



New Manufacturing Investment and Unions

Though weak, U.S. labor unions remain a significant factor in corporate decisions about new investment

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Introduction

With the decline of labor union membership in the United States over recent decades, discussions of policy toward unions usually show up in the back pages of newspapers, if at all. But recently, labor union policy has been front-page news. One major story is that in 2011, the National Labor Relations Board (NLRB) began proceedings to block Boeing, the largest manufacturing exporter in the United States, from opening a billion-dollar plant in South Carolina, due to alleged labor law violations. That the (now-resolved) dispute even made headlines is significant news in an era of supposed union irrelevance.

Another major labor story involves efforts in several states to pass “right-to-work” laws, anti-union statutes that prohibit making union membership a requirement of employment. In December 2012, Michigan, a traditional center of union power, enacted a right-to-work law, joining the ranks of anti-union states in the South that passed such laws over 50 years ago. Indiana did so in February 2012, and Wisconsin enacted a related law for public sector unions in 2011.

Also on the front page are discussions of a potential revitalization of American manufacturing. The automobile industry has been in recovery since the 2009 crisis. General Electric’s (GE’s) “reverse offshoring” of water heater production from China back to Kentucky got substantial media attention, as did Boeing’s rollout of the new fuel-efficient 787 Dreamliner, which it hopes will be a key source of competitive advantage for years to come.

Despite these stories, overall gains in manufacturing have been meager relative to the broad de-

ABSTRACT

Despite recent media stories about both labor unions and the potential revitalization of U.S. manufacturing, most current policy discussions about improving business climate to foster manufacturing neglect the role of unions. This, plus the continued decline in U.S. union membership, might lead one to believe that unions matter little for *new* investment decisions.

This essay argues that, in fact, unions remain an extremely significant factor in decisions by U.S. manufacturers about where they will or will not make new investments. Both unions and manufacturing are discussed in an analysis that distinguishes between new investment at *new* plants and at *existing* plants. Two central arguments are presented:

(1) Union success (or lack thereof) in organizing *new* plants is a reflection, in part, of an intentional strategy by firms to choose locations that have historically not been receptive to unions, in the South and in rural areas. This well-established historical process continues today. That is, unions *still* make a difference for new investment in manufacturing because they influence where firms decide to open new plants.

(2) Unions also remain relevant for corporate decisions about new investment at *existing* plants. Many such facilities are hubs of interaction between unionized blue-collar workers and nonunion white-collar workers, including researchers and engineers in research and development labs. To continue this valued interaction at a new nonunion plant, the firm would have to shift white-collar workers, at potentially high cost. The firm might instead consider adding new investment to an existing facility. In this way, the new investment keeps alive a union established long ago.

Through its influence on the ease of labor organizing, policy can therefore influence both the location and the amount of new investment in U.S. manufacturing.



Union



cline of U.S. manufacturing since the 1970s, and many, including President Barack Obama, argue that it should be an important policy priority to promote U.S. manufacturing. For example, a recent presidential report urges improvements in the business climate for manufacturing (President's Council of Advisors on Science and Technology, July 2012).

It's telling, perhaps, that this report doesn't mention unions in its discussion of business climate, consistent with a view that unions are largely irrelevant to corporate decisions about investment in manufacturing. The share of the manufacturing workforce in unions has been in free fall for many years, only 9.6 percent in 2012, compared with 38.9 percent in 1973.¹ This statistic actually understates current union weakness, because factories that are unionized today, to a remarkable degree, are the legacy of union victories over 50 years ago.

These facts might lead one to the view that while unions were relevant to *old* investment decisions (in locations where unions were established decades ago under a more favorable environment), they matter little for *new* investment decisions. In discussions of business climate, policymakers and businesspeople think about *new* investments, of course, not investments made years ago. Given today's small union membership numbers, it might seem sensible to leave unions out of the discussion about current business climate and *new* investment.

I believe that this conclusion is ill founded, and in this essay, I will argue that in fact unions remain an extremely significant factor in decisions by U.S. manufacturers about where they will or will not make new investments. To make this point, I discuss both unions and manufacturing, and I present an analysis that distinguishes between new investment at *new* plants and at *existing* plants.

