

Using Longitudinal Data on Establishments to Analyze the Effects of Union Organizing Campaigns in the United States

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ABSTRACT. – Most studies of the impact of unions use individual rather than establishment level data. In this paper, we combine information on union organizing activity from the U.S. National Labor Relations Board Representation Case files with information on a wide range of economic variables from the U.S. Bureau of the Census' Longitudinal Research Datafile (LRD). These economic variables include production worker wages, employment and hours, nonwage labor costs, shipments, and materials costs. Our results indicate that successful unionization of production workers leads to significant declines in employment and output in manufacturing plants. Surprisingly, these "scale" effects are not associated with any increase in relative wages.

Analyse des effets de la campagne de syndicalisation aux États-Unis au travers d'un échantillon d'établissements

RÉSUMÉ. – Un grand nombre d'étude sur l'impact de la syndicalisation utilisent des données individuelles plutôt que des données d'établissements. Dans ce papier, nous utilisons à la fois des données provenant du bureau du recensement américain et du U.S. National Labor Relations Board Representation Case et des variables de la Longitudinal Research Datafile (LRD) telles que le salaire des ouvriers, l'emploi et les heures de travail, les coûts du travail non salarié, les stocks, et les coûts matériels. Nos résultats indiquent qu'une syndicalisation réussie des ouvriers entraîne des baisses significatives sur l'emploi et la production pour les établissements industriels. Étrangement, ces effets d'échelle ne sont pas associés à une augmentation des salaires relatifs.

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1 Introduction

Despite the substantial decline in U.S. private sector unionism, interest remains in unions' allocative and distributive impacts on the economy. In recent years several studies have explored unions' effects on employment, investment, working conditions, shareholder wealth, and on the long standing questions of wage premia and labor costs ¹. Although most of this literature examines how these outcomes vary in established bargaining relationships, several studies focus on new unionization's impacts on the firm. Studies by RUBACK and ZIMMERMAN [1984] and BRONARS and DEERE [1990], BRONARS and DEERE [1993*b*] suggest that new unionization has little allocative effect and merely transfers income from shareholders to employees. By contrast, studies by FREEMAN [1986] and FREEMAN and KLEINER [1990] suggest that new unionism is associated with lower employment and by more favorable industrial relations practices and increased benefits. These studies also report that new unionization has very little effect on worker wages.

In an effort to extend this analysis, this paper examines the impact that successful union organizing campaigns have on employment, output, and costs in a broad sample of U.S. manufacturing establishments. We build on recent research by using a matched sample of establishments constructed from (i) the National Labor Relations Board's (NLRB) administrative files on representation elections and (ii) the U.S. Census Bureau's Longitudinal Research Datafile (LRD). Because unions primarily use NLRB sanctioned elections to organize plants, the NLRB's database contains a nearly complete listing of formal organizing campaigns and their outcomes. The LRD file contains panel data on a broad array of measures of manufacturing establishments' output, employment and costs. The resulting matched file contains a substantially larger number of plants covering every Census region than has been available for similar studies (FREEMAN and KLEINER, 1990; BRONARS and DEERE, 1993*b*). In addition, the unit of observation in our sample is the establishment in which the union organizing drive takes place, as opposed to the firm.

Our results indicate that when a union successfully organizes production workers in manufacturing plants, the plant's scale of operations declines relative to plants in which the union's organizing efforts were unsuccessful. This decline manifests itself in reduced annual shipments, materials costs, and production worker employment. Further, these employment and output effects persist for up to nine years after the organizing campaign ended. In addition, unionization of production workers appears to lead to an increase in the share nonproduction workers, and a decline in labor productivity. Further, we find that these impacts are largest for the smallest plants in our sample. Therefore, even though our sample is limited to organizing drives

1. Examples of these studies include ASHENFELTER and BROWN [1986], MACURDY and PENCARVEL [1986], CARD [1986], BRONARS and DEERE [1993*a*], ABOWD [1989], and LEWIS [1986].

in larger than average plants, it seems likely that our findings understate the impact of new unionization in all manufacturing.

Surprisingly, these “scale” and “substitution” effects are not associated with any increase in relative wages. Average wages and salaries for all employees, and average annual and hourly wages for production workers do not increase in plants in which the union prevailed compared with plants in which the union’s bid was unsuccessful. Moreover, no find evidence of a relative wage increase during the nine years that we followed plants after the organizing campaign ended.

The paper proceeds as follows: in section II we describe the formal steps that a union takes to organize a plant in the United States and discuss the likely impact that unionization would have on the workplace. In section 3, we describe the two sources of data used in this study. Section 4 describes our empirical methodology. In section 5, we present our empirical findings. Some conclusions follow in section 6.

2 Establishing a Union

For a union to establish itself in a private U.S. plant or firm it generally must secure the support of a majority of employees within certain broadly defined occupational categories. A union almost always establishes this majority through a secret ballot election². The National Labor Relations Act (NLRA) prescribes the steps that a union must take to obtain such an election. Usually the process begins when, with the encouragement of a union, interested employees circulate “authorization cards” among themselves. These cards form the basis of a petition to the NLRB which asks the Board to order an election. Next, the Board encourages the prospective union and the employer to settle on a “bargaining unit”. This unit contains the employees who are eligible to vote in the election. In some cases, when the parties can not settle on a unit, the NLRB’s Regional Director determines the unit. After these pre-election issues are resolved, a brief campaign follows. The NLRB regulates the parties’ conduct during these campaigns to ensure that the election is conducted under “laboratory conditions”. Disputes between the parties over improper campaign conduct may substantially delay the Borad’s certification of the election’s results.

2. One exception occurs when the employer voluntarily recognizes a union that has demonstrated the support of a majority of its employees. Usually the employer establishes this majority if 50 percent of its employees have named the union on their authorization cards. Another exception occurred during the period covered by this study in instances when the NLRB having found that the empolyer committed serious unfair labor practices during the period leading up to the election, ordered the employer to bargain with a union that has lost the certification election (e.g. NRLB v Gisell Packing Company, 1969).

Indeed when the Board determines that one party's improper conduct affected the election's outcome, it will order a new election.

After the Board resolves any post-election disputes over improper campaign conduct, it certifies the election's outcome. If the union loses the election, another election cannot be held in the plant for at least one year. However, if the union won the election, it becomes the "exclusive representative" of the bargaining unit's employees. This right means that the employer may not implement any policy altering the terms or conditions of employment for any individual or groups of individuals within the bargaining unit, without first bargaining over the effects of those changes with the union³.

The NLRB's certification of the union also requires employers to bargain in "good faith" with the union in an attempt to reach a collective bargaining agreement. This means that they must meet with the newly certified union, provide information supporting their positions, and attempt to reach an agreement. However, employers do not have to agree to the union's demands. As a result, even though a union wins a certification election it will not always be able to secure a first contract. Unfortunately, neither the NLRB nor any agency systematically collects statistics on the fraction of certified unions that fail to negotiate a collective bargaining agreement. But because partial surveys of certified unions and their employers suggest that this fraction probably exceeds one-fourth⁴, we presume that there are many plants in our sample in which victorious unions failed to secure a first contract.

Assuming that unions secure first contracts, there are different views about these agreements' likely impacts on the plant's employment, output, and costs. The traditional view of monopoly unionism predicts that increased wages and benefits should be accompanied by lower employment and output. Others argue that newly certified unions do not seek to raise wages when they first bargain with employers, but to alter the plant's industrial relations practices. This objective would lead unions to seek formal grievance procedures, the use of seniority to determine promotions would lead unions to seek formal grievance procedures, the use of seniority to determine promotions and layoffs, and more explicit job classifications (FREEMAN and MEDOFF, 1984). In this instance, new unionization may not at first be accompanied by wage increases, but still would be accompanied by lower employment and output. Because contracts that cause employers to alter the level of employment and output are inefficient, contract view of unionism predicts that the parties should seek contracts that raise wages without changing the scale of production. In these "efficient contracts" the increased labor costs represent a transfer of wealth from shareholders to

3. In recent years, this right even has limited employers from unilaterally establishing worker-management committees for the purposes of enhancing productivity and creating a more flexible work environment (e.g. Electromation, 1992).

4. For a survey of studies examining the likelihood that unions secure a first contract, see LALONDE and MELTZER [1991], pp. 1011-14.

union members resulting from the union's newly acquired bargaining power (de MENIL, 1971).

