3-digit NAICS) x commuting zone level and are reported in parentheses. *, **, and *** represent significance at 10%, 5%, and 1%, respectively. Numbers are rounded to comply with Census's disclosure policy.

DEP VAR =	(1)	(2)	(3)	(4)	(5)	(6)
	Capital Expenditure		Capex (Equipment)		Capex (Structure)	
D_Union	-0.0301*** (0.010)	0.0414 (0.099)	-0.0314*** (0.011)	0.0269 (0.110)	-0.0331*** (0.009)	0.0576 (0.085)
Wage		-0.0573*** (0.014)		-0.0539*** (0.016)		-0.0538*** (0.013)
Incentives_M		0.0105 (0.009)		0.0146 (0.010)		-0.00053 (0.008)
Incentives_NM		0.0397*** (0.009)		0.0403*** (0.010)		0.0413*** (0.008)
TFP		0.0731*** (0.009)		0.0864*** (0.010)		0.0455*** (0.008)
D_Union x Wage		0.00426 (0.029)		0.00474 (0.032)		-0.00303 (0.025)
D_Union x Incentives_M		0.014 (0.018)		0.0194 (0.021)		0.00925 (0.016)
D_Union x Incentives_NM		-0.0379** (0.016)		-0.0359* (0.019)		-0.0488*** (0.015)
D_Union x TFP		-0.0173 (0.015)		-0.0184 (0.018)		0.000389 (0.013)
Log(TVS)	0.0709*** (0.004)	0.0700*** (0.004)	0.0692*** (0.005)	0.0677*** (0.005)	0.0675*** (0.004)	0.0672*** (0.004)
Log(Age)	-0.0635*** (0.006)	-0.0590*** (0.006)	-0.0669*** (0.007)	-0.0619*** (0.007)	-0.0461*** (0.005)	-0.0428*** (0.005)
Pct of BA_NM	0.0811 (0.070)	0.0699 (0.070)	0.135* (0.078)	0.117 (0.078)	-0.0024 (0.062)	-0.00235 (0.062)
Pct of BA_M	0.00681 (0.014)	0.00183 (0.014)	0.00838 (0.016)	0.00193 (0.016)	0.00375 (0.013)	0.00126 (0.013)
Log(Firm Emp)	-0.0138*** (0.002)	-0.0155*** (0.002)	-0.0196*** (0.002)	-0.0218*** (0.002)	-0.00159 (0.002)	-0.00243 (0.002)
Constant	-0.473*** (0.041)	-0.525*** (0.055)	-0.403*** (0.044)	-0.491*** (0.060)	-0.604*** (0.039)	-0.608*** (0.050)
N(rounded)	25000	25000	25000	25000	25000	25000
R-Square	0.0836	0.0899	0.0874	0.0937	0.0749	0.0796
Ind FE	Yes	Yes	Yes	Yes	Yes	Yes
Czone FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 7: **Union, Plant Closure, and Growth**

This table reports regression results to examine the association between unionization and capital expenditures using the 2010 ASM and the 2017 CMF. The dependent variables are Capex, Capex(Equipment), and Capex(Structure), which are calculated as the change in total capital stock, change in equipment, and change in structures between 2010 and 2017, respectively. D_Union is an indicator variable that equals one if workers at the establishment have membership in labor unions and zero otherwise. Incentive_M and Incentive_NM are scores for incentives of managers and incentives of non-managers, respectively. Standard errors clustered at the industry (3-digit NAICS) x commuting zone level and are reported in parentheses. *, **, and *** represent significance at 10%, 5%, and 1%, respectively. Numbers are rounded to comply with Census's disclosure policy.