I argue first that low union success in organizing *new plants* is not an accident, but rather a reflection, in part, of an intentional strategy by firms to choose locations that have historically not been receptive

to unions, in the South and in rural areas. True, this is an old story, a process that has been going on for decades.² My point is that this process continues *today*. That is, unions *still* make a difference for new investment in manufacturing because they influence where firms decide to open new plants.

Second, I argue that unions remain quite relevant for corporate decisions about new investment being considered at *existing* plants. Many such facilities are significant hubs of interaction between unionized blue-collar workers and nonunion white-collar workers, including researchers and engineers in research and development (R&D) labs. These facilities are old (in some cases 100 years or more!), and unions at them were generally organized just after the National Labor Relations Act of 1935 provided a favorable environment to do so.

If a firm with such a facility were to shift production workers to a new nonunion plant, it would have to shift the white-collar workers as well, if it wants to continue the interactions. It might be costly to break up an existing successful research center, and so the firm might instead consider adding new investment to an existing facility.³ In this way, the new investment keeps alive a union established long ago. Public policy that affects such a firm's interactions with the incumbent union and its bargaining strength then potentially affects the business climate in which the decision about new investment is made.

To illustrate the continuing relevance of unions to investment decisions, consider again GE's decision to bring production back from China to its appliance plant in Kentucky. The Kentucky plant is old and has long been union. It is also the headquarters for GE's appliance business and the R&D center. In public statements, including comments by CEO Jeff Immelt, GE makes explicit the high value it places on having innovation and production at the same location.⁴ GE sustained this co-location by choosing to add new investment to its already unionized plant. However, it is important to emphasize the role recent weakness of unions potentially played in providing a favorable climate for the investment. As part of the deal, the union made a concession that the new workers be paid \$10 less per hour than existing workers.⁵ This kind of two-tiered wage structure is anathema to union solidarity, and a concession like this was rarely made in earlier periods when unions were strong.

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Consider also the NLRB's 2011 case against Boeing. Historically, Boeing's base of production is its heavily unionized facilities in Washington state. (I say "heavily" because even engineers there are in a union.) Boeing has had a rocky relationship with its unions over the years, and strikes are a regular occurrence. In 2010, Boeing began opening a second Dreamliner production line in a South Carolina nonunion plant; "only the third site in the world to assemble and deliver twin-aisle commercial airplanes," according to Boeing.⁶ CEO Jim McNerney explained that Boeing was doing this because the company was tired of "strikes happening every three to four years in Puget Sound."⁷ Based on these remarks and others like it, the NLRB filed its case accusing Boeing of an illegal labor practice regarding threats firms can make about how they might respond to strikes.

I offer the Boeing CEO's expressed motivation for moving to South Carolina as "Exhibit A" for my case that big manufacturers even today are choosing locations to avoid unions. However, company officials have to be very careful about public statements on this issue because these statements have legal ramifications. Hence, for the analysis I will focus on what firms *do*, rather than on what their officials *say*. By observing the choices firms make when they decide where to make new investments, I can draw inferences about what matters to them most.

The main work of this paper is an analysis of recent investment behavior by GE, which will serve as "Exhibit B." Putting GE under the microscope reveals a picture with a great deal of clarity. In the recent period that I look at, whenever GE has built a brand new plant, it has picked a location unlikely to be unionized. And when GE has invested in an existing unionized facility, for the vast majority of new jobs involved, the facility was one with significant R&D presence, and new workers were hired at a lower wage tier than existing employees.

This is a case study of two firms. While these are two very important firms—the two largest manufacturing exporters in the U.S.—as in any case study, there is always an issue of the broader applicability of the results. I believe the insights of this analysis hold more broadly for large U.S. companies in heavy industry, and I give two quick examples to back this up. First, Caterpillar, the construction-equipment manufacturer, is another firm high on the list of

top exporters. Union avoidance in this firm's investment decisions has been very much in the recent news.⁸ Second, if I had included the auto industry in this study (and, in particular, the site-selection decisions of foreign-owned firms), I expect that many of the conclusions would be similar. Foreign automakers in every case have chosen plant locations where they have been able to remain nonunion.

Background

Several key points about firms and unions will aid discussion of the case studies that follow.

