The Effect of State Policies on the Location of Manufacturing: Evidence from State Borders

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This paper provides new evidence that state policies play a role in the location of industry. The paper classifies a state as probusiness if it has a right-to-work law and antibusiness if it does not. The paper finds that, on average, there is a large, abrupt increase in manufacturing activity when one crosses a state border from an antibusiness state into a probusiness state.

I. Introduction

Do the probusiness policies pursued by some states attract manufacturing to these states? This is a controversial issue. In state capitals throughout the country, proponents of probusiness policies routinely claim that state policies are an important determinant of the location of manufacturing. But the results in the academic literature on this subject are mixed, and there is a lack of consensus as to whether or not differences in state policies have a large impact on manufacturing location (see Bartik [1991] and Wasylenko [1991] for surveys).

Progress in this literature has been hampered by the difficulty of

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distinguishing the effects of state policies from the effects of other state characteristics that are unrelated to policy. This paper examines this issue with a fresh approach that circumvents this difficult identification problem. The approach considers what happens to manufacturing activity when one crosses state borders. Suppose that a state with a policy that is *probusiness* toward manufacturing is adjacent to a state with a policy that is *antibusiness* toward manufacturing. If state policies are an important determinant of the location of manufacturing, one should find an abrupt change in manufacturing activity when one crosses a border at which policy changes, because state characteristics unrelated to policy are the same on both sides of the border.

The paper finds that there is such an abrupt change. I estimate that manufacturing's share of total employment increases by about one-third when one crosses the border from an antibusiness state to a probusiness state. These results suggest that state policies matter.

II. Description of Method and Results

A. *The Measure of State Policy*

I classify a state as *probusiness* if it has a right-to-work law and *antibusiness* if it does not. A right-to-work law bans the union shop, that is, a workplace in which all employees are required to join the union. I focus on this crude, but easy to calculate, measure of state policy for two reasons. One is that a right-to-work law is a policy that has some appeal to manufacturers because a right-to-work law weakens unions.[1] The other is that the same forces in a state that lead to the passage of right-to-work laws also lead to the adoption of other policies favorable to manufacturing. This point is developed further below.

Florida and Arkansas passed the first right-to-work laws in 1944. Figure 1 shows which states have these laws today. With three exceptions, the map as it looks today was in place by 1958.[2] The geography of these laws is striking. No state in the traditional *manufacturing belt*

[1] A right-to-work law creates a free-rider problem among employees. Ellwood and Fine (1987) and Ichniowski and Zax (1991) present evidence that right-to-work laws have a small negative effect on unionization. There is great controversy in the literature as to how big these effects are. See Moore and Newman (1985) for a survey. Business and union interests have fought at great lengths about these laws, which suggests that the laws make some difference (see Gall 1988).

[2] The three exceptions are as follows: in 1965, Indiana repealed the right-to-work law it had passed in 1957; Louisiana passed its right-to-work law in 1976; and Idaho passed its law in 1986.

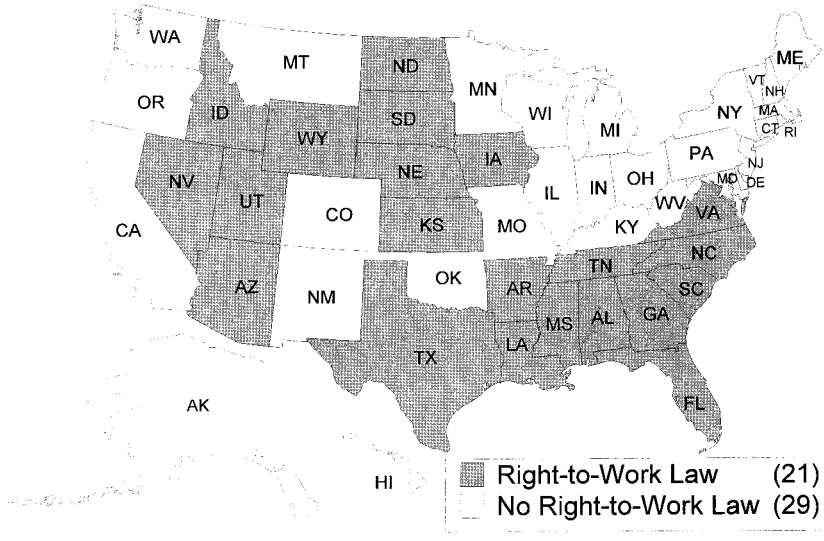

FIG. 1.—Geography of right-to-work laws

(the New England, mid-Atlantic, and Great Lakes states) has a right-to-work law. Every southern state that joined the Confederacy has one. Most of the Plains states west of the manufacturing belt (e.g., North and South Dakota) have these laws.

There are some remarkable facts about what has happened to manufacturing in the right-to-work states over the postwar period. Manufacturing employment in the states without right-to-work laws is virtually the same today as it was in 1947. In the right-to-work states, manufacturing employment has increased 150 percent. Eight of the 10 states with the highest manufacturing employment growth rates are right-to-work states. All 10 states with the lowest growth rates are not right-to-work states. A regression of state manufacturing growth on a dummy variable for a right-to-work law yields a large coefficient on the dummy variable with a huge *t*-statistic.

The National Right-to-Work Committee, an antiunion lobbying group, reports statistics such as these as supposed proof that right-to-work laws attract manufacturing. Newman (1983) and Plaut and Pluta (1983) run regressions like the one just mentioned and imply that they are learning something about the effects of state policies. These claims ignore a serious identification problem. The right-to-work states systematically differ in a number of geographic characteristics from the non-right-to-work states. The statistics reported above can say very little about the effects of state policy.

B. *The Identification Problem*

In general, it is difficult to distinguish the effects of state policies from the effects of state characteristics that have nothing to do with state policies. This subsection explains why the problem is particularly severe in the case of concern here, that is, in identifying the effects of the policies pursued by the right-to-work states on the location of manufacturing. The subsection then explains how the border analysis resolves the identification problem.

The problem that must be confronted here is that even if state policies had no effect on the location of manufacturing, one would still expect to find a positive correlation between manufacturing growth and right-to-work laws because of the systematic way that right-to-work states differ from non-right-to-work states. This point can be made by considering the following four major forces of change over the postwar period in the location patterns of manufacturing.[3]

The productivity revolution in agriculture.—Because of this revolution, states that had high agricultural employment shares, like those in the South, experienced dramatic increases in manufacturing. But these same states also passed right-to-work laws because there were no strong industrial unions to block their passage.

Revolutions in transportation.—The substitution of trucking for rail transport may have diminished the forces that originally caused manufacturing to agglomerate in the manufacturing belt. As manufacturing has spread out, states that initially had low manufacturing employment shares have increased their manufacturing employment shares. But these were the same states to pass right-to-work laws, again because of the absence of powerful industrial unions.

Union avoidance.—It is widely believed that manufacturers left the North in part to escape unions (see, e.g., Olson 1982). Unions have been weak in the South and continue to be weak for various reasons, most of which probably have little to do with policy. Southerners as a group are perceived to have hostile attitudes toward unions. These attitudes made the South attractive to manufacturers. These attitudes also led to the passage of antiunion statutes such as right-to-work laws.

The advent of air conditioning.—This made the climate in the South relatively more attractive than the climate in the North. Air conditioning played a role in attracting people, and along with this migration of people came a migration of manufacturing activity. Since

[3] See Fuchs (1962) and Wheat (1973) for discussions of these major forces of change.

right-to-work states tend to be in the South, the advent of air conditioning alone would have induced a positive correlation between manufacturing growth and right-to-work status.

To estimate the effects of policy, I need some method that will enable me to control for differences across states in these various characteristics that are unrelated to policy. Traditional approaches to this problem would be difficult to implement. I would need a model of how manufacturing activity depends on geographic characteristics, such as the climate of a location; the fertility of the soil; access to an ocean, river, or lake; the proximity to raw materials; and the attitudes of people toward unions. A particularly difficult issue is how I might handle the possibility of agglomeration economies. Two locations might be identical in natural geographic factors. But because of agglomeration economies, manufacturing might concentrate in one of the locations and not the other.

This paper is able to draw inferences about the effects of state policies by examining what happens at state borders. At state borders, the geographic determinants of the distribution of manufacturing—for example, climate, soil fertility, access to transportation, and the level of agglomeration benefits—are approximately the same on both sides of the border. What differs at the border is policy. To the extent that the probusiness policies pursued by the right-to-work states have been a factor in the migration of industry, there should be an abrupt change in manufacturing activity at the border. In contrast, if the policies make no difference, there should be no abrupt change at the border.

Consider the case of climate. While the average temperature in the South is certainly much higher than in the North, in the border area, the temperature is approximately the same on both sides of the border. To the extent that the economic development of the South has been due to its favorable climate, there should be no abrupt change at the border.

C. The Results

I find evidence that manufacturing activity increases abruptly when one crosses the border from an antibusiness state to a probusiness state. To obtain my estimates, I use data on manufacturing employment levels for counties and classify each county by how far its population centroid is from the border. I find that manufacturing employment in a county as a percentage of total employment in the county increases, on average, by approximately one-third when one crosses the border into the probusiness side.

In addition to examining the levels of industrial activity, I look at

growth rates in manufacturing employment over the postwar period 1947–92. As mentioned earlier, growth in the probusiness states is remarkably higher than in the antibusiness states. I find that there is a sharp difference in growth rates at the borders at which policy changes.

It is important to emphasize that my finding that the manufacturing employment share increases one-third at a state border does not imply that a probusiness policy increases the share by one-third throughout the state. As discussed in Section III, the effects of policy differences far from the border are smaller than the effects close to the border. Hence, the estimate of the effect at the border places an upper bound on the statewide effect of the policy.