DEP VAR =	Exit		Emp Growth		Sales Growth	
	(1)	(2)	(3)	(4)	(5)	(6)
D_Union	0.0365*** (0.0069)	-0.0277 (0.0625)	-0.0548*** (0.0103)	0.0482 (0.106)	-0.0524*** (0.0117)	0.0625 (0.116)
Wage		-0.0057 (0.00802)		0.158*** (0.0125)		0.0408*** (0.0142)
Incentives_M		0.0101** (0.00459)		0.0007 (0.00668)		0.00767 (0.00808)
Incentives_NM		-0.0199*** (0.00508)		0.0323*** (0.00734)		0.0334*** (0.00864)
TFP		0.00726 (0.00501)		0.00656 (0.00758)		-0.0989*** (0.00935)
D_Union × Wage		0.0225 (0.0188)		-0.0271 (0.0327)		-0.0137 (0.0351)
D_Union × Incentives_M		-0.0167 (0.0116)		0.0266 (0.0174)		-0.0346* (0.0192)
D_Union × Incentives_NM		0.0117 (0.0115)		-0.0407** (0.0175)		-0.0163 (0.0203)
D_Union × TFP		0.00206 (0.0113)		-0.00342 (0.0160)		0.0155 (0.0198)
Log(TVS)	-0.0480*** (0.0022)	-0.0471*** (0.00225)	-0.00304 (0.0035)	-0.0119*** (0.00356)	-0.0811*** (0.0043)	-0.0868*** (0.00434)
Log(Age)	-0.0255*** (0.0032)	-0.0258*** (0.00320)	-0.0465*** (0.0050)	-0.0459*** (0.00495)	-0.0108* (0.0058)	-0.0116** (0.00582)
% of BA_NM	0.015 (0.0413)	0.0216 (0.0415)	0.201*** (0.0611)	0.119* (0.0611)	0.572*** (0.0716)	0.544*** (0.0718)
% of BA_M	0.00996 (0.0086)	0.0107 (0.00865)	0.0453*** (0.0127)	0.0352*** (0.0127)	0.0678*** (0.0147)	0.0660*** (0.0147)
Log(Firm Emp)	0.00568*** (0.0013)	0.00568*** (0.00137)	-0.0199*** (0.0021)	-0.0227*** (0.00207)	0.00221 (0.0024)	0.000952 (0.00239)
Constant	0.680*** (0.0190)	0.693*** (0.0279)	0.327*** (0.0308)	-0.0967** (0.0445)	0.917*** (0.0368)	0.972*** (0.0524)
N (rounded)	30000	30000	25000	25000	25000	25000
R-Square	0.0768	0.0776	0.077	0.0864	0.114	0.121
Ind FE	Yes	Yes	Yes	Yes	Yes	Yes
Czone FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 8: Union and Capital-Labor Ratio

This table reports regression results to examine the association between unionization and the capital-labor ratio using the 2010 ASM and the 2017 CMF. The dependent variables are capital-labor ratio (K/L) for columns 1-2 and changes in capital-labor ratio $\Delta(K/L)$ for columns 3-4. K/L is defined as the logarithm of capital stock over the number of employees in 2010, and $\Delta(K/L)$ is measured between 2010 and 2017. D_Union is an indicator variable that equals one if workers at the establishment have membership in labor unions and zero otherwise. Wage is the logarithm of the average wage at the establishment, and local wage is the logarithm of average wages across all other plants in the same industry (4-digit NAICS) and commuting zone. Δ Wage and Δ Local Wage are measured between 2010 and 2017. Incentive_M and Incentive_NM are incentive scores of managers and non-managers, respectively, constructed from the 2010 MOPS. Standard errors clustered at the industry (3-digit NAICS) x commuting zone level and are reported in parentheses. *, **, and *** represent significance at 10%, 5%, and 1%, respectively. Numbers are rounded to comply with Census's disclosure policy.

DEP VAR:	(1) K/L	(2) K/L	(3) K/L	(4) Δ (K/L)	(5) $\Delta(K/L)$
D_Union	0.0780*** (0.016)	0.0420*** (0.015)	0.0617*** (0.016)	0.0355*** (0.013)	0.0314** (0.013)
Wage		0.864*** (0.021)			
Local Wage			0.388*** (0.028)		
Δ Wage				0.411*** (0.021)	
Δ LocalWage					0.0007 (0.019)
Incentives_M		0.00719 (0.010)	0.0207** (0.010)	0.0105 (0.009)	0.00698 (0.009)
Incentives_NM		-0.0213** (0.010)	-0.0337*** (0.010)	0.0111 (0.009)	0.0117 (0.009)
Log(TVS)	0.0981*** (0.006)	0.0411*** (0.006)	0.0873*** (0.006)	0.0772*** (0.005)	0.0757*** (0.005)
Log(Age)	0.0802*** (0.008)	0.0713*** (0.007)	0.0800*** (0.008)	-0.0178** (0.007)	-0.0180** (0.007)
Pct of BA (non-manager)	-0.0385 (0.094)	-0.425*** (0.091)	-0.096 (0.094)	-0.165** (0.082)	-0.133 (0.083)
Pct of BA (manager)	0.189*** (0.021)	0.118*** (0.020)	0.179*** (0.021)	-0.0397** (0.017)	-0.0424** (0.017)
Log(Firm Emp)	0.0374*** (0.003)	0.0418*** (0.003)	0.0382*** (0.003)	0.00254 (0.003)	0.00401 (0.003)
Constant	2.985*** (0.048)	0.345*** (0.080)	3.035*** (0.049)	-0.900*** (0.047)	-0.835*** (0.048)
Number of Obs. (rounded)	30000	30000	30000	25000	25000
R-Square	0.35	0.396	0.356	0.114	0.0724
Ind FE	Yes	Yes	Yes	Yes	Yes
Czone FE	Yes	Yes	Yes	Yes	Yes