1. *Unions are organized at the plant level; once established, they seldom disappear.*

Generally speaking, union organization takes place at the plant level, involving a representation election supervised by the NLRB. Once a union gets in a plant and, in particular, is able to negotiate a first contract, it becomes entrenched over time. An NLRB mechanism for decertifying a union does exist, but it affects only a trivial number of cases. In 2005, for instance, unions representing 11,000 workers were decertified, but out of a base of 9 million represented private sector workers, this is a decertification rate of only 0.13 percent.⁹ Hence, once a union becomes entrenched at a plant, it is generally there for good, until the plant shuts down.

2. *Unions spread to neighboring establishments, so firms often build new plants in distant areas.*

Unions tend to spill out of organized plants into nearby businesses; that is, to some degree unions are "contagious." In Holmes (2006), I provide evidence on this point, showing how unions in steel mills, auto plants and coal mines found their way into neighboring grocery stores and health care facilities. If a union can spread from an auto plant to a nursing home down the street, it can likely extend to a neighboring auto plant. Aware of this, firms understand that starting a new nonunion plant generally requires geographic separation from existing unionized plants.

3. *Manufacturers may augment existing unionized plants if benefits outweigh costs.*

If a manufacturer invests and adds produc-

tion worker jobs to an existing unionized plant, the new workers usually join the current union. The manufacturer may make this decision, rather than open a new nonunion facility elsewhere, if the initial site has advantages, like proximity to R&D labs, that offset the disadvantage of being unionized. In this way, a unionization event from many years ago is kept alive.

General Electric

With that as background, I'll now turn to the meat of the essay where I analyze what key manufacturers are doing. I focus on GE, but I also come back to Boeing.

GE is one of most influential U.S. companies. It is the second largest U.S. manufacturing exporter (after Boeing). It is the third most innovative U.S. firm, measured in terms of patent counts (after IBM and Microsoft).¹⁰ It is at the center of discussion about revitalization of U.S. manufacturing. Immelt is highly visible in this discussion and serves on the Council on Jobs and Competitiveness set up by Obama.

GE is also interesting for my purposes because it has a long history of having both union and non-union operations. It has long held a reputation of taking a tough stance in dealing with unions. (See the discussion in Meyer (2001), for example.) Here, I take a look at its recent behavior regarding plant openings and new investment.

GE publicizes its new plant openings and investments in an internet series called "GE Reports," under the category "jobs."¹¹ I reviewed all announcements in the series published over the four-year period Jan. 1, 2009, to Dec. 31, 2012, and created a data set of new plant openings and expansions. I restricted attention to announcements in which new jobs were added and excluded announcements for GE Capital and GE Corporate, in order to focus on the manufacturing divisions. When multiple expansions occurred at the same location—for example, the appliance factory in Louisville, Ky., mentioned in the introduction had three expansions during this period—I combined the records. After going through 93 announcements and combining information this way, I found 24 locations in which new investment and job growth were announced over the four-year period, with a total of 8,344 new

jobs. The 24 locations are listed in Tables 1, 2 and 3.

In constructing the tables, I first categorize locations as *new* or *existing*.¹² In my definition of existing, I include brand new buildings and facilities that are part of a larger preexisting GE campus. For example, there is battery factory in Schenectady, N.Y., that was described as new in the announcement, but I classified it as preexisting because it was added to GE's main campus in Schenectady, which serves as its headquarters location and the site of a number of existing facilities.¹³ Using this classification system, I determined that of the 24 locations receiving new investment, eight were new locations and 16 were existing locations. Table 1 lists the new facilities.

Take a look at the locations of the eight new plants. With one exception, a plant in Michigan discussed below, they are *all* in locations where unions are weak: two aviation plants in Mississippi, a locomotive plant in Texas, other locations in the South. A partial exception: a non-South location in Colorado, a state where unions are relatively weak. The full exception: GE's new facility in Michigan, in the Detroit area, a center of union power. But this, as it turns out, is an R&D center, with only white-collar labor;¹⁴ unionization is thus a nonissue.