In our study, when we find that new unionization is associated with lower employment and output in the plant, it does not imply that employment and output decline in the firm that owns these plants. Because nearly 85 percent of the establishments in our sample are part of multi-plant firms, managers may respond to new unionization by shifting production to other plants. This fact implies that the labor demand schedules may be more elastic for manufacturing plants than for the firms that own these plants. However, this shift in production still constitutes a source of inefficiency

3 The Matched Sample

To study how establishments respond to new unionization, we matched records from the NLRB's administrative data on representation elections to records in the U.S. Census Bureau's LRD. The NLRB's election file covers elections held between 1977 and 1989 and includes information on the plant's name and location, whether the employees petitioning for the election were production workers, the numbers of eligible voters, whether either of the parties objected to the others conduct, and the election's outcome.

The LRD is a compilation of plant-level data from various Census of Manufactures (CM) and Annual Survey of Manufactures (ASM) that includes detailed information on manufacturing plant's employment, output, and costs⁵. The file contains this information for all plants in Census years, which occurs in years ending in a "2" or a "7", and for a sample of plants included in the ASM for all other years. The probability that a plant appears in any given ASM is proportional to its total employment in the most recent CM, which plants with more than 250 employees appearing with certainty. The Census Bureau annually surveys establishments in the ASM for five years at which point they select a new sample. However, they exclude all "noncertainty" case (plants with fewer than 250 employees) from the subsequent panel. As a result, the LRD contains long panels for large plants, and 5 year panels for smaller plants.

We created our file for this study by matching the NLRB's administrative data to plants in the LRD using name, address, and industry information available in both files. We successfully matched approximately one-third of the election records in the NLRB data to plant records in the LRD.

5. See the Data Appendix for further details on the LRD and detailed definitions of the variables used in this study.

Of the resulting 8,640 matches we could construct a panel that contained observations during the two years prior to, and second year after the election for only 2,038 plants. In addition, we decided to limit our study to certification elections involving production workers, because such elections likely involve a large share of the plant's employees, and occur in a plant in which none of its other workers are represented by a union⁶. This decision further reduced the sample to 1,095 plants. (We call this sample our 5 year panel.)

To see whether union victories in certification elections affects plant's employment, output, and costs, we examine the impact of the election on ten variables from the LRD. Our employment variables are total employment in the plant, the number production workers, and total annual hours worked by production workers. Our measure of output is the total value of the plant's shipments in a year. Our measures of costs are the costs of material inputs, annual wage and salary per employee, annual production worker wages per production worker, the average hourly wages of production workers, and the nonwage labor costs per employee. This last measure includes employers' contributions to social security, their unemployment insurance tax payments, and their workers compensation premiums. Finally, we also assess the impact of new unionization on two measures of labor productivity. The first measure is the log of the ratio of shipments to total employment; the second measure is the log of value added per employee, where we define value added as shipments minus materials costs. The Data Appendix presents a more detailed description of these variables.

Requiring plants in our data to have five years of continuous data means that our sample is skewed toward elections involving plants with a relatively large numbers of employees. In our sample the fraction of elections involving more than 180 workers is approximately 45 percent. By contrast, as shown by Figure 1, the percentage of all NLRB certification elections involving more than 180 employees is 15 percent, and the percentage of such plants in our matched file of 8,640 plants is 18 percent. Therefore, our sample is skewed towards large manufacturing plants because of the sampling design of the sampling design of the ASM. To try and correct for any bias caused by this selection, we constructed weights so that the size distribution of our matched data resemble the size distribution of the NLRB election data. We performed the entire analysis with and without these weights, but never found that including them produced substantially different results. Therefore, below we report only unweighted results.

Our sample of plants also is not representative of U.S. manufacturing plants. As shown by Table 1, two years before the certification election,

6. This decision also meant that we excluded 575 plants in which the employees petitioned for a "decertification" selection. Such an election occurs when 30 percent of the employees in an established bargaining unit petition the NLRB to decertify their union. We leave the analysis of this sample to future research.

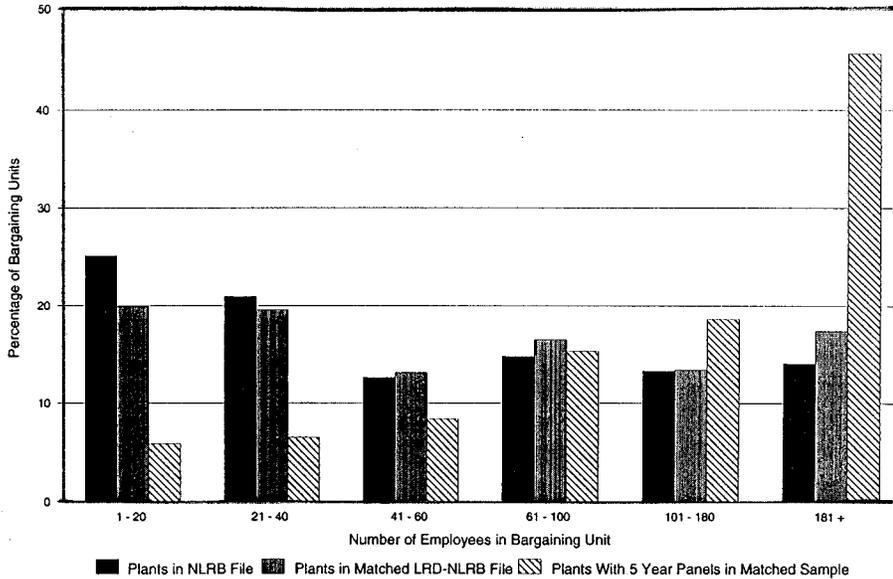


FIGURE 1
Distribution of employees in production worker units.

the average employment, value of shipments, and materials costs of our sample's plants is approximately 50 percent larger than in plants in the LRD that we could not match to our NLRB file⁷. We expected this finding because of the design of the LRD and the likely behavior of unions. As a result of the fixed costs associated with organizing or administering a new bargaining unit, unions have incentives to target their organizing activities toward large plants. By contrast, the differences among plants' labor costs are much less striking, wages and supplemental labor costs are somewhat higher in our sample of plants than in the rest of the manufacturing sector.

Although our sample over represents large elections and large plants, it covers the entire manufacturing sector, every U.S. Census region, and the period from mid-1977 through 1988. Plants from both the durable and nondurable goods sectors are equally represented. But, not surprisingly, a relatively large share of elections in our sample were held in the heavily unionized Middle Atlantic and East North Central states and were held prior to 1982 when unions petitioned for large numbers of elections. Approximately one-third of the elections in our sample were held in plants located in the "rust belt" states and 66 percent of the elections were held between mid-1977 and the end of 1981.

7. The statistics for LRD plants that we do not match to the NLRB file are from 1979. That year is approximately two years prior to the date of the median election in our sample.

TABLE 1

Means for Output, Employment, and Cost Variables Two Years Prior to the Year of Election.

	Short Panel- Units In Which Union Win Election	Short Panel- Units In Which Unions Lose Election	Long Panel- Units In Which Unions Win Election	Long Panel- Units In Which Unions Lose Election	Plants in 1979 That We Never Match to NLRB File
Total Value of Shipments (\$000s)	Mean 22,254 Stan. Err. 2,686 1,787	21,839	36,390	31,300	13,189
Cost of Materials (\$000s)	Mean 12,746 Stan. Err. 1,829 1,081	11,202	19,727	15,261	7,431
Employment in the Plant	Mean 393 Stan. Err. 36	457	611	662	233
Production Worker Employment	Mean 295 Stan. Err. 28	347	451	495	168
Annual Production Worker Hours (000s)	Mean 580 Stan. Err. 57	686	879	967	330
Ratio Nonproduction to Production Workers	Mean 0.42 Stan. Err. 0.03	0.40	0.48	0.43	0.50
Real Value Added (1972 \$ 000s)	Mean 9,659 Stan. Err. 1,088	10,719	14,559	14,155	5,939
Average Wage and Salaries per Employee (1972\$)	Mean 7,978 Stan. Err. 131	7,610	8,561	8,203	8,036
Production Worker Annual Wages per Production Worker (1972\$)	Mean 7,221 Stan. Err. 138	6,809	7,818	7,441	7,115
Production Worker Hourly Wages (1972\$)	Mean 3.60 Stan. Err. 0.07	3.42	3.96	3.72	3.65
Nonwage Labor Costs per Employee (1972\$)	Mean 1,636 Stan. Err. 47	1,491	1,802	1,663	1,441
Number of Establishments	Mean 339	774	226	497	54,393

Notes: See Appendix for definitions of the variables.