It is also important to emphasize that the results reported here identify the overall effect at the border of adopting the set of probusiness policies that have been pursued by the right-to-work states. The results do not identify the contribution of any one policy to this overall effect. In particular, the results do not say what would happen if a state currently without a right-to-work law passed such a law but left all other policies fixed.

D. Right-to-Work States and Probusiness Policies

I use the term *probusiness policy* in a narrow sense in this paper compared with the common usage of the term. I mean it to include only those policies that have a disproportionate effect in attracting manufacturing to a state as opposed to those policies that equally benefit all sectors. In this subsection, I discuss various policies that are probusiness according to my definition, and I argue that states with right-to-work laws have tended to adopt other probusiness policies.

Any policy that weakens unions satisfies my definition of a probusiness policy. The manufacturing sector is more heavily unionized than the rest of the private sector, so laws that weaken unions make a bigger difference in the manufacturing sector. Weak environmental and safety regulations are also probusiness policies, since these regulations tend to be more relevant to the manufacturing sector than to other sectors. Subsidies for the construction of new manufacturing plants and grants of land for these projects obviously satisfy my definition of a probusiness policy.

A low overall tax rate is not a probusiness policy by my definition if all sectors benefit equally from the low tax. However, any low tax that disproportionately benefits manufacturing is probusiness. Low taxes on capital can be expected to favor manufacturing since the

manufacturing sector tends to be more capital-intensive than other sectors.

As mentioned earlier, the same forces that led to the passage of right-to-work laws in right-to-work states have also led to the adoption of other probusiness policies in these states. For at least the past 50 years, the southern states have waged an aggressive campaign to attract manufacturing (see Cobb 1993). In addition to the passage of right-to-work laws, these states have been known for their subsidies for new factories, low taxes on capital, and lax regulations. Most of the states in the Plains region west of the manufacturing belt also passed right-to-work laws. This region is obviously different in many ways from the South. Nevertheless, like the southern states, the Plains states have a reputation for probusiness policies compared with the manufacturing belt states. For example, a study of border cities by the Minnesota Planning Division (1983) reports that a typical business could cut its taxes in half by crossing the border into North Dakota (a right-to-work state) from Minnesota (a non-right-to-work state).

Economists are generally suspicious of published rankings of state business climates. These rankings take crude measures of various state policies and aggregate them in an arbitrary way. Bearing in mind its limitations, in Section VI, I consider a well-known ranking of state business climates constructed by Fantus Consulting. The ranking is based on 15 characteristics of state policy. To a remarkable degree, the states that rank high on this overall index all have right-to-work laws, whereas states that rank low do not have these laws. This illustrates the close connection between adoption of right-to-work laws and adoption of other probusiness policies.

Section VI considers an extension of the analysis that uses the Fantus ranking instead of right-to-work status to classify state policies. I estimate that large differences in the Fantus ranking at state borders are associated with large differences in manufacturing activity at state borders. My finding that this is true at borders at which right-to-work status changes is to be expected from the earlier results since the Fantus ranking is highly correlated with right-to-work status. But there is also a big effect of the Fantus variable at borders at which right-to-work status does not change. The results of this preliminary analysis suggest that other policies besides right-to-work status are playing an important role in accounting for the differences in manufacturing activity at state borders.

Section VI also considers a second extension that looks at the effects of state policies on the size distribution of manufacturing establishments. Probusiness policies can be expected to have a disproportionate impact on large factories. Policies that weaken unions are

more relevant to large establishments since they are more likely to be unionized. Low taxes on capital are more relevant to large establishments since they are more likely to be capital-intensive. The results are consistent with this hypothesis. The fraction of all employment that is in large manufacturing establishments increases abruptly when one crosses the border from an antibusiness state to a probusiness state.

E. Some Relevant Literature

The method of this paper is in the spirit of the recent literature that uses data on identical twins to help resolve hard identification problems (e.g., Ashenfelter and Krueger 1994). There is some precedent in applying these ideas to a geographical context. Isserman and Rephann (1995) study the effects of the Appalachian Regional Commission. They match each county in Appalachia with a *twin* county outside of Appalachia with similar demographic and economic characteristics. The twin counties are viewed as a control group in the empirical analysis. Some authors have previously looked explicitly at state borders. Fox (1986) finds evidence that differences in sales tax rates between neighboring states affect retail sales in border counties. Card and Krueger (1994) consider the New Jersey–Pennsylvania border area to examine the effects of an increase in the minimum wage.

The rest of the paper is organized as follows. Section III is a brief theoretical section that makes a few points about what can happen at state borders. Section IV explains how I handle the geographic nature of the data. Section V is the main section of the paper. It examines what happens to manufacturing activity at the border between probusiness and antibusiness states. Section VI considers two extensions of the analysis. Section VII presents a conclusion.

III. Theoretical Background

Before looking at the data, I find it useful to start with a theoretical model that lays out what can happen at state borders when adjacent states pursue different policies. This section presents a simple model and makes several points that will play a role in the later discussion. For example, this section discusses what an estimate of a policy's effect near the border can say about the policy's effect away from the border.

The economy is a line segment. Locations are indexed by $y \in [-1, 1]$. There are two political jurisdictions, or states, and $y = 0$ is the boundary. The locations with $y \leq 0$ are in a state called the South. The locations with $y > 0$ are in a state called the North. The South

pursues a probusiness policy, and the North pursues an antibusiness policy.

At each location, there is a set of manufacturing entrepreneurs. Assume for now that the entrepreneurs are initially uniformly spread out through the economy. An entrepreneur initially located at a point y chooses whether to set up a factory at his or her initial location y or to set up no plant at all. As explained below, some entrepreneurs may have a third option of building a plant at an alternative location. Let q denote the productivity of a manufacturing entrepreneur. This equals the amount of the final good that is produced if a manufacturing agent of productivity q sets up a plant and employs a worker. Assume that q is uniformly distributed on the unit interval and that the distribution of q is independent of location.

Workers are perfectly mobile and homogeneous. The competitive wage w is constant across locations.

If a manufacturing entrepreneur sets up a factory in a location in the South, the entrepreneur's profit equals his or her productivity q less the competitive wage w paid to the single employee less any moving costs incurred. (Moving costs are described below.) If a manufacturing entrepreneur sets up in the North, an additional cost c is incurred. This cost arises because the North pursues the antibusiness policy. The cost c has a variety of interpretations. It can represent the cost of unions that emerge in the North because of pro-union policies. Alternatively, the cost can arise because of stringent regulations or high taxes in the North.

As mentioned above, some entrepreneurs have the option of moving to an alternative location. With probability p, an entrepreneur initially located at location $y > 0$ in the North has some alternative location $y' < 0$ in the South. Given that an entrepreneur has an alternative location, assume that this location y' is drawn from a uniform distribution over the set of locations $[-1, 0]$ in the South. Finally, assume that the cost of moving from y to y' is $t \cdot (y - y')$, that is, t dollars per unit of distance moved.

This simple formulation captures two intuitive ideas. One is that the farther one moves from his or her initial location, the higher the cost. The other is that an entrepreneur may not have the option of moving to the border point $y' = 0$ in the South to minimize moving costs. The initial location at y may have some specific geographic features that the entrepreneur needs, for example, access to a river or availability of a crucial raw material. The border point $y = 0$ may not have these crucial geographic features, but an interior location $y' < 0$ in the South may have them.

Let $M(y)$ denote the measure of manufacturing employment at location y. Since each factory hires one worker, $M(y)$ equals the mea-

sure of entrepreneurs initially at y who set up plants plus any entrepreneurs who move to y to set up a plant. It is straightforward to calculate $M(y)$, and its shape is illustrated in figure 2*a*. There exists a critical distance $\hat{y}$, defined by $t\hat{y} \equiv c$, such that the cost of moving this distance exactly equals the cost c of the antibusiness policy. Entrepreneurs at locations $y > \hat{y}$ in the North are so far from the border that it would never be worth moving to the South. The measure of manufacturing employment here (denote this m°) equals the measure of entrepreneurs initially there with a productivity level q above $w + c$. The analogous case of $y < -\hat{y}$ is so far in the interior of the South that no entrepreneur would move there. The measure of employment here, m', is the measure of entrepreneurs with productivity above w. Note that m' is higher than m° since the productivity threshold of w on the probusiness side of the border is lower than the productivity threshold of $w + c$ on the antibusiness side.

Now consider $y \in (0, \hat{y})$. Manufacturing entrepreneurs in this region may be lucky enough to obtain locations in the South that are worth moving to, that is, locations at which $t \cdot (y - y') < c$. The lower y is, the closer the initial location is to the border and the higher the probability is that the entrepreneur draws a southern location worth moving to. This accounts for why manufacturing employment $M(y)$ is lower, the lower y is. Right at the border at which the policy changes, there is a discontinuous increase in manufacturing employment as one crosses into the South. As one lowers y further and moves farther south, manufacturing employment $M(y)$ decreases. This follows because as one moves farther away from the border in the South, the pool of entrepreneurs who are willing to pay the moving cost to get there shrinks.

Think of the status quo as a case in which the policies are the same in both states. In particular, suppose that initially both states pursue the same antibusiness policy. In this case, employment equals m° at all locations. This is illustrated by the dotted line in figure 2*a*. Now consider what happens if the South adopts the probusiness policy. In this particular figure, the effect of the policy is very small at locations away from the border since m' is not much bigger than m°. However, the policy change has a big effect at the border, driven by the entrepreneurs initially located just north of the border, who make a small move to the area just south of the border. This example shows that finding a big effect at the border by no means implies that a policy has a big effect far from the border. The effect of a policy may fizzle out to virtually nothing when one moves away from the border.