Of course, union avoidance is only one of many factors considered in a plant location decision. For example, states in the South getting the new plants may have offered better tax incentives than other

Table 1
GE Investment in New Facilities
Announced 2009-12

Location	Division	Announced New Employment
Van Buren, Mich.	Global Research	1,230
Fort Worth, Texas	Transportation	905
Atlanta, Ga.	Energy	400
Aurora, Colo.	Energy	355
Auburn, Ala.	Aviation	300
Batesville, Miss.	Aviation	300
Ellisville, Miss.	Aviation	250
Greenville, S.C.	Energy	136

Source: Author's calculations, following the procedure discussed in the text and endnotes

Table 2
Nonunion Existing GE Facilities Receiving New Investment
 Announced 2009-12

Location	Division	Announced New Employment
Greenville, S.C.	Aviation	240
Grove City, Pa.	Transportation	150
Slater, Mo.	Energy	115
La Fayette, Ga.	Appliances	100
Troy, N.Y.	Healthcare	100
Dayton, Ohio	Aviation	100
Muskegon, Mich.	Aviation	90
Durham, N.C.	Aviation	40
Rochester, N.Y.	Energy	15

Source: Author’s calculations, following the procedure discussed in the text and endnotes

potential sites in northern states. In fact, GE’s CEO is on record as saying that tax incentives matter in site selection.¹⁵ But this is why GE’s choice to put the R&D center in the Detroit area is interesting. If taxes are the primary consideration and taxes are lower in the South, I might expect the R&D center to be put in the South as well. With a case study of only eight data points, I cannot draw definitive conclusions. Nonetheless, it is striking that a sim-

ple theory that GE picks nonunion locations when unions matter gets it right eight out of eight tries. Along with the other evidence from Boeing, it suggests a pattern of behavior.

I next turn to new investment at the 16 locations where GE already had facilities. I classify these plants as “union” or “nonunion” depending on whether the location has workers represented by a union (based on various public sources).¹⁶ The nine nonunion facilities are listed in Table 2, and the seven union plants are listed in Table 3.

Two comments about the nine nonunion facilities. Note first, there is a nonunion GE aviation plant in Michigan. As this is a production facility with blue-collar workers, it might be surprising that it has remained nonunion in Michigan. However, the plant is in western Michigan, where unions are not as strong. Next, note the nonunion GE transportation facility in Grove City, Pa. The plant makes engines for a locomotive plant in Erie, listed in Table 3 in the “union” category. The Erie locomotive plant dates from 1913 and has been a union plant since 1940.¹⁷ The engine plant in Grove City dates from 1971 and has remained nonunion, despite the connection with the union plant in Erie.¹⁸ Apparently, the 85-mile distance between the two locations has been enough to keep the union in Erie out of the Grove City plant.

I now turn to the seven union plants that received new investment, listed in Table 3. The plants are sorted from the highest number of *new* jobs to the lowest, and I focus on the top three, highlighted

Table 3
GE Facilities with Unions Receiving New Investment
 Announced 2009-12

Location	Division	Number of New Employment	Division Headquarters	R&D Lab	Number of Patents 2000-11
Schenectady, N.Y.	Energy	1,200	Yes	Yes	4,348
Louisville, Ky.	Appliances	1,130	Yes	Yes	280
Erie, Pa.	Transportation	610	Yes	Yes	351
Bloomington, Ind.	Appliances	200	No	No	0
Baltimore, Md.	Aviation	200	No	No	17
Bucyrus, Ohio	Lighting	130	No	No	0
Madisonville, Ky.	Aviation	48	No	No	23

Source: Author’s calculations, following the procedure discussed in the text and endnotes

in bold. These are the GE energy facility at Schenectady, with 1,200 new jobs, the GE appliance facility in Louisville, with 1,130 new jobs, and the GE transportation facility in Erie, with 610 new jobs. Together they account for the vast majority of new jobs in union plants, 2,940 out of 3,518.

The last three columns of Table 3 reveal interesting facts about these three facilities. First, each is the respective headquarters for its division. Second, each of these three locations has an R&D lab on site.¹⁹ Third, each of the three locations is a successful producer of a large number of patents. I base this on calculations with publicly available U.S. patent data. I extracted all granted patents assigned to GE over the period 2000-11. In the data for each patent, the location of each inventor is provided. The last column of Table 3 reports the number of GE patents over this period with at least one inventor in each of the given locations.²⁰ Schenectady, the overall GE headquarters, has 4,348 granted patents over the period, while Louisville has 280 and Erie has 351. This is an impressive amount of innovative output.