The substantial decline in election activity after 1982 in our sample reflects the sharp decline in formal union organizing activity during the 1980s. During the 1970s, the number of certification elections conducted by the NLRB reached a postwar high. But after 1982 the number of elections held fell to less than one-half of their 1970s levels. In the manufacturing sector, the number of elections held fell from 3,800 to about 1,600 annually. As a result, 58 percent of all NLRB elections during the years covered by our study were held before 1982 ⁸.

Despite this drop in union organizing activity, the fraction of elections won by unions remained stable during the period covered by our sample. NLRB statistics indicate that unions won 49 percent of certification elections during the last half of the 1970s, compared with a 48 percent win rate during the last half of the 1980s. In our sample, unions won 36 percent of the certification elections annually. The win rate in our sample is lower, because unions are less likely to win elections held in manufacturing plants and when they involve large bargaining units. For example, during the period covered by our study, unions won approximately 40 percent of the representation elections held in the manufacturing sector and an even smaller percentage of elections held in units with more than 200 workers ⁹.

An important shortcoming of our sample of plants is that we can not examine the long-term impact of unionization. To address this shortcoming, we constructed a second sample that includes only plants with at least ten years of continuous data. This second sample is approximately one-third smaller than the first sample, and as indicated by the figures in Table 1, is even more skewed toward large bargaining units in large plants. However, the advantage of this sample is that we can identify the long-run dynamic effects of new unionization in larger manufacturing plants.

4 Econometric Issues

We measure the impact of new unionization on manufacturing plants using two different strategies. When we use the first sample of plants with 5 year panels, we compare the differences between the regression-adjusted changes in the outcome variables from the second year after and second year before the election. This “differences-in-differences” estimator measures the effect of certification by comparing changes in outcomes in plants in which the union secured certification to plants in which the union’s bid for certification was unsuccessful. When we use the sample of plants with at least 10 years of continuous data, we use a fixed-effects estimator to measure the impact of new unionization. We attribute any systematic difference between changes

8. See NLRB Annual Reports (1975-1988), Table 16.

9. See LALONDE and MELTZER (1991), Tables 1 and 2, pp. 959, 961.

in the outcome variables in the years after the organizing campaign and the election's outcome to the impact of a union's certification. We also use this estimator to test whether unionization "affects" these outcome variables in the years immediately before the election.

Our estimates from both approaches measure the impact of the election's outcome conditional on the plant experiencing a union organizing drive. We do not measure the separate impact that the union organizing drive itself has on the plant. Therefore, a potential problem with our estimation strategies is that if plants in which the union lost its bid for certification also responded to the threat of unionization by raising wages or cutting employment this will tend to bias downward our estimated effects. But, as shown by Table 1, unions do not target their organizing campaigns randomly among manufacturing plants. As a result, using plants that did not experience a formal organizing drive as a "comparison" group in this analysis, require us to model the union's "selection" process and to define a set of instruments that identify this equation. We believe these selection issues are less serious when we compare plants which unions targeted for formal union organizing drives.

4.1. The Statistical Model

To make our methodology more concrete, we begin with the following statistical model of the plant's employment, output, or costs in year t :

$$(1a) \quad \ln Y_{it} = \alpha_i + \gamma_i t + \beta X_{it} + \delta_k U_{it}^k + \varepsilon_{it},$$

where

$$(1b) \quad U_{it}^k = 1 \text{ if the union won a certification election during year } \\ s = t - k, \text{ and 0 otherwise.}$$

According to (1a), the outcome variables depend on plant-specific permanent and time varying fixed effects, a vector of observed characteristics, which in this study are limited to a quadratic function of the plant's age and a dummy variable denoting its ownership, a vector of dummy variables indicating (for years $t > s$) whether a union won a representation election in year s , and an error reflecting the contribution of other unobserved variables.

When we use the first sample of plants with 5 year panels, we estimate this model by "differencing out" the fixed effect, α_i , and comparing the regression-adjusted change in our outcome variables between the second year after and the second year before the year of the election:

$$(2) \quad \Delta \ln Y_{it} = \gamma_i (t - s + 2) + \beta (X_{it} - X_{i,s-2}) + \delta_2 U_{it}^{s+2} + (\varepsilon_{it} - \varepsilon_{i,s-2}).$$

In (2), the outcome variables' changes depend on the firm-specific growth rate, γ_i , the plant's age and whether its ownership changed, the certification election's outcome, and (nonlinear) changes in unobserved variables.

Because our panel is short, we used as proxies for plant-specific growth rates the plant's two digit SIC industry, its census region, whether it is located in a Metropolitan Statistical Area (MSA) within those regions, the year of the election, and its total employment during years $s - 2$ ¹⁰.

When we use the sample of plants with at least 10 year of continuous data, we estimate this model by using a standard fixed-effects estimator. We estimate two versions of the fixed effects model. The first model is the "unrestricted" version of (1) in which we obtain separate estimates of certification, δ_k , for each year from four years prior to the year of the election, the election year, and nine years after the year of the election. Strictly speaking, this fixed effects estimator does entail two important restrictions on (1): First, it restricts the time-varying effect, γ_i , to be zero; second, it restricts the effect of certification to equal zero starting with the fifth year prior to the year of the election. This later restriction ensures that our model is overidentified.

Our second estimator is based on a "restricted" version of (1) in which we constrain the separate unionization effects, δ_k , to follow a particular pattern during the periods prior to and after the first year following the year of the election. Instead of using a vector of dummy variables, U_{it}^k , to capture the effects of certification in (1), we use the following five variables:

$$(3a) \quad UP_{it} = t - (s - 4) \text{ if } s - 4 < s, \text{ and } 0 \text{ otherwise;}$$

$$(3b) \quad U_{it}^s = 1 \text{ if } s = t \text{ and } 0 \text{ otherwise;}$$

$$(3c) \quad U_{it}^{s+1} = 1 \text{ if } s + 1 = t, \text{ and } 0 \text{ otherwise;}$$

$$(3d) \quad UA_{it} = 1 \text{ if } s + 2 \leq t, \text{ and } 0 \text{ otherwise;}$$

$$(3e) \quad UT_{it} = t - (s + 2) \text{ if } s + 2 \leq t, \text{ and } 0 \text{ otherwise.}$$

These variables restrict the effects of certification (i) to fall (or rise) along a linear trend during the three years prior to the election year, (ii) to be separate in the year of the election and in the year after the election, and (iii) to have a constant effect beginning in the second year after the election that subsequently rises (or falls) along a linear trend. Although, we present the results based on both models below, those based on the "restricted" are easier to interpret and moreover do an adequate job summarizing the data. Therefore, we focus on these results in our discussion.

10. Our empirical results were not affected when we also included region-year interactions in the model. These interactions control for the possibility that unions are more likely to win elections within regions during bad times.

4.2. Sources of Bias

Before estimating (1) using our two samples, we consider how two potential sources of bias could affect our estimates. The first source of bias is the familiar one in which the error is correlated the election's outcome. Such a correlation is possible because by using our proxies for firm-specific growth rates, we subsumed into the error information on whether prior to the election our outcome variables are growing more or less slowly than other plants in the same industry and region. As a result, if we were to find that employment grew more slowly in plants in which a union won, this finding might simply mean that within our industry and regional classifications, unions were more likely to prevail in plants that would have experienced slower employment growth anyway. This possibility implies that our estimates would overstate any adverse effect that the union's victory had on employment.

A second source of bias arises if plant's managers anticipate being successfully organized and as a result adjust employment, output, and costs even before the formal organizing drive begins¹¹. These adjustments could include diverting production toward plants less likely to unionize, postponing capital investments, or raising employees' wages in an effort to discourage their support for the union. If we were to use these variables after this adjustment, we would tend to understate the impact of new unionization on the affected plants. Indeed in separate studies, ABOWD [1989*b*] and BRONARS and DEERE [1993*a*] report that the likelihood of being organized influences firms' behavior.

Therefore, when we use the first sample of plants with 5 year panels we compare post-election values of employment, output and costs to their values two years rather than one year prior the election in order to reduce the likelihood that these preelection variables are correlated with the election's outcome. Likewise, when we use the sample of plants with at least 10 years of continuous data, we explicitly allow for the possibility that the effects of unionization to manifest themselves prior to the selection.