But it is also possible for the effect of the policy *not* to fizzle out as one moves away from the border, as can be seen in the following

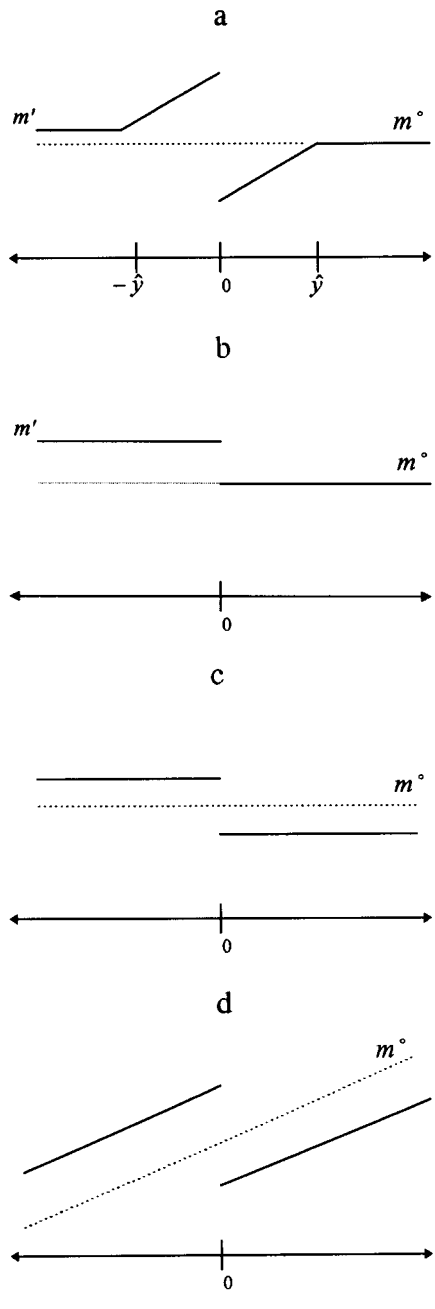

FIG. 2.—*a*, Effect at border fizzles out; *b*, $t = \infty$; *c*, $t = 0$; *d*, trend in manufacturing endowment and $t = 0$.

two examples. Suppose first that $t = \infty$, so that moving costs are infinite. This example is illustrated in figure 2*b*. Without the policy, all locations have employment of m°. If the probusiness policy is adopted in the South, employment in the South increases to m' because the productivity threshold decreases from $w + c$ to w. Employment in the North remains fixed because moving costs are too high for entrepreneurs to move.

In the second example, $t = 0$, so that moving costs are zero. This is illustrated in figure 2*c*. Assume also that c is close to zero. In the status quo, where the South does not adopt the policy, employment is m° everywhere. If the South adopts the policy, employment decreases in the North and increases in the South by virtually the same amount. The policy has virtually no effect on aggregate manufacturing employment since the cost of the policy is negligible. Even though the cost of the policy is negligible, any entrepreneur who has an opportunity to move to the South does so because the moving cost is zero.

Figures 2*b* and 2*c* illustrate that it is not possible to draw welfare conclusions from this border analysis. The two examples look exactly alike. Manufacturing employment is flat in the South, falls discontinuously at the border, and is flat in the North. However, these two examples are very different in terms of the welfare effects of the policy. In the case of figure 2*b*, the adoption of the probusiness policy by the South creates wealth in the South and has no effect in the North. Total employment and total welfare increase. In the case of figure 2*c*, adoption of the policy has a negligible effect on aggregate employment and welfare, but it does affect the distribution of employment.

Suppose that one were interested in determining the effect of the policy at locations far from the border. On the basis of the discussion so far, one might want to look at what happens to manufacturing employment as one moves away from the border. If, as in figure 2*a*, manufacturing employment in the South drops off quickly away from the border, one might think that the effects of the policy away from the border are not large. The final example illustrates that one should be careful about drawing such a conclusion.

Drop the assumption that the initial manufacturing endowments are uniformly distributed across the economy. Assume instead that the initial endowments are such that if policies were the same in the North and the South, the North would have a higher share of manufacturing activity. This is illustrated in figure 2*d*. The dotted line illustrates manufacturing employment in the status quo when the North and the South pursue the same antibusiness policy. In this case, manufacturing employment continuously increases as one moves in the direction of the North.

Suppose that the South adopts the probusiness policy. (One reason it might adopt a different policy from the North is that its manufacturing endowment is different.) Suppose that $t = 0$ as in figure 2*c*. The effect of the probusiness policy will look something like the solid line in figure 2*d*. The policy has a large effect on manufacturing activity at locations far from the border. However, the pattern near the border looks the same as in figure 2*a*, where the effects far from the border are small. So, one has to be careful not to confuse figure 2*a* with figure 2*d*. In principle, it might be possible to distinguish figure 2*a* from figure 2*d* by looking for the kinks $\hat{y}$ and $-\hat{y}$ in figure 2*a*. However, this would certainly be a tricky business, and I do not try to do it here.

In the empirical analysis, I shall look at what happens to manufacturing employment as a share of total employment. To tie the empirical work to the model, consider an extension of the model to allow for the existence of *service* entrepreneurs who are similar to the manufacturing entrepreneurs already described, with one difference: service entrepreneurs do not pay the cost c of the antibusiness policy in the North. The motivation for why state policies might have different effects for manufacturing and services is discussed in Section II*D*. Under the assumption that service entrepreneurs do not pay c, the differences in state policies will not affect the distribution of service employment. Suppose that I look at manufacturing's share of total employment (i.e., manufacturing plus services) and plot this as a function of distance from the border. Manufacturing's share as a function of distance from the border will be similar in shape to the plots in figures 2*a*–2*d*.

On the basis of the discussion in this section, I can draw several conclusions. First, if the policy makes a difference for manufacturing activity (i.e., if $c > 0$) but not for service activity, then there will be a discontinuous jump in manufacturing's share of total employment when one crosses the border into the probusiness state. Second, it is difficult to determine the effect of the policy far away from the border on the basis of what one sees close to the border. What I can say is that an estimate of the effect at the border places an upper bound on the effect far from the border. Third, it is difficult to draw welfare conclusions. Even if there is a large change in manufacturing activity at the border, the welfare effects of the policy might be small.

IV. The Treatment of the Geographic Data

This section describes the treatment of the geographic data. I start with a few definitions. States that currently have right- to-work laws (see fig. 1) are *probusiness* states, and those that do not are *antibusi-*

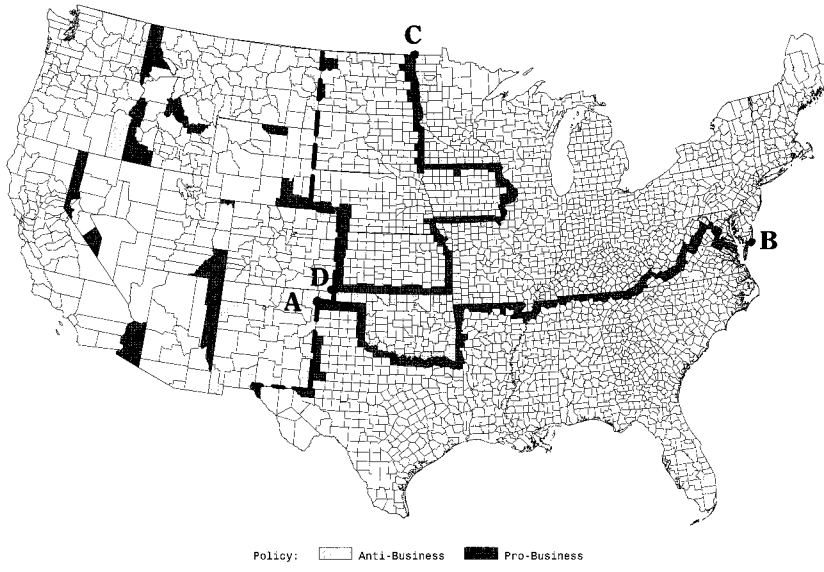

FIG. 3.—Counties within 25 miles of the policy change border

ness states. The *policy change border* is the set of state borders that separate probusiness states from antibusiness states.

The county is the geographic unit for this analysis. The county offers the finest level of detail for which comprehensive Census Bureau data are available. Figure 3 depicts the boundary lines of the 3,078 counties of the 48 contiguous states.[4]

I obtained the longitude and latitude coordinates of the population centroid of each county. Using these geographic coordinates, I calculated the minimum distance from the population centroid of the county to the policy change border and called this variable mindist_i. Figure 3 illustrates all the counties that are within 25 miles of the border, that is, the counties for which $\text{mindist}_i \leq 25$. Those on the probusiness side are dark gray, and those on the antibusiness side are light gray.

In Figure 3, a dashed line separates the western states (Montana, Wyoming, Colorado, New Mexico, and the states farther west) from the rest of the country. If one looks east of this dashed line, the counties 25 miles from the border nicely trace out the policy change border. These counties form a strip of land on both sides of the

[4] My definition of counties follows the Regional Economic Information System Program of the Bureau of Economic Analysis. This definition of counties merges the independent cities of Virginia into the counties that surround them. This makes the county structure in Virginia more like the structure in other states.

border of fairly uniform width. In contrast, the counties in the West that are 25 miles from the border make up what looks to be an odd assortment of counties. The reason for this difference is that counties in the West are so much bigger than counties outside of the West. Many counties in the West are larger than the state of New Jersey.