Earlier, I argued that if production workers are unionized at a facility, the location disadvantage for new investment of the existing union could potentially be offset by beneficial co-location with R&D activity and other white-collar work. I see evidence for this claim in GE's investment behavior. The vast majority of new investment in unionized facilities has occurred in plants with significant R&D and

connections to headquarters.

I consider one last issue for the seven union plants receiving new investment: What is happening to the *net* number of union jobs at each of the facilities? The "GE Reports" series mentions expansions leading to *new jobs* to publicize GE's contribution to U.S. employment, but it doesn't publicize job *cuts* through efficiencies or *outsourcing*. To look at the net effect on union jobs, I use data from the Department of Labor on union membership for each of the union locals at the respective plants.²¹ Membership by local and year are reported in Table 4, and the bottom row tabulates the sum across all seven union plants receiving new investment. Membership at these seven facilities between 2010 and 2011 increased from 7,592 to 8,710 workers, consistent with GE's message that it is increasing production worker employment at these plants.

However, the recent gain is not enough to offset the fall from 2007. Moreover, these are the selection of union plants getting new investment. I have looked at some of the other large unionized plants *not* getting new investment, and membership is falling in these plants. One takeaway point is that even though GE is putting some new investment in unionized plants that for historical reasons are connected to headquarters and R&D facilities, this force is not strong enough to offset continual decline of the unionized workforce at GE.

Plant Location	Local Union	Membership of Local Union by Year					
		2006	2007	2008	2009	2010	2011
Schenectady, N.Y.	IUE-CWA 301	1,228	1,378	1,440	1,251	1,159	1,294
Louisville, Ky.	IUE-CWA 761	2,298	2,606	2,303	1,909	1,928	1,862
Erie, Pa.	UE 506	3,494	3,574	3,786	3,422	2,602	3,530
Bloomington, Ind.	IBEW 2249	914	869	756	680	544	570
Baltimore, Md.	UAW 738	485	571	653	515	651	651
Bucyrus, Ohio	IUE-CWA 704	148	152	151	153	193	294
Madisonville, Ky.	IUE-CWA 701	660	675	640	506	515	509
Total		9,227	9,825	9,729	8,436	7,592	8,710

Source: Author's calculations with LM Filing Data, as discussed in the text

Boeing

Let's get back to the earlier story about Boeing, where I noted that the NLRB had filed a complaint against Boeing in 2011. The complaint alleged that Boeing had engaged in an unlawful labor practice, by making public statements that it was moving production to a nonunion facility to avoid strikes.²² As a remedy, the acting general counsel sought a court order that Boeing be forced to open the second production line in a union facility in the Washington state area instead of the nonunion facility in South Carolina.

In the end, the issue was resolved by Boeing agreeing to add additional union jobs in Washington state in return for the union dropping the charges, enabling Boeing to go ahead with the South Carolina plant.²³ The story illustrates both kinds of investment highlighted in this essay. First, there is new investment at a location where unions are weak, at a site where Boeing did not have a previous facility.²⁴ Second, there is new investment at an existing unionized facility, at a site close to Boeing's R&D infrastructure and other white-collar activity.

The story has two epilogues. In January 2012, Boeing announced that it was closing its entire operations in Wichita, Kan., a unionized facility. (Kansas is not known as a strong union state, but the facility in question dates to 1927, and old facilities in heavy industry are generally union, no matter where they are located.) Many of the jobs were shifted to nonunion facilities in Texas and Oklahoma, some to union facilities in Washington state and some cut altogether. Various news articles report cutbacks in defense spending as the driving factor behind this closure.²⁵ Even so, it is also clear that this decision has implications for the "chess game" of labor management relations going forward, with a longstanding union outpost eliminated and nonunion activity expanded.

The second epilogue is that Boeing's main union is currently trying to unionize the South Carolina plant.²⁶ Clearly, Boeing has an incentive to try to keep the workers happy enough that they won't want the union. And it is reasonable to expect that the workers would be familiar with earlier statements by company officials that a nonunion workforce is why Boeing came in the first place. (Public officials in South Carolina have actually reminded the workers on this point.²⁷) If the South Carolina workers

were to vote in the union, they will be giving up the competitive advantage they hold over union workers in Washington state in future competition for new plant investment. Obviously, this situation puts the union in a weak position.