4.3. Correlations Between Union Victory and Pre-election Outcomes

The potential seriousness of these sources of bias suggests that we should examine whether the election's outcome could explain the level of and changes in the plant's employment, output, and costs prior to the election. Such a relationship would suggest that we have not adequately controlled for plant-specific growth rates in our model, or that firms responded to

11. The law provides managers with an incentive to behave in this fashion, because one the union has filed a petition with the NLRB, the employer may not unilaterally change any term or condition of employment during the formal organizing drive. An exception to this occurs when the employer can show that he or she had planned to make these changes prior to the onset of the unions organizational efforts and they are not implementing these changes to affect the election's outcome.

the possibility of a union victory well in advance of the formal organizing campaign.

Our concern about the correlation between unobserved fixed characteristics of the plant and the election outcome is underscored by our finding that unions are more likely to succeed when organizing smaller plants. As shown by column one of Table 2, among plants experiencing organizing campaigns, which we can follow over a five year period, we find that total employment is 15 percent lower among those in which a union won the representation election two years later. This result also holds for our measures of production worker employment and production worker hours. Because, we control for differences among plants two digit SIC codes, U.S. Census region, and whether the plants are located in a metropolitan area (MSA), these variables do not explain this finding ¹².

In addition, the point estimates in column one of Table 2 also suggest that unions are somewhat more successful organizing plants with higher labor productivity. By contrast, we do not find any evidence that unions' success in their organizing campaigns depends on plant's labor costs. Among plants holding elections in production units, average wages for these workers are only 2 percent higher among plants in which the union won, and this estimate was not statistically significant.

One concern about our finding showing that election outcomes are related to plant size is that our framework may not control adequately for some important unobserved differences among plants. To be sure, our "differencing" and "fixed-effect" frameworks accounts for any "permanent" differences among plants. But, they do not account for differences among unobserved characteristics that change "within" industry and region. However, as shown by Table 2, the regression-adjusted changes in employment, output, and costs between the second and first year prior to the year of the election are not significantly related to the election's outcome ¹³.

To explore further whether previous changes in plant's employment, output, and costs were correlated with the election's outcome, we also analyzed these changes over a longer period time by using the subsample of plants with at least 10 years of continuous data. As shown by the last four columns of Table 2, the results from comparing changes in the outcome variables between (i) the fifth and second year prior to the selection, and (ii) the seventh and second year prior to the election are inconclusive. One reason for this ambiguity is that the sample sizes are smaller, especially when we examine changes between the seventh and second year prior to the election. Although, we find no statistically significant relation between the election's outcome and these changes, some of the point estimates

12. This result is consistent with the NLRB's statistics showing that union win rates are inversely related to the number of persons in the bargaining unit. See NLRB Annual Reports (1980-88), Table 17.

13. As shown by column three of Table 2, this result held both with and without controls for total employment in the plant two years prior to the year of the election.

Impact of Election Outcome on Preelection Output, Employment, and Costs

	Levels Two Years Prior to the Election Year	Difference Between year (s-2) and year (s-1), With Controls	Difference Between year (s-2) and year (s-1), With Controls and Employment	Difference Between year (s-2) and year (s-5)	Difference Between year (s-2) and year (s-5), With Controls	Difference Between year (s-2) and year (s-7)	Difference Between year (s-2) and year (s-7), With Controls
Total Value Shipments	Coefficient Stan. Err	-0.082 0.072	-0.027 0.026	-0.064 0.042	-0.059 0.070	-0.079 0.070	-0.059 0.070
Materials	Coefficient Stan. Err	-0.086 0.081	-0.023 0.030	-0.086 0.060	-0.084 0.050	-0.059 0.067	-0.063 0.067
Total Employment	Coefficient Stan. Err	-0.143 0.064	-0.017 0.020	-0.048 0.030	-0.051 0.029	0.031 0.060	0.033 0.055
Production Employment	Coefficient Stan. Err	-0.155 0.065	-0.016 0.021	-0.051 0.034	-0.050 0.033	-0.001 0.059	0.023 0.055
Production Hours	Coefficient Stan. Err	-0.154 0.066	-0.018 0.024	-0.057 0.036	-0.048 0.035	-0.020 0.059	-0.002 0.056
Ratio NPW to PW	Coefficient Stan. Err	-0.002 0.041	-0.011 0.030	-0.086 0.109	-0.132 0.114	-0.173 0.184	-0.292 0.189
Productivity	Coefficient Stan. Err	0.061 0.042	-0.010 0.019	-0.014 0.029	-0.008 0.030	-0.078 0.046	-0.071 0.049
Output - Materials Costs/Employment	Coefficient Stan. Err	0.062 0.046	-0.042 0.037	0.031 0.167	0.110 0.172	0.145 0.211	0.158 0.225
Average Wage and Salary	Coefficient Stan. Err	0.017 0.019	-0.007 0.011	0.032 0.014	0.035 0.014	-0.017 0.019	-0.015 0.020
PW Annual Wage	Coefficient Stan. Err	0.018 0.021	-0.005 0.012	0.016 0.017	0.018 0.017	-0.036 0.020	-0.032 0.021
PW Hourly Wage	Coefficient Stan. Err	0.017 0.020	-0.009 0.012	0.020 0.017	0.016 0.017	-0.017 0.021	-0.006 0.022
Supplemental Labor Costs	Coefficient Stan. Err	0.014 0.037	0.029 0.031	-0.035 0.039	-0.030 0.040	-0.128 0.063	-0.138 0.068
Number of Observations	Coefficient	1093	1093	670	670	459	459

Notes: The figures in the table are the coefficient on a dummy variable indicating whether the union won a certification election in years. The dependent variables are expressed in logs and are defined in the Appendix. Additional controls include the age of the plant, and dummy variables for change in ownership, the year of the election, the plant's 2 digit SIC industry, its region, and whether it is located in an SMSA.

are large enough to suggest that our subsequent findings on the effects of unionization may be too large ¹⁴.

5 Empirical Findings

In this section, we document our empirical findings by first presenting results based on (i) the sample of plants with 5 year panels; and then based on (ii) the subsample of these plants with at least 10 years of continuous observations. Recall from our earlier discussion that this subsample is approximately one-third smaller than the first sample and its composition is skewed towards larger plants. In Table 3, we compare the estimated impacts of union certification based on equation (2) on the output, employment and cost variables during the second year after the election. The figures in the table are estimates of δ_k in equation (1).

5.1. Employment and Output

As shown by the second column of the table, shipments and materials costs decline by 14 and 12 percent, respectively, in plants in which the union wins the election compared to plants in which it is unsuccessful. These declines in output and materials costs are matched by an 11 percent decline in production worker employment and hours. In addition to this substantial “scale” effect on the plant’s operations, successful unionization also is associated with a “substitution” effect as indicated by the smaller relative decline in total employment, and the significant rise in the ratio of nonproduction to production workers in the plant.

Much of the reduction in the plant’s scale occurs by the first year after the year of the election. As shown by the first column of the table, during the first year shipments and materials costs have declined by 10 percent in plants in which the union was victorious compared with plants in which the union was defeated. The magnitude of these effects are approximately one-third smaller than during the second year after the year of the election. These results suggest that the longer-term effects of certification might not be much different than what we observe here.

We generate similar, although smaller, impacts of union certification on employment and output during the second year when using our second sample of plants with at least ten years of continuous data. As shown by the

14. One significant change during the period between the seventh and second year prior to the election is that supplemental labor costs fell in plants in which the union subsequently secured certification relative to plants in which the union organizing drive was unsuccessful. This result would suggest that our subsequent estimates of the effect of union certification on supplemental labor costs might be too low.

The Impact of Union Certification on Manufacturing Plants' Output, Employment, and Costs Two Years After the Year of Election.