For most of the results I report in this paper, I exclude the western states from the analysis. My main reason for doing so is the large size of the counties in these states. A key step in my method is to accurately measure the distance of observed manufacturing activity from the policy change border. The coarseness of the geographic information in the western states makes accurate measurements of distance relatively difficult to make. A second reason is that by excluding the West, I avoid the awkward issue of how to classify Idaho, a state that only recently passed its right-to-work law (in 1986). Outside of the West, all states along the policy change border have had the same right-to-work policy since 1958. A third reason is that many of the counties in the western states are sparsely populated. There is likely to be a lot of noise in data from sparsely populated counties.

While the western states are excluded in the main analysis, I have redone the analysis with the western states included, and the estimates do not change much. This is discussed at the end of Section V.

Henceforth, exclude the states west of the dashed line. In the remaining states, the policy change border has two segments. Segment 1 begins at point *A*, at the western end of the Oklahoma-Texas border, and ends at point *B*, where the Maryland-Virginia border meets the Atlantic Ocean. I obtained the geographic coordinates of the line segments that make up this border. I mapped out the border and determined mile markers along the border analogous to something one might find on a highway. For example, the mile marker is zero at point *A*. The mile marker is 716 at the point at which the Oklahoma-Texas border ends and the Oklahoma-Arkansas border begins. The mile marker is 2,386 at the point at which segment 1 ends at the Atlantic Ocean.

Segment 2 of the policy change border begins at point *C*, where the Minnesota–North Dakota border intersects the boundary with Canada. It ends at point *D*, at the western end of the Oklahoma-Kansas border. Segment 2 is 1,891 miles long.

As discussed earlier, I determined the minimum distance, mindist_i, of county i to the policy change border. I also kept track of the mile marker along the policy change border at which the minimum distance was attained. The geography of the actual policy change border is somewhat complicated because the border curves and bends. I found it useful to map the geographic information into a

space in which the border is a straight line. Define two variables, y_i and x_i, for each county i. Set the absolute value of y_i equal to the distance between the center of the county and the border. Let y_i be positive if the county is in an antibusiness state, and negative otherwise. Formally, if county i is in an antibusiness state, then $y_i = \text{mindist}_i$; if county i is in a probusiness state, then $y_i = -\text{mindist}_i$. The variable x_i is defined to be the point along the policy change border at which the minimum distance to the border is obtained. The point x_i specifies both the segment number and the mile marker of the closest point along the border. This procedure maps the complicated geographic data of the counties into a Cartesian space, where the policy change border is defined by the straight line $y = 0$. The counties with positive y are in the antibusiness region. The counties with negative y are in the probusiness region. The variable x provides a lateral dimension. A change in x at $y = 0$ is a movement along the policy change border.

V. The Effect on Manufacturing Activity

I now address the main question of this paper. Is there an abrupt change in manufacturing activity at the border at which policy changes?

Two measures of manufacturing activity are considered. One measure is manufacturing employment in a county as a percentage of total private nonagricultural employment in the county. The use of this measure is discussed at the end of Section III. I focus on the data from 1992, the most recent available when I began this project, but I also consider other years. I use County Business Patterns (CBP) data as well as data from the *Census of Manufactures*.[5] In the 1992 CBP data, employment of all U.S. manufacturing establishments is 18.2 million, and this represents 19.6 percent of total private employment that year.

The other measure is the growth rate in manufacturing employment over the postwar period from 1947 to 1992. I focus on the postwar period because this is the period during which the South made its great gains in economic development. The year 1947 also happens to be the year of the Taft-Hartley Act, which made it legal for states to enforce right-to-work laws, and states began passing these laws around that time. The growth rate in county i is defined as

[5] In a few cases, the employment figure for a particular county is withheld. In these cases, I use CBP data on cell counts of establishments by finely detailed employment size classes to estimate county employment.

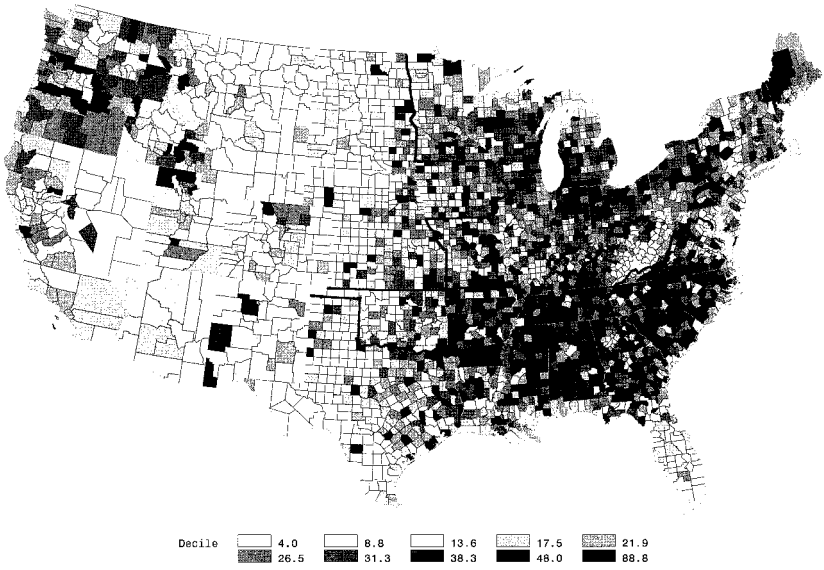

FIG. 4.—Distribution of 1992 manufacturing shares: county deciles

$$\text{growth}_i = 100 \times \frac{\text{emp}_{i,92} - \text{emp}_{i,47}}{.5\text{emp}_{i,47} + .5\text{emp}_{i,92}}, \quad (1)$$

where $\text{emp}_{i,47}$ and $\text{emp}_{i,92}$ are the levels of manufacturing employment. This measure of growth has a maximum value of 200, which is attained if a county had no employment in 1947 and positive employment in 1992. Analogously, the minimum value is -200. I choose this measure of growth because otherwise some counties would have infinite growth rates. Over the period from 1947 to 1992, total U.S. manufacturing employment grew at a rate of 24 percent as defined in equation (1).

Before I begin the statistical analysis, it is useful to look at a picture. Figure 4 illustrates the geographic distribution of the county manufacturing share deciles. The number to the right of the boxes at the bottom is the top share in the decile. For example, the first decile of counties consists of the counties with manufacturing shares between zero and 4.0. The counties in the first decile are indicated in white. The tenth decile consists of counties with shares between 48.0 and 88.8. They are indicated in black. The intermediate deciles are indicated by intermediate shades of gray. The two segments of the policy change border are noted in black, with the exception of the part of the border that involves Arkansas and Tennessee, where I use white to denote state borders.

A striking thing about figure 4 is the extent to which the top-decile counties (the ones marked in black) are concentrated in the South. Large sections of states such as Tennessee and Mississippi are marked in black. Consider segment 1 of the policy change border—the border that coincides with the border of the Confederacy. Begin with the Arkansas-Oklahoma portion of this border and head east along the northern border of Arkansas, Tennessee, and Virginia. It is clear in the figure that the counties on the probusiness side of this portion of the border tend to have higher manufacturing shares than the counties on the antibusiness side. But is the increase in manufacturing activity gradual from one region to the other, or is there an abrupt change at the border? It is hard to say. On one hand, to a striking extent, the shares begin to get high approximately at the border. The dark shades of gray in Arkansas appear to trace out the borders of Arkansas with Oklahoma and Missouri. (Even the heel of the boot in the southeastern corner of Missouri is visible.) On the other hand, at some places, the high manufacturing shares spill over into the antibusiness side of the border, as they do in parts of the Kentucky-Tennessee border. Of course, some noise is to be expected. The advantage of the statistical analysis to follow is that some of this noise can be averaged out.

Now consider segment 2 of the policy change border, the segment separating the Plains states from the industrial states of the Midwest. It is hard to pick up anything here at the border with the naked eye (with the exception, perhaps, of the relatively high frequency of first-decile counties in the Minnesota border area with the Dakotas).

One last comment about figure 4 concerns the white (i.e., first-decile) region in Kentucky and West Virginia near the border with Virginia. One of the main industries in this region is coal mining. There is a discontinuity in nature in terms of mountains and coal veins that coincides with state boundaries. Even if state policies made no difference, one would expect manufacturing shares to decline when one crosses the border into Kentucky and West Virginia, since the employment share in mining goes up. Therefore, in the statistical analysis to follow, I shall, for the most part, exclude the Kentucky-Virginia border and the West Virginia–Virginia border.

The statistical analysis is divided into two parts. The first part looks at some simple cross-tabulations of the data. The second part estimates a simple statistical model.

A. Cross-Tabulations of the Data

I begin by defining groups of counties on the basis of how far the counties are from the border and which side of the border they are

on. Let the *antibusiness border layer* be the set of counties with $y_i \in (0, 25]$. In words, these are the counties in antibusiness states (since $y > 0$) that are within 25 miles of the policy change border (since $y_i \leq 25$). These counties are illustrated in figure 3 in light gray. There are 151 counties in this set. Note that this count does not include counties in the western states. The *probusiness border layer* is the set of counties with $y_i \in [-25, 0)$. There are 174 counties in this layer. I also define interior layers three deep on each side of the border. For example, for the antibusiness counties, the *first interior layer* consists of those counties in which the center is 25–50 miles from the border; that is, $y_i \in (25, 50]$. The *second interior layer* consists of those with $y_i \in (50, 75]$. The *third interior layer* consists of those with $y_i \in (75, 100]$. Analogously, there are three interior layers on the probusiness side. The number of counties in each of the six interior layers ranges from a low of 116 counties for the third antibusiness interior layer to a high of 149 counties for the first probusiness interior layer.