Remarks about Labor Relations Policy

Public policy affects the extent of unions. For example, the 1935 passage of the National Labor Relations Act was followed by a huge surge in the share of unionized workers. (See Freeman 1998.) Think of there being a policy lever, where how high the lever is pushed determines how easy it is for unions to organize in a workplace. For example, in 2009 at the beginning of Obama's first term, when the Democrats controlled both houses of Congress, there was discussion of the "Employee Free Choice Act," a bill to allow unions to substitute the secret ballot in an NLRB supervised election with a system where union organizers collect signed cards from workers.

This policy, called "card check," would be a significant upward push on the policy lever. (With the new Congress, it is currently not under consideration.) The NLRB recently made administrative rule changes to speed up union representation elections.²⁸ This is an upward push on the lever, because employers have less time to respond. The right-to-work laws recently enacted in Michigan and Indiana push the lever down. In addition to the direct negative effect on unions in these two states, there will likely be a broader negative effect on unions throughout the country. These laws make it harder to collect union dues, and this can potentially lessen the resources available for organizing in other states. For example, when the autoworkers union conducts organizing drives at nonunion auto plants in the South, they are funded by autoworkers' dues in states like Michigan and Indiana.

Suppose the pro-union organizing policy lever gets pushed up so high that the union gets into Boeing's new South Carolina plant, and Boeing expects that this will be true for other new plants it might open in the South. Based on the findings above, how will this policy change affect new manufacturing investment?

The analysis above presents evidence that even today, big firms like Boeing and GE are selecting locations to avoid unions. If Boeing were to get a

union even in South Carolina, it will have less incentive to shift production from Washington state to South Carolina. Thus, an increase in the policy lever potentially affects *where* new investment goes within the United States.

In addition to *where*, the policy lever can potentially affect *how much* overall new investment there is in this country. If one accepts the proposition that firms choose locations within the United States to avoid unions, then one has to consider the possibility that a change in policy might lead the firm to not invest in the United States. That is, if policy changes so that the firm gets a union no matter where in this country it goes, it might consider investing abroad or not investing at all. In the NLRB case referred to above, the NLRB notes that Boeing has experienced strikes by production workers in 1977, 1989, 1995, 2005 and 2008. In December 2012, Boeing's engineers union leaders in Seattle said that "the likelihood of a strike is very high," and though negotiations continued in early 2013, prospects for settlement on a contract remained distant.²⁹ Dealing with strikes on a regular basis can only make Boeing less competitive in the world marketplace, diminishing the returns to new investment. 

Endnotes

¹ Statistics on union membership share are based on the Current Population Survey conducted by the U.S. Census Bureau and were obtained from tabulations published at unionstats.com.

² Fuchs (1962) is an early work arguing for the important role of unions in the migration of industry to the South. See also Holmes (1998) for a discussion of the role of anti-union policies pursued in Southern states.

³ I note two costs in particular. First, key researchers might be unwilling to move. Second, there is much discussion in the economics literature for how R&D centers potentially benefit from knowledge spillovers from other researchers in the vicinity. If the R&D center is moved, it might lose access to these beneficial spillovers.

⁴ See, in particular, Immelt's comments in the *Harvard Business Review*, Immelt (2012). He highlights the Kentucky appliance plant and writes, "Our success on the factory floor rests on human innovation and technical

innovation." He adds, "Engineering and manufacturing are hands-on and interactive ... at a time when speed to market is everything, separating design and development from manufacturing didn't make sense."

⁵ In discussing GE's decision to invest in the Kentucky plant, Immelt writes, "The third element in human innovation is a new model for labor relations. ... The union accepted a lower wage for new hires, we pledged to create new jobs" (Immelt 2012). For more on the story, see "G.E. to Add Two New U.S. Plants as Unions Agree on Cost Controls," *New York Times*, Aug. 6, 2009.

⁶ This is how Boeing's website describes the South Carolina facility. The other two are the Boeing facility in Everett, Wash., and the airbus facility in Toulouse, France.

⁷ The CEO is quoted in the case document, NLRB Case 19-CA-32431, dated April 20, 2011. The brief also quotes similar comments made by other company officials.