Table 9: Spillover Effects: Wages and Incentives

This table reports regression results to examine the association between unionization and wages and incentives using the 2010 MOPS. The dependent variables are indicated by the header row. D_Union is an indicator variable that equals one if workers at the establishment have membership in labor unions and zero otherwise. "Non-Union Plant in Union Firm" is an indicator variable for non-unionized plants in a firm with at least one unionized plant. "Non-Union Plant in Firm's Union Ind" ("Non-Union Plant outside Firm's Union Ind") is an indicator variable for non-unionized plants in a firm with at least one unionized plant in the same (outside of the) industry. "Non-Union Plant in Firm's Union CZ" ("Non-Union Plant outside Firm's Union CZ" is an indicator variable for non-unionized plants in a firm with at least one unionized plant in the same (a different) commuting zone. Standard errors clustered at the industry (3-digit NAICS) x commuting zone level and are reported in parentheses. *, **, and *** represent significance at 10%, 5%, and 1%, respectively. Numbers are rounded to comply with Census's disclosure policy.

DEP VAR	(1) Wage	(2) Incentives_M	(3) Incentives_NM	(4) Wage	(5) Incentives_M	(6) Incentives_NM
D_Union	0.130*** (0.0068)	-0.085*** (0.0146)	-0.338*** (0.0141)	0.128*** (0.0068)	-0.084*** (0.0146)	-0.334*** (0.0141)
Non-Union & Union Ind	0.081*** (0.00578)	-0.052*** (0.0125)	-0.145*** (0.0119)			
Non-Union & Outside Union Ind	0.045*** (0.00808)	-0.061*** (0.0161)	-0.097*** (0.0160)			
Non-Union & Union CZ				0.094*** (0.00721)	-0.087*** (0.0155)	-0.217*** (0.0150)
Non-Union & Outside Union CZ				0.059*** (0.00619)	-0.035*** (0.0128)	-0.082*** (0.0125)
Log(TVS)	0.0417*** (0.00182)	0.0926*** (0.00391)	0.0839*** (0.00373)	0.0414*** (0.00183)	0.0935*** (0.00392)	0.0857*** (0.00374)
Log(Age)	0.00399 (0.00250)	-0.0493*** (0.00577)	-0.0529*** (0.00532)	0.00387 (0.00250)	-0.0487*** (0.00576)	-0.0519*** (0.00531)
Log(Firm Emp)	0.00142 (0.00127)	0.0803*** (0.00280)	0.0472*** (0.00269)	0.00193 (0.00129)	0.0787*** (0.00283)	0.0440*** (0.00271)
TFP	0.0827*** (0.00412)	-0.0128 (0.00822)	-0.0174** (0.00780)	0.0828*** (0.00412)	-0.0133 (0.00822)	-0.0184** (0.00780)
Pct_BA_NM	0.389*** (0.0334)	0.689*** (0.0735)	0.656*** (0.0713)	0.382*** (0.0334)	0.700*** (0.0737)	0.684*** (0.0715)
Pct_BA_M	0.0403*** (0.00693)	0.153*** (0.0155)	0.116*** (0.0148)	0.0406*** (0.00694)	0.152*** (0.0155)	0.113*** (0.0148)
N(rounded)	30000	30000	30000	30000	30000	30000
R-Square	0.34	0.21	0.14	0.34	0.21	0.14
Ind FE	Yes	Yes	Yes	Yes	Yes	Yes
Czone FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 10: Spillover Effects: Survival, Capex, and Employment Growth

This table reports regression results to examine the association between unionization and wages and incentives using the 2010 MOPS. The dependent variables are indicated by the header row. D_Union is an indicator variable that equals one if workers at the establishment have membership in labor unions and zero otherwise. "Non-Union & Union Ind" ("Non-Union Plant & outside Union Ind") is an indicator variable for non-unionized plants in a firm with at least one unionized plant in the same (different) industry. "Non-Union & Union CZ" ("Non-Union & Outside Union CZ") is an indicator variable for non-unionized plants in a firm with at least one unionized plant in the same (different) commuting zone. Standard errors clustered at the industry (3-digit NAICS) x commuting zone level are reported in parentheses. *, **, and *** represent significance at 10%, 5%, and 1%, respectively. Numbers are rounded to comply with the Census's disclosure policy.