For each county, I determined the manufacturing share of total employment in the county and the manufacturing employment growth rate from 1947 to 1992. I then calculated simple unweighted means across counties. Column 1 of table 1 reports the mean cross-county share for the various border layers. Column 2 reports the mean cross-county growth. Columns 3 and 4 report the means when the coal region discussed earlier is excluded (i.e., the Kentucky-Virginia border and the West Virginia–Virginia border).

I begin the discussion by focusing on the border layers. Panel A presents the means for the antibusiness border layer and panel B the means for the probusiness border layer. The table shows that there are substantial differences in the mean shares between the two border layers. With the coal region included, the mean share is 21.0 percent on the antibusiness side and 28.6 percent on the probusiness side. With the coal region excluded, the shares are 22.1 on the antibusiness side and 27.9 on the probusiness side. In the remaining tables of this section, I exclude the coal region. As one might expect, all the estimates of differences at the border are bigger if I leave the coal region in.

Table 1 indicates that there is also a difference in the growth rates at the border. With the coal region included, the mean growth rate in the antibusiness border is 62.4. Just on the other side of the border, the mean growth rate is 100.7. These differences remain, even when the coal region is excluded.

To help assess the significance of the differences in the manufacturing shares and growth rates between the border layers, it is useful to consider how these variables change as one moves across the inte-

TABLE 1

MANUFACTURING EMPLOYMENT SHARES AND GROWTH RATES: CROSS-COUNTY AVERAGES BY DISTANCE FROM BORDER AND SIDE OF BORDER

	Coal Region Included		Coal Region Excluded	
Miles from Border	Share of 1992 Total (1)	Growth Rate, 1947–92 (2)	Share of 1992 Total (3)	Growth Rate, 1947–92 (4)
	A. Antibusiness Side of Border			
75–100	25.9	67.5	25.0	68.2
50–75	23.1	62.7	25.0	80.9
25–50	23.2	82.0	24.7	88.8
0–25	21.0	62.4	22.1	77.2
	B. Probusiness Side of Border			
0–25	28.6	100.7	27.9	104.2
25–50	26.7	89.1	25.5	88.3
50–75	26.7	92.9	24.5	90.1
75–100	25.4	91.8	23.1	93.5

rior of the probusiness side and the interior of the antibusiness side. Suppose that one were to start at the probusiness layer 75–100 miles from the border (call this pro:75–100). Consider a move into the adjacent layer 50–75 miles from the border (pro:50–75). The manufacturing share goes from 23.1 at pro:75–100 to 24.5 at pro:50–75, a change in share of 1.4. (I am using the data that exclude the coal region here.) The change in share of 1.4 from this movement is given in the last row of table 2. Analogously, if one moves from pro:50–75 to pro:25–50, the share increases from 24.5 to 25.5, an in-

TABLE 2

TESTS OF EQUALITY OF MEANS OF ADJACENT LAYERS (Coal Region Excluded)

	Share		Growth Rate	
Adjacent County Layers	Change in Mean (1)	*p*-Value for Test of Equality (2)	Change in Mean (3)	*p*-Value for Test of Equality (4)
Anti:50–75 → anti:75–100	.0	.975	12.7	.259
Anti:25–50 → anti:50–75	.3	.880	−7.9	.463
Anti:0–25 → anti:25–50	2.6	.185	11.6	.283
Pro:0–25 → anti:0–25	−5.8	.003	−27.0	.008
Pro:25–50 → pro:0–25	2.4	.217	15.9	.104
Pro:50–75 → pro:25–50	1.0	.620	−1.8	.863
Pro:75–100 → pro:50–75	1.4	.517	−3.4	.742

crease of 1.0. The next step to the border layer pro:0–25 increases the share by 2.4. So far, all the movement has occurred within the probusiness side. In the next step, one crosses the border into anti:0–25, and the share drops by 5.8. Once one is on the antibusiness side, the share starts going back up again as one crosses adjacent layers, with the changes equaling 2.6, 0.3, and 0.

There is an interesting pattern here: the share goes up gradually with a movement in the direction of the antibusiness layer, except for the big drop at the border. This pattern looks like what happens in figure 2*a* in the theoretical model and also like figure 2*d*. While this is intriguing, I want to put off for the moment what to make of this particular pattern. At this point, I am interested in establishing that the difference at the border is big in absolute value compared with the differences found in the interior. That is, the change in the share at the border is *abrupt* compared with the changes in the share within the interior. One way to make this point is to simply observe that the difference in share at the border of 5.8 is more than twice as large in absolute value as the differences of any of the other adjacent pairs. (The next highest is 2.6.) Another way to make the point is to use simple statistical methods. Consider a series of pairwise *t*-tests of null hypotheses that particular adjacent layers are drawn from the same distribution. Column 2 of table 2 gives the *p*-values for tests of these null hypotheses. For example, for the pro:75–100 and pro:50–75 adjacent layers, the *p*-value is .517; that is, under the null hypothesis of equality, with probability .517, the difference in means would be bigger in absolute value than the observed difference. The null hypothesis of equality cannot be rejected in this case. In contrast, the *p*-value for the adjacent border layers is .003, which is highly significant. What happens at the border sticks out as being very different from what happens between the other adjacent layers.

Similar results are obtained for the growth rate. Table 1 shows that the average growth rate is 104.2 percent for the probusiness border layer and 77.2 percent for the antibusiness border layer. This difference is bigger in absolute value than the differences of all the other adjacent layers. This difference is statistically significant (with a *p*-value of .008), and none of the other differences in growth rates between adjacent layers is statistically significant.

The results so far suggest that, on average, there is an abrupt increase in manufacturing shares and growth rates when one crosses the border into probusiness states. A natural question to ask is whether this difference is occurring throughout the policy change border. Or is it just happening for a few particular states?

Table 3 is a first step at addressing this issue. It is the same as table 1, except that it provides a breakdown by the two segments of the

TABLE 3

MANUFACTURING EMPLOYMENT SHARES AND GROWTH RATES BY SEGMENT AND DISTANCE FROM BORDER

MILES FROM BORDER	1992 SHARE		1947–92 GROWTH	
	Segment 1: Confederacy Border* (1)	Segment 2: Plains States Border (2)	Segment 1: Confederacy Border* (3)	Segment 2: Plains States Border (4)
	A. Antibusiness Side of Border			
75–100	25.4	24.4	75.9	58.3
50–75	23.0	26.7	97.7	67.5
25–50	28.5	21.1	101.8	76.5
0–25	26.6	17.7	99.1	54.7
	B. Probusiness Side of Border			
0–25	32.3	23.2	104.5	104.0
25–50	30.4	20.3	85.8	91.0
50–75	28.3	19.7	88.8	91.7
75–100	28.5	17.1	97.7	89.1

* Excludes coal region.

policy change border. That is, it distinguishes between counties that are closest to segment 1 (the border segment that coincides with the border between the Confederacy and the Union) and counties that are closest to segment 2 (the border segment separating the Plains states from the Midwest industrial states).

Consider first what happens to the manufacturing share. Table 3 shows that the big change in the manufacturing share that I found with the combined data occurs in each of the separate segments. For both segments, manufacturing shares increase by about 5.5 when one crosses the border into the probusiness side.

Notice that for the manufacturing shares of segment 2, with the exception of the big drop at the border, there is a strong upward trend as one moves up the column. This upward trend is not surprising. A movement up the column is a movement away from states such as North and South Dakota to industrial states such as Minnesota, Wisconsin, and Illinois. If state policies had no effect on business location, I would expect, a priori, to find manufacturing shares gradually increasing with a movement away from the Great Plains toward the industrial heartland. If state policies did have an effect on location, I might expect the share to gradually trend upward, then fall at the border, and then gradually trend upward again, as in figure 2*d* from the theoretical model. So the model in figure 2*d* is one explanation for what is happening along segment 2.

As discussed in the theoretical section, there is another reason the share might trend upward with a movement across the border into the antibusiness side. This reason is that the effects of the policy may fizzle out as one moves away from the border. This is what happens in the model illustrated in figure 2*a*. So, in correspondence with figures 2*a* and 2*d*, I have two explanations for the trend found at segment 2: the effects of the policy fizzle out and the underlying geographic suitability for manufacturing gradually increases. The merits of these two explanations are hard to sort out, and I am not going to do so in this paper, except to make the following observation. The policy fizzling out model alone cannot account for the pattern in segment 2. In the policy fizzling out model illustrated in figure 2*a*, the manufacturing share far into the interior of the probusiness side is at least as high as the share far into the interior of the antibusiness side. But in the data for segment 2, the shares in the interior of the probusiness side of 19.7 and 17.1 are much lower than the shares of 24.4 and 26.7 in the interior of the antibusiness side. This suggests that some underlying trend in nonpolicy geographic factors plays some role in accounting for why the manufacturing share trends upward in segment 2 as one moves toward the antibusiness states.

Now consider what happens with the growth rates for the two segments. In segment 1, the average growth rate of the border layer is 104.5, and this is the highest growth rate over all the different layers. However, this is only negligibly higher than the average growth rate of the antibusiness layer. Hence, there is little difference at the border for segment 1. The story is very different for segment 2. There is a marked difference in average growth between the border layers: 54.7 on the antibusiness side and 104.0 on the probusiness side. But, in addition, the average growth rates of all the layers on the antibusiness side are quite small, whereas the growth rates of all the layers on the probusiness side are quite big. Something fundamental seems to be changing at the border here.