	Sample With 5 Year Panels-1st Year After Election Year, With Controls	Sample With 5 Year Panels-2nd Year After Election Year, With Controls	Sample With 10 or More Years in Panel-2nd Year After Election, No Controls	Sample With 10 or More Years in Panel-2nd Year After Election, With Controls
Total Value of Shipments	Coefficient 0.037	-0.142	-0.096	-0.104
	Stan. Err.	0.042	0.047	0.047
Cost of Materials	Coefficient 0.044	-0.118	-0.088	-0.092
	Stan. Err.	0.049	0.054	0.055
Employment in the Plant	Coefficient 0.030	-0.080	-0.013	-0.040
	Stan. Err.	0.036	0.039	0.038
Production Worker Employment	Coefficient 0.032	-0.108	-0.064	-0.092
	Stan. Err.	0.037	0.041	0.041
Annual Production Worker Hours	Coefficient 0.035	-0.124	-0.066	-0.095
	Stan. Err.	0.039	0.044	0.044
Ratio of Non Production Workers to Production Workers	Coefficient 0.041	0.102	0.433	0.454
	Stan. Err.	0.043	0.148	0.153
Productivity 1 - Shipments per Employee	Coefficient 0.024	-0.062	-0.082	-0.064
	Stan. Err.	0.027	0.031	0.033
Productivity 2 - Value Added per Employee	Coefficient 0.043	-0.109	-0.359	-0.355
	Stan. Err.	0.043	0.164	0.171
Average Wage and Salaries per Employee	Coefficient 0.014	0.001	-0.007	0.000
	Stan. Err.	0.015	0.015	0.015
Production Worker Annual Wages per Production Worker	Coefficient 0.017	-0.015	-0.017	-0.009
	Stan. Err.	0.018	0.019	0.020
Production Worker Average Hourly Wages	Coefficient 0.017	0.000	-0.015	-0.006
	Stan. Err.	0.018	0.018	0.019
Nonwage Labor Costs per Employee	Coefficient 0.032	0.035	0.075	0.080
	Stan. Err.	0.035	0.037	0.039
Number of Establishments	Coefficient 1088	1088	656	656

Notes: See Table 2. Coefficients based on equation (2) in text.

third and fourth columns of the table, the estimated impacts of the union's election victory on output, costs, and production worker employment are a few percentage points smaller using this subsample of larger manufacturing plants.

Because of the design of the ASM, small establishments can be in the LRD only for five consecutive years. As a result, these plants are thrown out of our subsample of plants with long panels. The difference in estimated impacts yielded from the two samples suggests that new unionization has larger "scale" effects on smaller plants than on larger plants. One reason for this result might be greater "substitution" effects in larger plants. This result is suggested by the large impact of new unionization on the ratio of nonproduction to production workers using our sample of plants with at least ten years of continuous data. The point estimate suggests that following a union's certification the percentage of nonproduction workers rises by as much as 18 percentage points from approximately 40 to 58 percent of the plant's work force.

To further test these hypotheses, we included in (1) the product of the "win" dummy variable and the log of the size of the plant two years before the election. The coefficient associated with this interaction term indicates how the effects of unionization rise or fall with plant size. At the same time we also included interactions between the "win" dummy variable and whether the plant was part of a single or multi-unit company and the share of employees eligible to vote in the election. Therefore, as shown by Table 4, the resulting estimated effect of plant size on the impact of new unionization does not result from production worker units constituting a smaller share of total employment in large plants compared with small plants.

As shown by column 3 of Table 4, the effect of certification on the output, employment, and cost measures decline substantially with the size of the plant. To interpret the magnitude of these estimates, consider that the difference between a plant with 175 employees and a plant with the sample mean number of employees (approximately 450) is about 1 log point. The estimate of .085 in the first row of column 3 indicates that such an increase in plant size would be associated with an 8 percentage point smaller effect of unionization on employment. One implication of this result is that when we use the second sample to analyze the long-term effects of union certification on output and employment, we probably understate the impact of new unionization.

5.2. Wages and Labor Costs

One explanation for the sharp declines in employment and output in plants in which unions win certification elections is that these unions successfully negotiate collective bargaining agreements that raise plant's labor costs. However, as indicated by Table 3, in neither sample do we find evidence that average wages are higher by the second year after of the election. Average wages for all employees, and average annual and hourly wages of production workers appear unaffected by unionization. Not only are the estimated coefficient statistically insignificant, but the "point" estimates are close to zero.

TABLE 4

The Marginal Effects of Plant and Election Characteristics on Election Outcomes in Production Units

	Win Dummy	Win *Single	Win *Size	Win *Eligible
Employment in the plant	-.547 (.181)	.054 (.085)	.081 (.033)	-.043 (.027)
Production worker employment	-.525 (.186)	.077 (.088)	.072 (.034)	-0.039 (.028)
Annual production worker hours (000's)	-.694 (.197)	.113 (.093)	.097 (.036)	-.053 (.030)
Average annual hours per worker	-.161 (.063)	.035 (.030)	.025 (.011)	-.013 (.009)
Total value of shipments (000's)	-.951 (.218)	.131 (.103)	.145 (.040)	-.043 (.033)
Cost of materials (000's)	-.816 (.249)	.084 (.118)	.126 (.046)	-.031 (.038)
Average wage and salaries	-.158 (.075)	.022 (.036)	.03 (.014)	-.004 (.011)
Production worker annual wages	-.132 (.094)	.066 (.044)	.019 (.017)	-.019 (.014)
Production worker hourly wages	-.028 (.093)	.031 (.044)	-.023 (.029)	-.005 (.014)
Nonwage labor costs per employee	-.128 (.183)	-.04 (.085)	.023 (.033)	-.09 (.027)
Nonwage voluntary costs/employee	-.195 (.256)	-.071 (.118)	.039 (.046)	-.098 (.038)

Note: See Table 2. Regressions also include controls for log of the number of employees two years before the election year. Win *Single denotes the interaction between the election's outcome and whether the plant is a single-plant firm. Win *Size denotes the interaction between the election's outcome and the log of the number of the plant's employees two years before the election year. Win *Size denotes the interaction between the election's outcome and the log of the fraction of employees eligible to vote in the election.

The finding of no wage effects is puzzling considering the literature on U.S. union premiums and the evidence of substantial employment and output effects in this paper and elsewhere. However, this finding may not be surprising if the objectives of newly certified unions are first to secure improved fringe benefits and alternative industrial relations practices and later to turn their attention to raising wages. This scenario suggests that it may take several years before we would observe significant wage effects from unionization and underscores the importance of using our second sample to examine the long-run effects of certification on labor costs.

The estimated effects of unionization on nonwage labor costs offers some weak evidence supporting the view that initially new unions seek to increase benefits instead of wages. As shown by the next to last row of the Table 3, nonwage labor costs rise by approximately 4 percent in plants in which the union was certified. In the subsample with long panels the estimated impact is 8 percent. Because, wages do not appear to be increasing, this increase does not result from an increase in benefits that are tied by law to

employee earnings. Instead, this rise results from an increased expenditures on voluntary nonwage benefits.

Even if nonwage labor costs rose by as much as five percent, this rise appears too small to explain the substantial employment and output declines observed earlier. In our data, nonwage labor costs (for all employees) represent approximately 20 percent of total labor costs. Therefore, a five percent rise in benefits costs implies that total labor costs and rising by perhaps 1 percent as a result of the certification. However, total employment falls by four to eight percent. Such a decline suggests that labor demand curves in manufacturing plants are much more elastic than has been found in other studies.

Another explanation for the substantial declines in employment and output is that new unions strive to secure more favorable industrial relations practices. They negotiate collective bargaining agreements that include seniority provisions affecting management's right to layoff or promote employees, restrictive work rules, grievance procedures, and third party resolution of disputes. In addition, employees who are union officials usually are allowed to carry out union business on company time and the law grants employees the right to have a union official present when they are disciplined by their supervisors. This system of industrial relations may be costly to the firm and explain part of the decline in output and employment.

Unfortunately, the LRD does not include information on industrial relations practices. As a result, we can not investigate this issue much further. However, one piece of evidence consistent with this explanation is that labor productivity defined as shipments divided by employment declines by approximately 6 percent in plants that are successfully organized by unions. Alternatively, labor productivity defined as valued added per employee falls by 10 percent by the second year after the election year, and by an even larger amount in our sample of plants with at least ten years of continuous data ¹⁵. This decline in labor productivity also is indicated by larger declines in the plant's output and materials costs, than in its total employment.

5.3. Shifting Resources Within the Firm

The substantial declines in employment and output also are troubling because they suggest that there are substantial "efficiency" costs associated with unionization. However, we may be substantially overstating these effects because we observe these changes only in the plant and not for the entire firm. If firms can respond to the unionization of one plant by switching production to other plants, then the costs of unionization to the firm may be small. Table 4 presents some weak evidence supporting this contention. As shown by column two, a positive coefficient for the interaction between the "win" dummy variable and whether the plant is a single-unit company

15. Value added per employee is defined as shipments minus materials costs divided by total employment.

indicates that union certification in such establishments has a less adverse effect on employment and output. This result suggests that plants that are part of multi-unit companies can divert production elsewhere.

The LRD provides us with an opportunity to pursue this question, because we can identify other plants that belong to the same company. For each plant in our sample, we identified all other plants within the same company that (i) we found records for in the LRD and (ii) had observations two years before and after the NLRB representation election. Because of the sampling scheme used in the ASM, our selection criteria usually meant that the resulting sample of “other” plants included the company’s larger (manufacturing) establishments, but not its smaller ones. We then aggregated these “other” plants into one observation for each company. We used equation (2) to examine whether a union’s certification in one plant of a company affected employment, output, and costs in the rest of the company.