DEP VAR	(1) Exit	(2) Capex	(3) Emp Growth	(4) Exit	(5) Capex	(6) Emp Growth
D_Union	0.0488*** (0.008)	-0.0623*** (0.012)	-0.0668*** (0.012)	0.0484*** (0.008)	-0.0631*** (0.012)	-0.0657*** (0.012)
Non-Union & Union Ind	0.0181*** (0.007)	-0.0619*** (0.011)	-0.0261** (0.011)			
Non-Union & Outside Union Ind	0.0337*** (0.009)	-0.0606*** (0.013)	-0.010 (0.014)			
Non-Union & Union CZZone				0.0326*** (0.009)	-0.0443*** (0.014)	-0.0423*** (0.013)
Non-Union & Outside Union CZZone				0.0154** (0.007)	-0.0719*** (0.011)	-0.0103 (0.011)
Log(TVS)	-0.0473*** (0.002)	0.0701*** (0.004)	-0.00332 (0.004)	-0.0477*** (0.002)	0.0696*** (0.004)	-0.00293 (0.004)
Log(Age)	-0.0257*** (0.003)	-0.0604*** (0.006)	-0.0454*** (0.005)	-0.0260*** (0.003)	-0.0607*** (0.006)	-0.0452*** (0.005)
Pct of BA_NM	0.0133 (0.041)	0.0792 (0.070)	0.201*** (0.061)	0.00941 (0.041)	0.0734 (0.070)	0.207*** (0.061)
Pct of BA_M	0.00836 (0.009)	0.00809 (0.014)	0.0457*** (0.013)	0.00909 (0.009)	0.00868 (0.014)	0.0453*** (0.013)
TFP	0.00722 (0.005)	0.0659*** (0.008)	0.0189*** (0.007)	0.00746 (0.005)	0.0662*** (0.008)	0.0187** (0.007)
Log(Firm Emp)	0.00266* (0.002)	-0.00635** (0.003)	-0.0174*** (0.002)	0.00337*** (0.002)	-0.00554** (0.003)	-0.0181*** (0.002)
N(rounded)	30000	25000	25000	30000	25000	25000
R-Square	0.0774	0.0877	0.0777	0.0774	0.0878	0.0779
Ind FE	Yes	Yes	Yes	Yes	Yes	Yes
Czone FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 11: **Change of RTW Status: Main Effects**

This table reports regression results to examine the effect of the RTW shock using the “Midwest Sample”. The dependent variables are indicated in the header row. D_Union is an indicator variable that equals one if workers at the establishment have membership in labor unions and zero otherwise. Treated is an indicator variable for the treated states (IN and MI) and zero for control states (IL, KY, OH, and WI). Pseudo Treated is an indicator variable that equals one for KY and WI and zero for IL and OH. Employment is the logarithm of total employment. Wage is the logarithm of the hourly wage for production workers. Capex(Equipment) and Capex(Structure) are calculated as the change in equipment and the change in structures between 2012 and 2014, respectively. Standard errors are clustered at the industry (3-digit NAICS) x commuting zone level and are reported in parentheses. *, **, and *** represent significance at 10%, 5%, and 1%, respectively. Numbers are rounded to comply with the Census’s disclosure policy.

DEP VAR	Panel A: Post Period				Panel B: Pre Period			
	ΔEmp	ΔWage	Capex (Equipment)	Capex (Structure)	ΔEmp	ΔWage	Capex (Equipment)	Capex (Structure)
D_Union	-0.0411** (0.012)	-0.0105* (0.00473)	-0.0227*** (0.005)	-0.0072 (0.007)	0.0004 (0.019)	-0.0133 (0.0111)	-0.0007 (0.005)	-0.0213** (0.005)
Treated × Union	0.0474** (0.012)	0.0105 (0.0113)	0.0172** (0.007)	0.0117 (0.011)	-0.0126 (0.032)	-0.0209 (0.0220)	0.0098 (0.033)	0.0336 (0.021)
Log(Age)	-0.0192** (0.007)	0.00194 (0.00463)	-0.0167** (0.006)	-0.0120* (0.005)	-0.0359** (0.010)	0.00401 (0.00449)	-0.0493*** (0.007)	-0.0315** (0.008)
Log(TVS) 2012	0.0023 (0.003)	-0.00143 (0.00253)	0.0184*** (0.003)	0.0071** (0.002)				
Log(TVS) 2007					-0.0241*** (0.004)	-0.00817 (0.00699)	-0.0372*** (0.008)	-0.0302*** (0.006)
TFP 2012	0.0185* (0.008)	-0.0380*** (0.00774)	0.0205 (0.011)	0.0061* (0.003)				
TFP 2007					0.0349** (0.012)	-0.0465*** (0.00440)	0.0862*** (0.015)	0.0614*** (0.012)
Constant	0.0232 (0.041)	0.114*** (0.0126)	-0.169*** (0.041)	-0.0573*** (0.008)	0.174** (0.065)		0.428*** (0.065)	0.335*** (0.077)
N	5200	5200	5200	5200	5200	5200	5200	5200
R-Square	0.116	0.103	0.125	0.102	0.164	0.116	0.178	0.151
FE	Ind × State	Ind × State	Ind × State	Ind × State	Ind × State	Ind × State	Ind × State	Ind × State