Table 4 takes a further step at examining the extent to which the effects found on the border as a whole are true for individual portions of the border. In this table, the policy change border is broken down into pairings of individual probusiness states with individual antibusiness states. Texas and Oklahoma are the first pairing, Arkansas and Oklahoma are the second pairing, and so forth. There are 17 pairs of individual states.[6] For each pair of bordering states, I calculated the mean share and growth for the counties in the border

[6] For the purposes of this table, the District of Columbia is combined with Maryland.

TABLE 4

MANUFACTURING EMPLOYMENT SHARES AND GROWTH RATES BY INDIVIDUAL BORDERS

BORDER STATES		1992 SHARE		GROWTH RATE, 1947–92	
Probusiness	Antibusiness	Probusiness (1)	Antibusiness (2)	Probusiness (3)	Antibusiness (4)
Texas	Oklahoma	17.3	16.1	**29**	**54**
Arkansas	Oklahoma	43.5	27.6	**132**	**144**
Arkansas	Missouri	40.7	30.1	158	125
Tennessee	Missouri	47.8	39.3	100	78
Tennessee	Kentucky	48.4	38.7	142	122
Virginia	Kentucky	17.7	3.4	143	−55
Virginia	West Virginia	31.7	20.1	59	5
Virginia	Maryland	16.3	8.5	89	84
North Dakota	Minnesota	16.2	6.3	137	20
South Dakota	Minnesota	16.2	11.1	138	27
Iowa	Minnesota	28.5	25.1	130	85
Iowa	Wisconsin	**29.9**	**30.2**	109	103
Iowa	Illinois	33.6	23.1	73	13
Iowa	Missouri	25.2	16.7	**121**	**122**
Nebraska	Missouri	13.8	10.0	**69**	**167**
Kansas	Missouri	**21.1**	**22.6**	**78**	**96**
Kansas	Oklahoma	19.5	11.2	80	−12

layers (the counties 25 miles from the border). Recall that over the entire border, the average share on the probusiness side is 28.6 and the average share on the antibusiness side is 21.0. Columns 1 and 2 of table 4 indicate that the share on the probusiness side is bigger than on the antibusiness side for virtually all the states along the border. There are only two exceptions out of the 17 pairwise comparisons (the numbers are printed in boldface). But in these two exceptions, the difference in shares between the bordering states is essentially zero. This table indicates that to a striking degree, the increase in manufacturing share on the probusiness side can be found throughout the policy change border.

Columns 3 and 4 look at average growth rates for each of the border state pairs. The results here are not quite as impressive as those for shares. Still, the growth rate is lower on the probusiness side in only five out of the 17 cases. The table indicates that the increase in growth on the probusiness side is widespread throughout the policy change border.

B. A Simple Statistical Model

Table 4 shows that there are big changes in manufacturing shares as one moves *along* the policy change border, in addition to the changes that occur as one moves *across* the policy change border. On one hand, along the Texas-Oklahoma portion of the border, the shares are relatively low on both sides: 17.3 and 16.1. On the other hand, along the Tennessee-Kentucky portion of the border, the shares on both sides are relatively high: 48.4 and 38.7. This is also clearly evident in figure 3. This suggests that it might be useful to consider a statistical model that allows for the expected employment share in a county to vary *along* the border as well as *across* the border. This subsection considers such a model.

Suppose that the observed manufacturing share in county i in 1992 is represented by

$$\text{share}_i = \theta \text{probusinessdum}_i + \alpha(x_i) + \beta(x_i) y_i + \epsilon_i. \qquad (2)$$

The variable probusinessdum_i is a dummy variable that equals one if county i is in a probusiness state and equals zero otherwise. The parameter θ is the effect of the probusiness policy on the manufacturing share. The functions $\alpha(\cdot)$ and $\beta(\cdot)$ are general continuous functions of x that allow manufacturing shares to vary across space in a general way. The variable ϵ_i is a classical measurement error.

To understand equation (2), consider the null hypothesis that state policies do not matter, that is, $\theta = 0$. Under equation (2), the expected share at a point along the border (i.e., $y = 0$) with mile

marker x is given by the general function $\alpha(x)$. The expected share at a point away from the border is obtained by adding the trend term $\beta(x)y$ to $\alpha(x)$. Note the dichotomy here. If at $y = 0$ one moves in the x direction, the expected share varies in a general nonlinear way through $\alpha(x)$. If one moves in the y direction, the share varies in a linear way with slope $\beta(x)$. My motivation for this dichotomy is that movements in the y direction will be relatively small in the analysis: at most, 100 miles either way. Hence, a first-order (i.e., linear) approximation may be reasonable here. However, the movements in the x direction will cover a distance of 4,000 miles, so a first-order approximation would not be reasonable.

According to equation (2), the manufacturing share varies in a continuous and fairly general way across space with a discontinuous change of θ when one crosses the border into the probusiness side. My goal here is to estimate θ. To do so, I approximate the function $\alpha(\cdot)$ with a fourth-degree polynomial along border segment 1 and a second, different, fourth-degree polynomial along border segment 2. I do not report my estimates of the parameters of the $\alpha(\cdot)$ function because these parameters are of little interest in themselves. I consider four specifications for the trend function $\beta(\cdot)$. The first specification is no trend; that is, $\beta(x) = 0$ for all x. The second specification is a constant for the entire border; that is, $\beta(x) = \beta_0$ for all x. The third specification is a constant trend $\beta(x) = \beta_1$ for all x along segment 1 and a different constant trend, $\beta(x) = \beta_2$ for all x, along segment 2. The fourth specification is to allow $\beta(x)$ to be a different fourth-degree polynomial for each segment, analogous to what I do for $\alpha(x)$.

Panel A of table 5 presents the ordinary least squares estimates of θ for each of these four specifications. I restrict attention to counties within 100 miles of the border ($y \in [-100, 100]$). In specification 1 with no trend, the estimate of θ is 3.4 with a standard error of 0.9. In specification 2, which allows for a constant trend, the estimate of θ rises to 6.4 with a standard error of 1.6, and the estimate for this constant trend β_0 is 0.03. Given the existence of a positive trend, it is easy to see why the estimate of θ is higher in specification 2 than in specification 1. If there is a positive trend (but I do not allow for it), then my estimate of θ will be biased downward because locations on the probusiness side have low (negative) y's. Specification 3 allows a different constant trend for the two segments of the border. There is a large positive trend for segment 2 ($\beta_2 = 0.08$), the Plains states border. This is consistent with the earlier discussion of what happened in the cross-tabulation in table 3 for this border. Note that the estimated trend for segment 1 (the Confederacy border) is essentially zero. Specification 4 allows for the trend to vary in a gen-

TABLE 5

STATISTICAL MODEL

Parameter	Specification 1: No Trend, $\beta(x) = 0$ (1)	Specification 2: Constant Trend, $\beta(x) = \beta_0$ (2)	Specification 3: Different Constant for Each Segment, $\beta(x) \in \{\beta_1, \beta_2\}$ (3)	Specification 4: Trend $\beta(x)$ a General Function of x (4)
	A. County Manufacturing Shares* ($N = 951$)			
θ	3.4	6.4	6.5	6.6
	(.9)	(1.6)	(1.6)	(1.6)
β_0	...	.03	...	...
		(.01)		
β_1	...	...	−.01	...
			(.02)	
β_2	...	...	.08	...
			(.02)	
R^2	.306	.310	.330	.350
	B. County Growth Rates* ($N = 892$)			
θ	19.1	21.2	21.2	23.1
	(5.0)	(9.4)	(9.4)	(9.2)
β_0	...	.02	...	...
		(.09)		
β_1	...	...	.08	...
			(.10)	
β_2	...	...	−.04	...
			(.10)	
R^2	.118	.118	.120	.161

* Excludes coal region.

eral way, and the estimate of θ of 6.6 is approximately the same as in specifications 2 and 3. In conclusion, the results with this statistical model indicate that when one crosses the border into the probusiness side, the average increase in manufacturing share is approximately 6.6. This is an increase of about one-third since the average share is approximately 20 percent. This is similar to the difference found in the cross-tabulation in table 1. This difference has a *t*-statistic of over four, which has a high degree of statistical significance.

I considered a statistical model of county growth rates of the same form as (2), and the estimates of θ for the growth rates are in panel B of table 5. The estimates of θ are similar across the four specifications. The estimate of θ for specification 4, the most general case, is 23.1; that is, the expected manufacturing employment growth rate increases by 23.1 when one crosses into the probusiness side.

To place some perspective on these estimates of the shift parameter θ, I conducted a simple experiment. I considered a set of counties

TABLE 6

STATISTICAL MODEL: ESTIMATES OF SHIFT PARAMETER θ FOR SIMULATED BORDERS, COUNTIES 50 MILES ABOVE AND BELOW SIMULATED BORDER

Location of Simulated Border	1992 Share	1947–92 Growth Rate
$y = 100$	−.0	−20.9
	(2.7)	(15.8)
$y = 75$	1.8	−4.6
	(2.7)	(15.3)
$y = 50$	1.1	6.1
	(2.5)	(14.4)
$y = 0$ (true border)	9.1	39.9
	(2.1)	(13.0)
$y = -50$	−.9	4.4
	(2.2)	(12.9)
$y = -75$	−1.4	2.3
	(2.4)	(14.6)
$y = -100$	−3.3	−15.1
	(2.4)	(14.8)

all drawn from the same side of the policy change border. Within this set of counties, I made up a simulated border and estimated the statistical model (2). In order to be able to look at a variety of simulated borders, I estimated the model for counties 50 miles above and below the border. Table 6 reports the results of this exercise.