As shown by Table 5, there is no evidence that employment and output are rising in “other” establishments of companies in which a union won a certification election in one of its plants. In both the first and second year after the year of the election, employment and output appear to have fallen modestly in these “other” establishments compared to the “other” establishments of companies in which the union lost its bid for certification in one of its plants.

The pre-election declines in employment and output shown in column one of the table suggest that the estimated post-election declines in these variables is overstated to some degree. Employment and output in these “other” plants declined between the second and first year prior to the election suggesting that they would have declined by the second year after the election regardless of the election’s outcome. Nevertheless, if certification caused modest employment and output declines in these “other” plants, it would suggest that these “other” plants are complements instead of substitutes in production. Such a result would imply that limiting the analysis of the effects of new unionization to plants that experience organization drives likely understates the impact of unions on “efficiency”.

5.4. The Long-Term Effects of Certification

Having documented the short-run effects of new unionization, we now turn to examine its long-term effects based on the second sample of plants with 10 years of continuous data. When we outlined our statistical model above, we described an unrestricted and a restricted model for estimating the long term effects of unionization on output, employment, and costs. The unrestricted model allowed for separate effects of certification during each of the four years prior to the election year, the election year, and each year after the election. The restricted model required that the effects of certification (i) fall (or rise) along a linear trend during the three years prior to the election year, (ii) to be separate in the year of the election and in the year after the election, and (iii) to have a constant effect beginning in the second year after the election that subsequently rises (or falls) along a linear trend.

We present in Table 6 the estimated coefficients from the restricted model. We present our estimated based on the unrestricted model in Table C in the

TABLE 5

Impact of Union Certification on Other Plants in the Same Firm

		Two Minus One Year Before Election	One Year After Minus Two Year Before Election	Two Years After Minus Two Years Before
Total Value of Shipments	Coefficient	-0.030	-0.060	-0.040
	Stan. Err.	0.020	0.028	0.041
Costs of Materials	Coefficient	-0.040	-0.062	-0.032
	Stan. Err.	0.024	0.035	0.046
Total Employment	Coefficient	-0.013	-0.032	-0.025
	Stan. Err.	0.018	0.023	0.034
Production Worker Employment	Coefficient	-0.013	-0.030	-0.032
	Stan. Err.	0.018	0.025	0.037
Annual Production Worker Hours	Coefficient	-0.019	-0.028	-0.019
	Stan. Err.	0.017	0.025	0.038
Ratio of Non Production Workers to Production Workers	Coefficient	-0.016	-0.000	0.023
	Stan. Err.	0.026	0.036	0.040
Productivity 1 - Shipments per Employee	Coefficient	-0.017	-0.027	-0.015
	Stan. Err.	0.014	0.019	0.023
Productivity 2 - Value Added per Employee	Coefficient	-0.034	-0.018	0.018
	Stan. Err.	0.029	0.034	0.044
Average Wage and Salaries per Employee	Coefficient	-0.007	-0.002	-0.010
	Stan. Err.	0.009	0.011	0.012
Annual Production Worker Wages per Production Worker	Coefficient	-0.009	-0.000	0.007
	Stan. Err.	0.011	0.014	0.014
Production Worker Average Hourly Wages	Coefficient	0.001	-0.000	-0.004
	Stan. Err.	0.010	0.013	0.015
Nonwage Labor Costs	Coefficient	-0.025	-0.006	-0.014
	Stan. Err.	0.019	0.032	0.025
Number of Firms	Coefficient	754	754	754

Notes: Other plants in the same company refer to all plants in the same company in which a certification election is held in one of its plants and that appear in the LRD for two years after and two years prior to the election year. If a company has more than one of those other plants their records were aggregated into one record. Estimates are based on equation (2) in text and include controls for time, industry, region, and SMSA effects.

Appendix. The F-statistics that test the restrictions in the restricted model for each outcome variable are given in the last row of Table 6. Only when we estimated the effects of certification on nonwage labor costs per employee did we reject these restrictions at the .05 significance level. Because the restricted model appears to provide an adequate summary of the data, we use it to examine the long-term impacts of new unionization.

The results indicate that the long-term effects of certification are substantial and similar to the short-term effects presented above. As shown by the rows labeled "Post Election Level" and "Post Election Trend", the employment and output impacts persist for at least nine years after the year of the election. As shown by column 1 of the table, by the second year

TABLE 6

Estimated Impacts of Union Certification on Output, Empolyment, and Costs from Restricted Model

	Coefficient	Log Total Value of Shipments	Log Materials Cost	Log Total Employment	Log Production Worker Employment	Log Production Worker Hours	Log Ratio of Nonproductive Production Workers	Productivity Shipments Per Worker	Productivity Value Added per Employee	Log Average Wage and Salaries	Log Average Production Worker Annual Wage	Log Average Production Worker Hourly Wages	Log Average Supplemental Labor Costs per Worker
Prior Election Trend	Coefficient	-0.009	-0.007	-0.007	-0.007	-0.004	-0.037	-0.001	-0.036	0.001	-0.004	-0.006	-0.018
	Stan. Err.	0.009	0.010	0.007	0.006	0.008	0.037	0.006	0.044	0.003	0.004	0.003	0.006
	t-ratio	-0.940	-0.640	-1.030	-0.890	-0.500	-1.010	-0.210	-0.820	0.190	-0.890	-1.870	-2.330
Election Year	Coefficient	-0.040	-0.022	-0.018	-0.023	-0.021	0.197	-0.023	-0.273	-0.018	-0.034	-0.036	-0.032
	Stan. Err.	0.030	0.035	0.023	0.026	0.027	0.121	0.021	0.144	0.010	0.012	0.011	0.026
	t-ratio	-1.360	-0.630	-0.780	-0.910	-0.790	1.620	-1.060	-1.890	-1.870	-2.820	-3.200	-1.260
Election Year + 1	Coefficient	-0.064	-0.038	-0.018	-0.038	-0.039	0.282	-0.046	-0.536	-0.017	-0.030	-0.029	-0.035
	Stan. Err.	0.031	0.036	0.024	0.026	0.027	0.125	0.022	0.149	0.010	0.012	0.012	0.026
	t-ratio	-2.080	-1.070	-0.780	-1.460	-1.420	2.260	-2.060	-3.610	-1.630	-2.410	-2.520	-1.340
Post Election Level	Coefficient	-0.089	-0.083	-0.025	-0.072	-0.073	0.378	-0.064	-0.245	-0.001	-0.016	-0.015	-0.032
	Stan. Err.	0.025	0.028	0.019	0.021	0.022	0.100	0.018	0.119	0.008	0.010	0.009	0.021
	t-ratio	-3.640	-2.940	-1.350	-3.430	-3.350	3.790	-3.640	-2.070	-0.110	-1.620	-1.580	-1.500
Post Election Trend	Coefficient	-0.000	-0.004	0.001	0.003	0.002	-0.052	-0.001	0.043	-0.003	-0.002	-0.002	0.003
	Stan. Err.	0.005	0.005	0.004	0.004	0.004	0.019	0.003	0.023	0.002	0.002	0.002	0.004
	t-ratio	-0.070	-0.730	0.300	0.650	0.580	-2.730	-0.410	1.900	-1.700	-1.120	-1.100	0.670
F-Statistic for Restrictions	Coefficient	0.169	0.343	0.394	0.303	0.201	1.390	0.545	1.427	0.729	0.755	0.370	1.864

Notes: Samples based on 739 manufacturing establishments in which a representation election was held between 1977 and 1988 and for which the LRD contains at least 10 years of consecutive records. Estimates are based in equations (1) and (3) in text. The coefficients in the table correspond to the variables defined in equations (3a) through (3e).

after the election output has fallen by 8.9 percent in plants in which the union secured certification. Further, there was no tendency for that effect to rise or fall in subsequent years. The estimated pattern for materials costs and production worker employment and hours is similar. Finally, we also find that new unionization is associated with a long-term decline in relative labor productivity as measured by shipments divided by total employment. The decline in productivity as measured by value added per employee is even more dramatic during the years following the election, but as indicated by the “Post Election Trend” variable, this impact dissipates with time after the election year.