Panel C: Post Period				
	(1) Δ Employment	(2) Δ Wage	(3) Capex (Equipment)	(4) Capex (Structure)
D_Union	-0.0555*** (0.00676)	-0.0083 (0.00679)	-0.0228** (0.00691)	-0.00621 (0.00659)
Pseudo Treated $\times$ Union	0.0360 (0.0245)	-0.0051 (0.0106)	0.0022 (0.0240)	-0.0051 (0.0156)
Log(Age)	-0.0173 (0.00944)	0.000459 (0.00525)	-0.0196* (0.00773)	-0.0081 (0.00475)
Log(TVS) 2012	0.00416 (0.00281)	-0.0412* (0.0136)	0.0182** (0.00353)	0.00625** (0.00147)
TFP 2012	0.0201 (0.0127)	-0.00136 (0.00332)	0.0175 (0.0138)	0.00384 (0.00325)
Constant	-0.0078 (0.0450)	0.128*** (0.00864)	-0.153** (0.0395)	-0.0551** (0.0117)
N (rounded)	3600	3600	3600	3600
R-Square	0.115	0.099	0.122	0.102
FE	Ind $\times$ State	Ind $\times$ State	Ind $\times$ State	Ind $\times$ State

Table 12: Change of RTW Status: Spill-over Effects

This table reports regression results to examine the effect of the RTW shock on affiliated non-unionized plants owned by the same firm that owns unionized plants in the Midwest Sample (i.e., "Affiliated Non-Union Sample"). The dependent variables are indicated in the header row. ANU_Treated is an indicator variable that equals one if the union plant is in a treated state and zero otherwise. Employment is the logarithm of total employment. Capex(Equipment), and Capex(Structure) are calculated as the change in equipment and change in structures between 2010 and 2017, respectively. Standard errors clustered at the industry (3-digit NAICS) x commuting zone level and are reported in parentheses. *, **, *** represent significance at 10%, 5%, and 1%, respectively. Numbers are rounded to comply with the Census's disclosure policy.

DEP VAR	Panel A: Post Period			Panel B: Pre Period		
	Δ Employment	Capex (Equipment)	Capex (Structure)	Δ Employment	Capex (Equipment)	Capex (Structure)
ANU_Treated	0.0429* (0.0216)	0.0203* (0.011)	0.0080 (0.009)	0.0308 (0.032)	-0.0001 (0.034)	-0.0044 (0.023)
Log(Age)	-0.0097 (0.015)	-0.0315*** (0.008)	-0.0016 (0.003)	-0.0354*** (0.010)	-0.0229 (0.0157)	-0.0139 (0.010)
Log(TVS) 2012	0.0122* (0.006)	0.0106*** (0.003)	0.0099*** (0.003)			
Log(TVS) 2007				0.0370*** (0.012)	-0.0098 (0.008)	-0.0071* (0.004)
TFP 2012	-0.0105 (0.013)	0.0064 (0.016)	-0.0033 (0.005)			
TFP 2007				-0.0393** (0.015)	-0.006 (0.025)	-0.0062 (0.008)
Log(Firm Emp)	-0.0114 (0.009)	-0.0139** (0.006)	-0.0040** (0.002)	-0.00247 (0.007)	-0.0170*** (0.006)	-0.0017 (0.007)
Constant	-0.0288 (0.089)	0.0828 (0.060)	-0.0865* (0.047)	-0.349** (0.133)	0.355*** (0.092)	0.142*** (0.030)
N(rounded)	2300	2300	2300	2300	2300	2300
R-Square	0.457	0.419	0.445	0.502	0.415	0.392
FE	Ind $\times$ State	Ind $\times$ State	Ind $\times$ State	Ind $\times$ State	Ind $\times$ State	Ind $\times$ State