The fourth row reports the case in which the simulated border is $y = 0$. This is the case in which the simulated border coincides with the actual border. The estimate of θ for manufacturing shares is 9.1 and for growth is 39.9. (I estimated the model under specification 4, where $\beta(x)$ is a general function.) These estimates are different from the estimates of θ in table 5 because here only counties within 50 miles of the border are included, whereas in table 5, counties up to 100 miles from the border are included. Nevertheless, the qualitative story is the same. At the actual border, there are big changes in manufacturing shares and growth rates that are highly statistically significant.

Now consider the row labeled $y = 50$. For this row, counties with y between zero and 100 were considered. All these counties are actually on the antibusiness side. But I estimated the statistical model using $y = 50$ as a simulated border; that is, y's between zero and 50 were treated as though they were probusiness, and y's between 50 and 100 were treated as antibusiness. The estimate for θ is 1.1 for the case of shares and 6.1 for the case of growth. Both of these figures are small and not statistically significant. The same can be said for the estimates of θ for the other simulated borders: the estimates are

TABLE 7

ESTIMATES OF SHIFT PARAMETER θ FOR ALTERNATIVE SPECIFICATIONS AND YEARS
(Excludes Coal Region)

	Estimate of θ	Observations
Share of 1992 employment (baseline case)	6.6 (1.6)	951
Share of population:		
1992	2.5 (.6)	951
1987	2.0 (.5)	951
1982	1.8 (.6)	951
1972	1.2 (.6)	723
1963	1.3 (.5)	917
1954	.9 (.5)	901
1947	.4 (.4)	895
Manufacturing employment growth:		
1947–92 (baseline)	23.1 (9.2)	892
1963–92	13.9 (8.6)	915
1982–92	11.1 (6.0)	948
Includes western states:		
1992 share	5.7 (1.3)	1,256
1947–92 growth	19.6 (9.2)	1,135

much smaller than those obtained at the true border, and the estimates are not statistically significant. Table 6 indicates that there is something special about the policy change border.

I conclude this section by discussing what happens when data from other years are considered and when the western states that so far have been excluded are incorporated into the analysis. Table 7 presents estimates for the shift parameter θ for these cases. For all these cases, the $\beta(\cdot)$ function is allowed to take the general form corresponding to specification 4 above. As in table 5, counties within 100 miles of the border are included. The first row of table 7 is the baseline case from table 5 for the effect on the 1992 manufacturing share. The estimate indicates that the average 1992 manufacturing share increases by 6.6 when one crosses the border into the probusiness side.

Data on manufacturing employment at the county level are available from the *Census of Manufactures* for a variety of years. However, I ran into problems collecting county-level data on total employment prior to 1964.[7] So, for this discussion, I look at manufacturing employment as a percentage of county population rather than total employment. Table 7 reports that the average 1992 manufacturing employment as a percentage of population increases by 2.5 when one crosses the border into the probusiness side. When I take into account that the 1992 U.S. population was 2.7 times total employment from the CBP data and that $2.5 \times 2.7 = 6.75$, this estimate of 2.5 percent of the total population is consistent with the previous estimate of 6.6 percent of total employment.

Table 7 reports the estimate of θ for various other census years before 1992. The estimate for 1947 is 0.4. Given the standard error of 0.4, this is not significantly different from zero in a statistical sense. Therefore, as of the beginning of the postwar period, there was not much of a difference at the border. The estimate for 1963 is 1.3, and this is significantly different from zero in a statistical sense. The estimate for 1987 is 2.0. It is interesting that the difference has grown from 2.0 to 2.5 over the period from 1987 to 1992. This suggests that there might be more at work here than the effects of right-to-work laws passed in the 1950s.

Table 7 also includes the results when all the western states are included in the analysis. Recall that I earlier excluded these states because the counties are so large and because Idaho changed its policy status in 1985. Table 7 shows that including these states makes little difference. The estimate of 5.7 on the effect on the manufacturing share is just a little below the estimate of 6.6 obtained when the western states are excluded.

VI. Two Extensions

This section considers two extensions of the analysis. One extension considers an alternative measure of policy. The other extension considers an alternative measure of industrial composition.

A. An Alternative Measure of State Policy

The analysis above uses a crude classification of state policies: a state is probusiness if it has a right-to-work law and antibusiness if it does

[7] The CBP program dates from 1947. However, before 1964, many counties were aggregated into larger reporting units. Data on the labor force by county are available from the *Census of Population*. However, this census reports employment by place of residence rather than place of employment.

not. In future work, it would be useful to extend the analysis to consider alternative measures of state policy. This subsection takes a first step in this direction by considering a well-known business climate ranking as an index of policy.

One can find rankings of state business climates in a variety of places. For this analysis, I choose the ranking constructed by Fantus Consulting in 1975.[8] Though dated, the Fantus index was constructed in a more comprehensive way than more recent alternatives. The ranking is based on 15 aspects of state policy, including labor market policies, workers' compensation policies, unemployment compensation taxes, corporate income taxes, and so forth. Table 8 presents the ranking of the states according to the overall score. At the bottom of this list are Massachusetts, California, and New York. The poor showings for these three states are certainly consistent with the conventional wisdom that these three states pursue policies that are relatively hostile to business.

Column 2 of table 8 reports whether or not the state currently has a right-to-work law. To a remarkable degree, the states that have right-to-work laws all have high Fantus rankings. This occurs even though right-to-work status counts for only one of the 15 criteria used to construct the index, and the 15 categories are equally weighted. This illustrates the point made in the Introduction that states with right-to-work laws tend to pursue other probusiness policies as well.

The previous analysis was limited to those state borders at which right-to-work status changed at the border. Unlike right-to-work status, the Fantus rankings change at all state borders. So here, policy varies at all state borders. To incorporate these additional state borders, I need to start over in the way I handle the geographic data.

This analysis considers the borders of all 48 contiguous states. (The results change very little if I exclude the western states or if I exclude the West Virginia and Kentucky coal region border.) There are 109 state border pairs: Alabama-Georgia, Alabama-Mississippi, and so forth. Let the borders be indexed by $b \in \{1, 2, \ldots, 109\}$. For each border pair b, classify the state that comes first in alphabetical order as state 1 for border b and the other state as state 2 for border b. A particular border is a *right-to-work border* if right-to-work status changes at the border. Otherwise it is a *non-right-to-work border*. There are 35 right-to-work borders and 74 non-right-to-work borders.

Consider a particular county i located in state s_i. I determine the

[8] Weinstein and Firestine (1978) present the results of this ranking and discuss how it was constructed.

TABLE 8

1975 Fantus Legislative Business Climate Rankings

State	1975 Fantus Ranking	Does State Have a Right-to-Work Law Now?
Texas	1	yes
Alabama	2	yes
Virginia	3	yes
South Dakota	4	yes
South Carolina	5	yes
North Carolina	6	yes
Florida	7	yes
Arkansas	8	yes
Indiana	9	no (had a law, repealed in 1965)
Utah	10	yes
North Dakota	11	yes
Mississippi	12	yes
Georgia	13	yes
Iowa	14	yes
Tennessee	15	yes
Arizona	16	yes
Nebraska	17	yes
Colorado	18	no
Missouri	19	no
Kansas	20	yes
Okahoma	21	no
Kentucky	22	no
New Mexico	23	no
Wyoming	24	yes
Idaho	25	yes (passed in 1985)
Louisiana	26	yes (passed in 1976)
Ohio	27	no
New Hampshire	28	no
West Virginia	29	no
Maine	30	no
Montana	31	no
Nevada	32	yes
Rhode Island	33	no
Wisconsin	34	no
Illinois	35	no
Maryland	36	no
New Jersey	37	no
Vermont	38	no
Washington	39	no
Oregon	40	no
Minnesota	41	no
Pennsylvania	42	no
Connecticut	43	no
Delaware	44	no
Michigan	45	no
Massachusetts	46	no
California	47	no
New York	48	no

Source.—Weinstein and Firestine (1978).

TABLE 9

STATISTICAL MODEL FOR ALTERNATIVE POLICY VARIABLE

Parameter	Just Right-to-Work Borders (1)	Just Non-Right-to-Work Borders (2)	All Borders (3)	(4)	(5)
	A. County Manufacturing Shares				
ϕ (Fantus)	.38	.32	.35	···	.28
	(.08)	(.09)	(.06)		(.07)
θ (right-to-work)	···	···	···	7.40	3.19
				(1.47)	(1.85)
R^2	.516	.525	.546	.544	.547
Observations	923	1,837	2,760	2,760	2,760
	B. County Growth Shares				
ϕ (Fantus)	2.28	1.56	1.96	···	1.92
	(.53)	(.53)	(.37)		(.46)
θ (right-to-work)	···	···	···	31.03	1.46
				(9.52)	(11.85)
R^2	.335	.362	.361	.356	.361
Observations	823	1,747	2,570	2,570	2,570

minimum distance, mindist_i, between county i and the closest bordering state. Let b_i denote the border that county i is closest to, and let x_i be the mile marker along the border at which the minimum distance is attained. If county i is in state 1 for border b, then let $y_i = \text{mindist}_i$. Otherwise, if county i is in state 2, let $y_i = -\text{mindist}_i$. In summary, each county i is associated with a border b_i, a point along the border x_i, and a point y_i that determines the distance and direction of county i from border b.