Could these findings result from preelection trends in these variables? The results in the row labeled “Prior Trend” indicate that this is possible. For example, the -0.009 figure associated with the “Shipments” column in row one of the table indicates that during the three years prior to the election, the value of shipments in plants in which the union eventually won fell by about one percent per year relative to plants in which the union subsequently lost the representation election. If this trend were to continue, then by the second year after of the election, shipments in plants in which the union won should have declined by approximately 6 percentage points relative to their counterparts in which the union lost. This decline would not have much to do with the outcome of the certification election, because the pattern was already present before the election. However, we should not make too much of this point, because (i) the preelection trend is imprecisely estimated, and (ii) this trend is not reflected in the estimate of the postelection trend in row five of the table.

In part 5.2 of this section, we observed that there was no evidence of a short-term effect of union certification on wages. This result continues to hold in the long-term. As indicated by the columns labeled “average wages and salaries”, “average production worker annual wages”, and “average production worker hourly wages” the effects of union certification on average wages are essentially zero with no evidence that they rise in subsequent years. In addition, nonwage labor costs are no longer increasing when we use the sample of plants with at least 10 years of continuous earnings data. These results reinforce the puzzle of why the employment and output effects associated with new unionization are so large when at the same time there appears to be no impact of new unionization on wages.

6 Conclusion

This study has examined the impact of a union’s certification on the employment, output and costs of U.S. manufacturing establishments. During the two years following a union’s certification in a production unit, we observed substantial declines in production worker employment and hours, shipments, and materials costs. These changes persist for at least nine years following the year of the election and appear to affect the company not

just the plant. At the same time, nonwage labor costs rose somewhat, but these increases were not statistically significant, did not persist in the long-term, and were too small to explain the employment and output declines. More importantly, we find no evidence that a union's certification affects employees' annual or hourly wages either in the short- or the long-term. This result holds for both small and large manufacturing plants.

We emphasize that these findings do not represent the total impact of union organizing drives or manufacturing establishments. Because plants may respond even to the threat of a successful organizing drive, our study measures only the impacts of a union's certification conditional on the plant being subject to a formal union organizing campaign. Indeed the lack of a wage effect in our data may result from plant managers who succeed in fending off a union organizing drive paying their employees the same as workers in plants in which the union's organizing efforts were successful.

Nonetheless, our results on employment and output suggest that unionization imposes substantial nonpecuniary costs on the plant. We can not identify these nonpecuniary costs with our data. However, our findings are consistent with those reported by Freeman and Kleiner [1990] in their study of 182 elections held in establishments located in areas covered by NLRB's Boston and Kansas City regional offices. We reanalyzed their data, so that we could compare the results for elections held in production units to results from our study. Their data indicates that, in the short-term, employment fell by 18 percentage points in firms in which the union won the certification election compared to firms in which the union lost. (See the first column of Appendix Table B.) They also found that a union victory had no effect on wages and benefits. Instead, their data showed that new unionization lead to substantial changes in the establishment's industrial relations practices.

Another potentially interesting result from Freeman's and Kleiner's study, that we could not examine with our data, is that the adverse effects of a union's certification may be larger when the successful union fails to secure a first contract. Although as shown by column three of Table B, the standard errors associated with this finding are larger than the point estimate, it is worth noting that they are plausible and may imply that the longer term effects of unionization are smaller than indicated by the results in our study. Successful unions that are able to secure first contracts may be able to negotiate higher employment levels, as a result of newly implemented work rule provisions, than their successful counterparts who are unable to negotiate a collective bargaining agreement with their employer.

APPENDIX

THE DATA

The U.S. Census Bureau's Longitudinal Research Datafile (LRD) consists of all establishment-level records from every Census of Manufacturers (CM) since 1963 (1963, 1967, 1972, 1977, 1982, 1987, 1992) and every Annual Survey of Manufacturers (ASM) since 1971 (1971-1991). According to the Census Bureau's definition an establishment is a "single plant or factory in which manufacturing operations are performed (U.S. Census, 1992, p. 27)". A company or enterprise may be comprised of one or more establishments. The U.S. Census links establishment records over time through the permanent plant number (PPN) which, as the name suggests, is a permanent, unique, identifier assigned to each establishment. Establishments that are part of the same firm are linked through the Census File Number (CFN), a ten-digit number of which the first six digits are identical for all establishments that are part of the same company or enterprise.

The CM collects information every five years from all manufacturing establishments operating in the United States. The ASM collects information in intercensus years from a sample of manufacturing establishments. A new

TABLE A

Number of manufacturing establishments in the longitudinal research datafile (LRD)

Year	Sample year for the ASM	Number of establishments		Total employment	
		Total	+250ees	All plants	Plants 250+
1963		305,747	11,462	16,181	9,230
1967		305,611	13,520	18,504	11,116
1972		32,398	13,590	18,001	10,313
1973	1969	73,460	14,218	14,883	10,994
1974	1974	68,262	14,241	14,730	10,956
1975	1974	71,145	12,681	13,404	9,609
1976	1974	70,346	13,211	13,757	9,970
1977		350,648	14,092	18,509	10,481
1978	1974	73,853	14,051	14,640	10,736
1979	1979	57,559	14,384	14,141	11,074
1980	1979	55,953	13,766	13,599	10,536
1981	1979	55,045	13,311	13,312	10,252
1982		348,384	13,067	17,818	9,463
1983	1979	51,619	12,098	11,880	8,943
1984	1984	56,551	12,778	12,890	9,457
1985	1984	55,128	12,404	12,636	9,227
1986	1984	59,747	11,981	12,280	8,892
1987		368,895	13,831	18,950	9,961
1988	1984	53,106	12,595	12,390	9,068
1989	1989	57276	12,597	12,406	9,048

Source: U.S. Census, 1992, Table 2, p. 11, and calculations by the authors.

TABLE B

Reanalysis of Freeman-Kleiner sample of elections

	Production units				Nonproduction units			
	Coefficient estimates of:				Coefficient estimates of:			
	N	Win only	Win	Contract	N	Win only	Win	Contract
Diff log no. employees	91	-.176 (.097)	-.257 (.138)	.125 (.148)	94	-.092 (.063)	-.235 (0.93)	.213 (.103)
Diff log sales	57	-.069 (.166)	-.062 (.219)	-.013 (.239)	58	-.140 (.123)	-.452 (.156)	.546 (.184)
Diff log wages	76	-.017 (.016)	-.016 (.023)	-.002 (.025)	71	-.025 (.021)	-.048* (.031)	.035* (.035)
Diff log fringes	69	-.044 (.024)	-.040 (.034)	-.006 (.038)	64	-.003 (.033)	-.062 (.046)	.093 (.053)

Notes: Difference in variable's log difference between post- and pre-election years. Controls for Boston NLRB region and year of election included. The employment and sales measures compare the year after the election to those at the election; the wage and fringe measures compare the year after the election to the year before the election. Results denoted with an asterisk are sensitive to the wage measure used in the analysis.

ASM sample is drawn two years after a CM (for example, a new ASM sample was drawn in 1974). The probability that a plant is included in an ASM is inversely proportional to its total employment in the most recent CM, with plants with 250 or more employees included in the ASM with certainty. Plants in an ASM are then surveyed every year for the next five years, at which time a new ASM panel is drawn. "Noncertainty" cases (plants with fewer than 250 employees) in the previous ASM panel are ineligible for the next ASM panel. This sampling scheme means that long panels can only be constructed large plants. Data for smaller plants will only be available in Census year and when a plant is included in an ASM panel.

Table A presents the number of plants available in the LRD for each year. Note that the vast majority of plants in the LRD have fewer than 250 employees. Yet as the last two columns of the table indicate, these large plants employ approximately one-half or more of all manufacturing workers. In addition to the differences between the number of observations available in the Census as opposed to the ASM years, there also is a sharp difference between the number of observations available in the 1970s as opposed to the 1980s from the ASM years. The reason for this difference is that prior to 1979, the Census Bureau included in the ASM any establishment that was part of a company containing at least one establishment selected for the sample. By dropping this requirement starting in 1979 the representation of small establishments in the LRD declined.

To create our matched sample, we began with the NLRB's Representation Election Database (compiled by the NLRB Management and Information Systems Branch). This file contains records for 67,282 representation elections held between July 1977 and March 1989. Of these elections, 27,056 were held in manufacturing plants. We first created a list of

TABLE C

Impact of a successful union organizing campaign on output, employment, and costs.