References

- Abraham, Katharine G, and Henry S Farber, 1988, Returns to seniority in union and nonunion jobs: a new look at the evidence, *ILR Review* 42, 3–19.
- Alcácer, Juan, and Minyuan Zhao, 2012, Local r&d strategies and multilocation firms: The role of internal linkages, *Management Science* 58, 734–753.
- Andersson, Fredrik, John C Haltiwanger, Mark J Kutzbach, Henry O Pollakowski, and Daniel H Weinberg, 2018, Job displacement and the duration of joblessness: The role of spatial mismatch, *Review of Economics and Statistics* 100, 203–218.
- Arrow, Kenneth J, Hollis B Chenery, Bagicha S Minhas, and Robert M Solow, 1961, Capital-labor substitution and economic efficiency, *The review of Economics and Statistics* 225–250.
- Azar, José, Ioana Marinescu, Marshall Steinbaum, and Bledi Taska, 2020, Concentration in us labor markets: Evidence from online vacancy data, *Labour Economics* 66, 101886.
- Baldwin, Carliss Y, 1983, Productivity and labor unions: An application of the theory of self-enforcing contracts, *Journal of Business* 155–185.
- Bena, Jan, Hernan Ortiz-Molina, and Elena Simintzi, 2022, Shielding firm value: Employment protection and process innovation, *Journal of Financial Economics* 146, 637–664.
- Benders, Jos, Marlieke Van Grinsven, and Jonas Ingvaldsen, 2019, The persistence of management ideas, *The Oxford handbook of management ideas* 270, 285.
- Benmelech, Efraim, Nittai K Bergman, and Hyunseob Kim, 2022, Strong employers and weak employees: how does employer concentration affect wages?, *Journal of Human Resources* 57, S200–S250.
- Bertrand, Marianne, and Sendhil Mullainathan, 2000, Do ceos set their own pay? the ones without principals do.
- Bertrand, Marianne, and Sendhil Mullainathan, 2003, Enjoying the quiet life? corporate governance and managerial preferences, *Journal of Political Economy* 111, 1043–1075.
- Black, Sandra E, and Lisa M Lynch, 2001, How to compete: the impact of workplace practices and information technology on productivity, *Review of Economics and statistics* 83, 434–445.
- Bloom, Nicholas, Erik Brynjolfsson, Lucia Foster, Ron Jarmin, Megha Patnaik, Itay Saporta-Eksten, and John Van Reenen, 2019, What drives differences in management practices?, *American Economic Review* 109, 1648–1683.
- Bloom, Nicholas, Erik Brynjolfsson, Lucia Foster, Ron S Jarmin, Itay Saporta Eksten, and John Van Reenen, 2013, Management in america, *US Census Bureau Center for Economic Studies Paper No. CES-WP-13-01* .

- Bloom, Nicholas, and John Van Reenen, 2007, Measuring and explaining management practices across firms and countries, *The quarterly journal of Economics* 122, 1351–1408.
- Bloom, Nicholas, and John Van Reenen, 2011, Human resource management and productivity, in *Handbook of labor economics*, volume 4, 1697–1767 (Elsevier).
- Bradley, Daniel, Incheol Kim, and Xuan Tian, 2017, Do unions affect innovation?, *Management Science* 63, 2251–2271.
- Bronars, Stephen G, and Donald R Deere, 1991, The threat of unionization, the use of debt, and the preservation of shareholder wealth, *The Quarterly Journal of Economics* 106, 231–254.
- Bronars, Stephen G, and Donald R Deere, 1993, Unionization, incomplete contracting, and capital investment, *Journal of Business* 117–132.
- Brown, Charles, and James Medoff, 1978, Trade unions in the production process, *Journal of political economy* 86, 355–378.
- Buffington, Catherine, Lucia Foster, Ron Jarmin, and Scott Ohlmacher, 2017, The management and organizational practices survey (mops): An overview 1, *Journal of Economic and Social Measurement* 42, 1–26.
- Chava, Sudheer, András Danis, and Alex Hsu, 2020, The economic impact of right-to-work laws: Evidence from collective bargaining agreements and corporate policies, *Journal of Financial Economics* 137, 451–469.
- Chen, Huafeng Jason, Marcin Kacperczyk, and Hernan Ortiz-Molina, 2011, Labor unions, operating flexibility, and the cost of equity, *Journal of Financial and Quantitative Analysis* 46, 25–58.
- Clark, Kim B, 1980, Unionization and productivity: Micro-econometric evidence, *The Quarterly Journal of Economics* 95, 613–639.
- Core, John, and Wayne Guay, 1999, The use of equity grants to manage optimal equity incentive levels, *Journal of accounting and economics* 28, 151–184.
- DiNardo, John, and David S Lee, 2004, Economic impacts of new unionization on private sector employers: 1984–2001, *The quarterly journal of economics* 119, 1383–1441.
- Dinlersoz, Emin, Jeremy Greenwood, and Henry Hyatt, 2017, What businesses attract unions? unionization over the life cycle of us establishments, *ILR Review* 70, 733–766.
- Duchin, Ran, Amir Goldberg, and Denis Sosyura, 2017, Spillovers inside conglomerates: Incentives and capital, *The Review of Financial Studies* 30, 1696–1743.
- Dunne, Timothy, and David A Macpherson, 1994, Unionism and gross employment flows, *Southern Economic Journal* 727–738.