⁸ For a story about Caterpillar closing a union plant in Ontario and transferring jobs to a nonunion plant in newly right-to-work Indiana, see "As Unions Lose Their Grip, Indiana Lures Manufacturing Jobs," *Wall Street Journal*, March 18, 2012.

⁹ This statistic is based on the author's calculations with the raw NLRB election data. The statistic includes cases where unions were decertified and replaced with an alternative union. Dickens and Leonard (1984) report an analogous estimate with earlier data that is the same order of magnitude.

¹⁰ The patent count figure is as reported for 2012 by IFI CLAIMS. The claim about exporting is one regularly made by GE. See, for example, GE Reports.

¹¹ See GE Reports.

¹² I use GE's records in the *Million Dollar Directory* of Dun and Bradstreet to build a database of GE's manufacturing plants. I merge this with plant information over the 1987-2010 period in the Toxic Release Inventory published by the Environmental Protection Agency, which can be used to determine when a plant is emitting pollution and is therefore in operation. I combined these data with the GE announcement information to distinguish new and existing plants.

¹³ See "New York powers up with new GE battery plant," GE Reports, May 12, 2009.

¹⁴ See "GE to bring research center and 1,100 jobs to Michigan," GE Reports, June 26, 2009.

¹⁵ See comments in Immelt (2012).

¹⁶ The master 2007-11 GE contract lists all facilities party to the contract that were represented by IUE-CWA, the largest union at GE. I also used government data from the Federal Mediation and Conciliation Service, which publishes information about the location of facilities with expiring union contracts. I resolved ambiguous cases through web searches, including inspection of various websites of local and national unions.

¹⁷ See *A Brief History of UE Bargaining with GE: Seventy Years of Struggle*, United Electrical, Radio and Machine Workers of America (undated manuscript), and GE Transportation BusinessWire news release, “GE Transportation Celebrates 40 Years in Grove City,” Aug. 6, 2011.

¹⁸ The age of the plant is based on “GE Transportation Celebrates 40 Years in Grove City.” Given Pennsylvania’s tradition of strong unions, the fact that GE has a nonunion plant there may come as a surprise. Two points are worth noting in addition to the geographic separation with the Erie plant noted in the text. First, the Grove City plant did not exist in the 1940-70 era when labor organizing at plants was easier. Second, it is in a rural area away from other unions.

¹⁹ Specifically, each location cited is listed in the *Directory of American Research and Technology*, 23rd ed., R. R. Bowker, Reed Elsevier, New Providence, N.J., 1998.

²⁰ The patent data report the city and state of a given inventor, but generally not the address. Table 2 reports the count of patents with at least one inventor in the given city and state.

²¹ The data are the LM Filing Data, published by the Office of Labor-Management Standards at its website. For all but two exceptions, I used the disaggregated membership information in the file, which is useful for separating out membership in the local not in a GE bargaining unit. For the Bucyrus and Madisonville units, only total local membership is available, but this should not be a problem because both appear to represent only GE employees.

²² The complaint is NLRB Case 19-CA-32431, dated April 20, 2011.

²³ See, “Union Seeks to Dismiss Complaint Against Boeing,” *New York Times*, Dec. 9, 2011.

²⁴ For brevity, I am glossing over details. In July 2009, Boeing purchased a supplier plant in South Carolina that already had a union. The plant workers voted to decertify the union in September, and subsequently in October Boeing announced it was going to build the second line in South Carolina.

²⁵ See “Boeing to Shut Wichita Plant, Citing Cuts at Pentagon,” *New York Times*, Jan. 4, 2012.

²⁶ See “Boeing faces union drive at 787 plant in South Carolina,” Reuters, Oct. 12, 2012.

²⁷ *Seattle Times*, Oct. 22, 2012, quoted Sen. Jim DeMint, R-S.C., as saying, “It would blow me away if the employees of Boeing here were so foolish as to unionize when that was one of the key reasons that this plant was built.”

²⁸ See “Labor Board Adopts Rules to Speed Unionization Votes,” *New York Times*, Dec. 11, 2011.

²⁹ See “Boeing’s engineer unions says strike is likely, prepares workers,” Reuters, Dec. 10, 2012. See also “Boeing, engineers set to resume contract talks Wednesday,” Reuters, Jan. 14, 2013.

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