Year	Shipments	Materials Costs	Employment	Production Workers
Election Year - 4	-0.015 (0.031)	0.006 (0.036)	-0.002 (0.024)	0.007 (0.027)
Election Year - 3	-0.036 (0.031)	-0.017 (0.036)	-0.018 (0.024)	-0.014 (0.027)
Election Year - 2	-0.038 (0.031)	-0.026 (0.036)	-0.027 (0.024)	-0.019 (0.027)
Election Year - 1	-0.018 (0.031)	-0.011 (0.036)	-0.015 (0.024)	-0.016 (0.026)
Election Year	-0.048 (0.031)	-0.023 (0.036)	-0.020 (0.024)	-0.023 (0.026)
Election Year + 1	-0.071 (0.032)	-0.039 (0.037)	-0.021 (0.024)	-0.038 (0.027)
Election Year + 2	-0.097 (0.033)	-0.078 (0.038)	-0.022 (0.026)	-0.059 (0.029)
Election Year + 3	-0.094 (0.035)	-0.094 (0.040)	-0.045 (0.027)	-0.081 (0.030)
Election Year + 4	-0.099 (0.036)	-0.128 (0.042)	-0.028 (0.028)	-0.063 (0.031)
Election Year + 5	-0.101 (0.038)	-0.085 (0.044)	-0.013 (0.029)	-0.055 (0.033)
Election Year + 6	-0.096 (0.039)	-0.058 (0.045)	-0.021 (0.030)	-0.070 (0.034)
Election Year + 7	-0.111 (0.041)	-0.087 (0.047)	-0.032 (0.031)	-0.086 (0.035)
Election Year + 8	-0.098 (0.043)	-0.114 (0.049)	0.015 (0.033)	-0.060 (0.037)
Election Year + 9	-0.114 (0.048)	-0.149 (0.055)	-0.035 (0.037)	-0.060 (0.041)

potential matches with the LRD based on the first five consonants in the establishment's business name, its 2 digit industry, and its state and county codes. Establishments without five consonants in their names were retained as long as the records in the two data sets matched on the consonants they had and on the industry and location variables. We, then confirmed the resulting matches by inspection. We were left with a sample of 8,640 matches, in 7,845 different establishments. Because of the LRD's sampling scheme, we had panel data extending 2 years prior to and after the year of the election for only 2,038 of the establishments: 1,717 of these observations were certification elections and the other 321 were decertification elections.

In this study, we examine the effects of certification in plants in which the union attempted to organize a production unit. Elections held in these units differ from those held in nonproduction units because elections held in production units involve a substantially larger fraction of the work force. The nonproduction worker units usually are comprised of office and clerical workers, professional and technical workers, truck drivers, and

TABLE C continued:

Year	Production Hours	Ratio NPW/PW	Productivity-1	Productivity-2
Election Year - 4	-0.001 (0.028)	-0.107 (0.127)	-0.012 (0.022)	-0.257 (0.151)
Election Year - 3	-0.019 (0.028)	-0.248 (0.127)	-0.018 (0.022)	-0.228 (0.151)
Election Year - 2	-0.015 (0.028)	-0.128 (0.126)	-0.010 (0.022)	-0.137 (0.150)
Election Year - 1	-0.008 (0.027)	-0.105 (0.125)	-0.004 (0.022)	-0.154 (0.149)
Election Year	-0.023 (0.028)	0.149 (0.125)	-0.027 (0.022)	-0.347 (0.149)
Election Year + 1	-0.041 (0.028)	0.231 (0.129)	-0.050 (0.023)	-0.611 (0.154)
Election Year + 2	-0.065 (0.030)	0.283 (0.135)	-0.074 (0.024)	-0.482 (0.150)
Election Year + 3	-0.088 (0.031)	0.283 (0.141)	-0.048 (0.025)	-0.168 (0.167)
Election Year + 4	-0.061 (0.033)	0.151 (0.148)	-0.071 (0.026)	-0.015 (0.176)
Election Year + 5	-0.068 (0.034)	0.118 (0.155)	-0.088 (0.027)	-0.035 (0.184)
Election Year + 6	-0.069 (0.035)	0.250 (0.159)	-0.075 (0.028)	-0.444 (0.189)
Election Year + 7	-0.077 (0.036)	0.223 (0.165)	-0.079 (0.029)	-0.345 (0.196)
Election Year + 8	-0.062 (0.038)	0.055 (0.174)	-0.113 (0.031)	-0.131 (0.207)
Election Year + 9	-0.076 (0.043)	-0.097 (0.195)	-0.079 (0.031)	0.160 (0.232)

security guards. We analyzed the impact of certification on 11 measures of employment, output, and costs. The variables are defined as follows:

Total Employment. Measured as the total production workers plus the number of nonproduction workers in the plant on March 12th.

Total Production Workers. The total number of production workers in the plant is measured as the average number of the number of production workers in the plants on the 12th of March, May, August, and November.

Total Production Worker Hours. It is measured as the sum of the total production worker man hours worked in the four quarters of the year.

Average Salary and Wages. Measured as the total salary and wages paid by the plant in a year divided by total employment in the plant. Total Salary and Wages are in thousands of 1972 dollars.

Average Worker Wages. Measured as total salary and wages paid to production workers over the year divided by the total number of production workers in the plant. Total production worker's salary and wages are in thousands of 1972 dollars.

Average Production Worker Hourly Wage. It is measured as the total salary and wages paid to production workers over the year, divided by the

TABLE C continued:

Year	Wages & Salaries	Production Earnings	Production Wages	Supplemental Labor Costs
Election Year - 4	-0.010 (0.010)	-0.017 (0.013)	-0.010 (0.012)	-0.013 (0.027)
Election Year - 3	0.005 (0.010)	-0.011 (0.013)	-0.006 (0.012)	-0.080 (0.027)
Election Year - 2	0.007 (0.010)	-0.004 (0.013)	-0.007 (0.012)	-0.071 (0.027)
Election Year - 1	-0.005 (0.010)	-0.018 (0.013)	-0.025 (0.012)	-0.038 (0.026)
Election Year	-0.019 (0.010)	-0.038 (0.013)	-0.038 (0.012)	-0.044 (0.026)
Election Year + 1	-0.018 (0.010)	-0.034 (0.013)	-0.031 (0.012)	-0.047 (0.027)
Election Year + 2	-0.006 (0.011)	-0.024 (0.014)	-0.018 (0.013)	-0.017 (0.029)
Election Year + 3	-0.009 (0.011)	-0.025 (0.014)	-0.017 (0.013)	-0.089 (0.030)
Election Year + 4	-0.000 (0.012)	-0.021 (0.015)	-0.022 (0.014)	-0.031 (0.031)
Election Year + 5	-0.014 (0.013)	-0.041 (0.015)	-0.028 (0.015)	-0.020 (0.033)
Election Year + 6	0.004 (0.013)	-0.008 (0.016)	-0.009 (0.015)	-0.022 (0.034)
Election Year + 7	-0.006 (0.013)	-0.024 (0.016)	-0.033 (0.015)	-0.025 (0.035)
Election Year + 8	-0.024 (0.014)	-0.028 (0.017)	-0.025 (0.016)	-0.101 (0.037)
Election Year + 9	-0.033 (0.016)	-0.041 (0.019)	-0.025 (0.018)	-0.026 (0.041)

Notes: The outcome variables are defined in the text of the Appendix.

total number of production worker man-hours worked in the plant over the year. Production worker mean hours are measured in thousands of hours and total production worker salary and wages are measured in thousands of 1972 dollars.

Average Total Supplemental Labor Costs. Measured as total supplemental labor costs in the plant, divided by total employment in the plant. Supplemental labor costs are the total costs paid over the year and are measured in thousands of 1972 dollars.

Average Voluntary Labor Costs. Measured as total voluntary supplemental labor costs in the plant divided by total employment in the plant. Voluntary supplemental labor costs are defined as total labor costs not specifically required by Federal or State legislation. The figures represent total costs paid over the year and are measured in thousands of dollars.

Total Value of Shipments. It is measured as the sum of: (1) the total value of products shipped for sale or transferred to other plants in the same company which were manufactured, fabricated, processed or assembled in the plant; (2) receipts from contract work performed for others; (3) sales of

products bought and resold without further processing; and (4) miscellaneous receipts. It is measured in thousands of 1972 dollars.

Costs of Materials. It is measured as the total costs of purchased materials and parts, the cost of resales, the cost of fuels, the cost of contract work, and the cost of purchased services. It is measured in thousands of 1972 dollars.

Productivity 1. Shipments divided by total employment.

Productivity 2. Value added divided by total employment, where we define value added as shipments minus materials costs.

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