- Falato, Antonio, Daniel Gallego, Hyunseob Kim, and Till von Wachter, 2023, The labor market impact of shareholder power: Worker-level evidence .
- Fallick, Bruce C, and Kevin A Hassett, 1999, Investment and union certification, *Journal of labor Economics* 17, 570–582.
- Farber, Henry S, 2017, Employment, hours, and earnings consequences of job loss: Us evidence from the displaced workers survey, *Journal of Labor Economics* 35, S235–S272.
- Festinger, Leon, 1954, A theory of social comparison processes, *Human relations* 7, 117–140.
- Foster, Lucia, John C Haltiwanger, and Cornell John Krizan, 2001, Aggregate productivity growth: Lessons from microeconomic evidence, in *New developments in productivity analysis*, 303–372 (University of Chicago Press).
- Freeman, Richard B, and Morris M Kleiner, 1999, Do unions make enterprises insolvent?, *ILR Review* 52, 510–527.
- Freeman, Richard B, and James L Medoff, 1984, What do unions do, *Indus. & Lab. Rel. Rev.* 38, 244.
- Gopalan, Radhakrishnan, Barton H Hamilton, Ankit Kalda, and David Sovich, 2021, State minimum wages, employment, and wage spillovers: Evidence from administrative payroll data, *Journal of Labor Economics* 39, 673–707.
- Graham, John R, Hyunseob Kim, Si Li, and Jiaping Qiu, 2023, Employee costs of corporate bankruptcy, *The Journal of Finance* 78, 2087–2137.
- Hall, Robert E, 2005, Employment efficiency and sticky wages: Evidence from flows in the labor market, *Review of Economics and statistics* 87, 397–407.
- Hirsch, Barry T, 1991, Labor unions and the economic performance of firms (kalamazoo, mi: We upjohn institute for employment research).
- Hirsch, Barry T, 1992, Firm investment behavior and collective bargaining strategy, *Industrial Relations: A Journal of Economy and Society* 31, 95–121.
- Hirsch, Barry T, 2017, What do unions do for economic performance?, in *What do unions do?*, 193–237 (Routledge).
- Holmes, Thomas J, 2006, Geographic spillover of unionism.
- Jacobson, Louis S, Robert J LaLonde, and Daniel G Sullivan, 1993, Earnings losses of displaced workers, *The American economic review* 685–709.
- Jensen, Michael C, and William H Meckling, 1976, Theory of the firm: Managerial behavior, agency costs and ownership structure, *Journal of financial economics* 3, 305–360.

- Klasa, Sandy, William F Maxwell, and Hernán Ortiz-Molina, 2009, The strategic use of corporate cash holdings in collective bargaining with labor unions, *Journal of financial economics* 92, 421–442.
- Kulik, Carol T, and Maureen L Ambrose, 1992, Personal and situational determinants of referent choice, *Academy of Management review* 17, 212–237.
- Lachowska, Marta, Alexandre Mas, and Stephen A Woodbury, 2020, Sources of displaced workers’ long-term earnings losses, *American Economic Review* 110, 3231–66.
- Lazear, Edward P, 2000, Performance pay and productivity, *American Economic Review* 90, 1346–1361.
- Lee, David S, and Alexandre Mas, 2012, Long-run impacts of unions on firms: New evidence from financial markets, 1961–1999, *The Quarterly Journal of Economics* 127, 333–378.
- Luttmer, Erzo FP, 2005, Neighbors as negatives: Relative earnings and well-being, *The Quarterly journal of economics* 120, 963–1002.
- Maksimovic, Vojislav, and Gordon Phillips, 2001, The market for corporate assets: Who engages in mergers and asset sales and are there efficiency gains?, *The journal of finance* 56, 2019–2065.
- Maksimovic, Vojislav, Gordon Phillips, and Liu Yang, 2013, Private and public merger waves, *The Journal of Finance* 68, 2177–2217.
- Matsa, David A, 2010, Capital structure as a strategic variable: Evidence from collective bargaining, *The Journal of Finance* 65, 1197–1232.
- Stansbury, Anna M, and Lawrence H Summers, 2018, Productivity and pay: Is the link broken?, Technical report, National Bureau of Economic Research.
- Tian, Xuan, and Wenyu Wang, 2021, Hard marriage with heavy burdens: Organized labor as takeover deterrents, *The Review of Corporate Finance Studies* 10, 306–346.

Table IA1: Union and Concentration

This table reports regression results to examine the association between unionization and compensation (Panel A) and incentives (Panel B) using the 2010 MOPS. In Panel A, the dependent variables are the logarithm of the hourly wage for production workers (columns 1 to 3) and the logarithm of average wages for all workers (columns 4 to 6), respectively. In Panel B, the dependent variables include performance-based measures as indicated by the header row. D_Union is an indicator variable that equals one if workers at the establishment have membership in labor unions and zero otherwise. HHI is the Herfindahl–Hirschman index (based on 3-digit NAICS). D_Conc is an indicator variable that equals one if the Herfindahl–Hirschman index (HHI) in the commuting zone is in the top quartile across all commuting zones in the U.S. and zero otherwise. D_Dom3 is an indicator variable that equals one if the establishment is in an industry (based on 3-digit NAICS) that employs more than 10% of the total employment in the commuting zone and zero otherwise. Standard errors clustered at the industry (3-digit NAICS) x commuting zone level and are reported in parentheses. *, **, and *** represent significance at 10%, 5%, and 1%, respectively. Numbers are rounded to comply with Census’s disclosure policy.