This subsection considers a statistical procedure that is analogous to that used in Section V*B*. Suppose that the manufacturing share in county i is determined by the following statistical model:

$$\text{share}_i = -\phi\text{Fantus}_i + \alpha_{b_i}(x_i) + \beta_{b_i}(x_i)y_i + \epsilon_i. \quad (3)$$

The variable Fantus_i denotes the Fantus ranking of the state that contains county i. A minus sign is included here because the higher Fantus_i is, the lower the ranking. As in Section V*B*, for each border b, there are functions $\alpha_b(\cdot)$ and $\beta_b(\cdot)$ that allow for the component of share_i that does not depend on policy to vary in a continuous way with x and y. Given the use of shift term $\alpha_{b_i}(x_i) + \beta_{b_i}(x_i)y_i$, the parameter ϕ measures how the average difference in manufacturing share at the border between two states varies with the difference in Fantus ranking between the two states.

Panel A of table 9 reports estimates of model (3) for various sub-

sets of the data.[9] The first estimate is obtained by restricting the analysis to the subset of counties in which the closest border is a right-to-work border. For this subset of the data, the estimate of the Fantus coefficient ϕ is 0.38. The estimate implies that every one unit of difference in Fantus ranking at a state border is associated, on average, with a difference of 0.38 percentage points in the manufacturing share. A large estimate such as this is something that can be completely anticipated from the earlier results. As discussed above, there is a high correlation between the Fantus ranking and the presence of a right-to-work law. In fact, for the 35 right-to-work borders, the side with the right-to-work law has a higher Fantus ranking in all but three cases. (And in these three exceptions, the Fantus ranking is approximately the same on both sides.)[10] For these 35 borders, the Fantus ranking increases by an average of 14 places when one crosses the border into the right-to-work side. Given the estimate above of $\phi = 0.38$, a 14-place differential in Fantus ranking is associated with a $5.32 = 14 \times 0.38$ average difference in the manufacturing share at the border. This is close to the 6.6-percentage-point difference at the right-to-work border estimated in the baseline case in Section V*B*.

The second estimate is obtained by restricting the analysis to the non-right-to-work borders. I have no way of anticipating what the results will be here because the previous analysis did not consider any of these borders. The estimate of ϕ here is 0.32. It is remarkable how close this estimate is to the estimate of 0.38 for the other data subset of right-to-work borders. The key finding of the previous section is that differences in state policies are associated with differences in manufacturing activity at state borders. The estimate of ϕ here corroborates this finding with a completely new set of borders.

The third estimate is obtained by combining both sets of borders. The estimate of ϕ is 0.35, the average of the two estimates from the separate border sets.

The last two regressions in panel A of table 9 add to the statistical model (3) a dummy variable for whether or not the state has a right-to-work law. As in the previous section, let the parameter θ denote the coefficient on the right-to-work dummy. The regression in col-

[9] The procedure is analogous to that in Sec. V*B*. Only counties with $\text{mindist}_i \leq 100$ are used in the estimation. For each b, a quadratic equation is used to approximate the function $\alpha_b(\cdot)$. (In Sec. V*B*, a quartic is used; in that case, there are two very long borders, whereas here there are 109 relatively short borders.) For each b, a constant is used to approximate $\beta_b(\cdot)$.

[10] The three exceptions are Kansas-Missouri, Colorado-Kansas, and Colorado-Wyoming, and the differences in Fantus rankings in these three cases are 1, 2, and 5, respectively.

umn 4 estimates θ under the constraint that the ϕ coefficient on the Fantus ranking is zero. The estimate for θ here is 7.4 with a standard error of about 1.5. This is approximately the same as the baseline estimate of 6.6 for θ in the previous section. The regression in column 5 allows both ϕ and θ to vary. The estimate for θ of 3.2 in this case is still a big number, but it is less than half of its value when ϕ is constrained to be zero. In addition, the standard error on the θ estimate rises to 1.9, which is high relative to the parameter estimate of 3.2. The story is different for the ϕ coefficient on the Fantus variable. The estimate of ϕ here is 0.28, which is 80 percent of the estimate of 0.35 for the case in which θ is constrained to be zero. The estimate of ϕ remains highly statistically significant. The Fantus variable, rather than the right-to-work variable, is the big story here.

Panel B of table 9 reports an analogous set of estimates for the case in which the manufacturing employment growth rate is the left-hand-side variable. The three key results in panel A for the share variable are also true in panel B for the growth variable. First, when I restrict the data set to include only the right-to-work borders, there is a large and significant coefficient on the Fantus variable. Given the high correlation between Fantus ranking and right-to-work status, this result, in essence, replicates the results in Section V concerning what happens to the growth variable at the right-to-work border. Second, when I restrict the data set to include only the non-right-to-work borders, there again is a large and significant coefficient on the Fantus variable. This is an entirely new set of data points, and the result corroborates the results from Section V that state policies matter. Third, when I include both the Fantus variable and the right-to-work variable in the regression, the Fantus variable is the main story.

B. An Alternative Measure of Industrial Composition

The analysis so far has focused on the effects of policy on the sectoral composition of a state's economy, that is, the fraction of employment in manufacturing. This subsection considers the effects of policy on the size distribution of establishments. As discussed in Section II, probusiness policies can be expected to have a disproportionate impact on large establishments. Large establishments are more likely to be unionized, so policies that weaken unions will matter more for them. Large establishments tend to be more capital-intensive, so lower taxes on capital will matter more for them.

Define an establishment with 100 or more employees to be a *large* establishment. In the 1992 CBP data, 44 percent of all employment is concentrated in large establishments. In the manufacturing sector

by itself, 70 percent of employment is in large establishments. Outside of manufacturing, 38 percent of employment is in large establishments.

I estimated a statistical model for the share of employment in large establishments that is the analogue of the model above for the share of employment in manufacturing.[11] I used the same specification as in the previous subsection. (The results are essentially the same when I use the specification from Sec. V.) Table 10 reports the results. As in table 9, I consider the right-to-work variable by itself, the Fantus variable by itself, and the two variables together.

Consider first the case of all industries. In the case in which the right-to-work variable is by itself, the estimate of θ is 6.6. The interpretation is that, on average, the percentage of all employment in large establishments increases by 6.6 percentage points when one crosses the border into a right-to-work state. When the Fantus variable is by itself, the Fantus variable gets a large coefficient. When both variables are together, the right-to-work coefficient remains large and the Fantus coefficient falls by one-half. This is the opposite of what happens in table 9, where the right-to-work coefficient shrinks and the Fantus coefficient remains big.

Next consider the case of just manufacturing employment. The fraction of manufacturing employment in large establishments increases, on average, by 16.3 percentage points when one crosses a state border into a right-to-work state. This is a substantial effect.

Finally, consider the case of all industries besides manufacturing. For this case, crossing a state border into a probusiness state has essentially a zero effect on the size distribution of establishments. This is very different from what happens in the manufacturing sector. These results suggest that probusiness policies have a different effect on the manufacturing sector than on other sectors and that the fact that manufacturing establishments are larger than other establishments is not the explanation for this different effect.

VII. Conclusion

This paper starts out with a simple classification scheme: a state is defined as probusiness if it has a right-to-work law. The paper then examines the border areas between probusiness and antibusiness states. The differences in manufacturing activity at the border are surprisingly big. On average, the manufacturing share of total em-

[11] I estimated the amount of employment in large and small establishments by using the cell counts reported in the CBP data for the number of establishments in each of the various employment size classes.

TABLE 10

ESTIMATES OF STATISTICAL MODEL: SHARE OF EMPLOYMENT IN LARGE ESTABLISHMENTS

	ALL INDUSTRIES (N = 2,760)			MANUFACTURING (N = 2,728)			OTHER INDUSTRIES (N = 2,760)		
PARAMETER	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ϕ (Fantus)	...	.24	.12	...	.60	.33	...	−.01	.07
		(.07)	(.09)		(.12)	(.15)		(.06)	(.07)
θ (right-to-work)	6.64	...	4.76	16.33	...	11.33	1.55	...	2.65
	(1.69)		(2.13)	(3.10)		(3.89)	(1.56)		(1.96)
R^2	.459	.458	.459	.434	.433	.435	.322	.322	.322

ployment in a county increases by about one-third when one crosses the border into the probusiness side. There is a lot of uncertainty and debate about whether or not state policies make much difference in the geographic distribution of industrial activity. The results of this paper suggest that state policies do matter.

It needs to be emphasized that the effect found here is an *overall* effect of state policy. The analysis does not identify the contribution to the overall effect of any one particular policy, for example, a right-to-work law. The next step is to quantify the roles of particular policies. The preliminary analysis in Section VI is a first step in this direction.

This paper develops a novel procedure for identifying whether policy matters, a procedure that may be applicable to other issues besides industry location. While the procedure is able to circumvent identification problems that have plagued previous work, it must be recognized that the procedure has its own limitations. Differences at state borders are not necessarily due to differences in state policies, since nature can have discontinuities. A good example is the coal veins and mountains that begin at the Kentucky-Virginia border. I excluded this coal region from the analysis, but there may be others I do not know about. And even if differences at the border are due to state policies, it may be policies from long ago that have nothing to do with a state's current policies toward business. For example, because Oklahoma was originally set up as an Indian territory more than 100 years ago, there remains today a sharp increase in the Native American population at the border between Arkansas and Oklahoma. Shifts in demographics at state borders can potentially be associated with shifts in the distribution of economic activities at state borders. These examples suggest the need for caution in ascribing the differences found at the border to differences in state policies toward business. I can take some comfort in the fact that the border considered consists of numerous pairs of adjacent states and is thousands of miles long. Over a long border, there can be some hope that extraneous factors will average out.

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