Panel A : Compensation						
DEP VAR =	(1)	(2)	(3)	(4)	(5)	(6)
	Hourly Wage			Average Wage		
D_Union	0.0787*** (0.008)	0.0813*** (0.007)	0.0769*** (0.007)	0.0251*** (0.006)	0.0290*** (0.006)	0.0234*** (0.006)
HHI3	-0.0237 (0.016)			-0.0515*** (0.014)		
D_Union x HHI3	0.0745*** (0.026)			0.0817*** (0.022)		
D_Conc		-0.0154** (0.006)			-0.0172*** (0.006)	
D_Union x D_Conc		0.0325*** (0.012)			0.0310*** (0.010)	
D_Dom3			-0.0428*** (0.006)			-0.0633*** (0.005)
D_Union x D_Dom3			0.0434*** (0.011)			0.0468*** (0.009)
Log(TVS)	0.0401*** (0.002)	0.0401*** (0.002)	0.0429*** (0.002)	0.0677*** (0.002)	0.0677*** (0.002)	0.0721*** (0.002)
Log(Age)	0.0060** (0.003)	0.0059** (0.003)	0.00667*** (0.003)	0.0105*** (0.002)	0.0103*** (0.002)	0.0114*** (0.002)
Log(Firm Emp)	0.0100*** (0.001)	0.0100*** (0.001)	0.0102*** (0.001)	-0.00497*** (0.001)	-0.0050*** (0.001)	-0.00478*** (0.001)
TFP	0.0830*** (0.004)	0.0829*** (0.004)	0.0826*** (0.004)	0.0349*** (0.004)	0.0348*** (0.004)	0.0343*** (0.004)
Pct of BA_NM	0.3920*** (0.034)	0.3920*** (0.034)	0.3930*** (0.033)	0.4520*** (0.030)	0.4520*** (0.030)	0.4540*** (0.030)
Pct of BA_M	0.0432*** (0.007)	0.0433*** (0.007)	0.0439*** (0.007)	0.0819*** (0.006)	0.0820*** (0.006)	0.0830*** (0.006)
Constant	2.263*** (0.018)	2.263*** (0.018)	2.238*** (0.018)	3.010*** (0.017)	3.008*** (0.017)	2.971*** (0.017)
N (rounded)	30000	30000	30000	30000	30000	30000
R-Square	0.338	0.338	0.339	0.438	0.438	0.44
Ind FE	Yes	Yes	Yes	Yes	Yes	Yes
Czone FE	Yes	Yes	Yes	Yes	Yes	Yes

Panel B : Incentives						
DEP VAR	(1) Bonus_M	(2) Bonus_NM	(3) Promotion_M	(4) Promotion_NM	(5) Dismissal_M	(6) Dismissal_NM
D_Union	-0.0164** (0.007)	-0.0869*** (0.007)	-0.0074 (0.007)	-0.0842*** (0.007)	-0.0197** (0.009)	-0.0756*** (0.009)
D_Conc	0.00476 (0.007)	-0.0071 (0.007)	-0.0001 (0.006)	0.0072 (0.006)	0.0050 (0.008)	0.0054 (0.008)
D_Union x D_Conc	-0.0055 (0.012)	-0.0105 (0.013)	-0.0233** (0.011)	-0.0275** (0.013)	-0.0163 (0.015)	-0.0301* (0.016)
Log(TVS)	0.0305*** (0.002)	0.0313*** (0.002)	0.0369*** (0.002)	0.0306*** (0.002)	0.0269*** (0.002)	0.0254*** (0.002)
Log(Age)	-0.0104*** (0.003)	-0.0113*** (0.003)	-0.0141*** (0.003)	-0.0161*** (0.002)	-0.0259*** (0.003)	-0.0290*** (0.003)
Log(Firm Emp)	0.0261*** (0.001)	0.0086*** (0.001)	0.0317*** (0.001)	0.0162*** (0.001)	0.0155*** (0.001)	0.0062*** (0.001)
TFP	0.0126*** (0.004)	0.0074* (0.004)	-0.0080** (0.004)	-0.0046 (0.003)	-0.0177*** (0.005)	-0.0208*** (0.005)
Pct of BA_NM	0.163*** (0.035)	0.235*** (0.037)	0.257*** (0.035)	0.278*** (0.033)	0.268*** (0.042)	0.138*** (0.042)
Pct of BA_M	0.0870*** (0.007)	0.0822*** (0.008)	0.0187** (0.008)	-0.0057 (0.007)	0.0448*** (0.009)	0.0336*** (0.009)
Constant	-0.0456*** (0.017)	-0.0401** (0.018)	0.285*** (0.018)	0.484*** (0.017)	0.272*** (0.021)	0.472*** (0.021)
N(rounded)	30000	30000	30000	30000	30000	30000
R-Square	0.165	0.0997	0.16	0.103	0.0699	0.0598
Ind FE	Yes	Yes	Yes	Yes	Yes	Yes
Czone FE	Yes	Yes	Yes	Yes	Yes	Yes