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July 16, 2003
1:30 PM

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during the Progressive Era

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November 2002

Draft to be presented at the NBER-DAE Summer Institute.

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The Impact of State Labor Regulations on Manufacturing Input Demands during the Progressive Era

During the late 19th and early 20th centuries, there was a tremendous expansion in the role that state governments played in regulating labor markets and labor conditions. Most states established bureaus to collect labor statistics and regulatory bodies to inspect boilers, factories, and mines. Many passed employer liability laws that served to expand the liability of employers for workplace accidents and the vast majority eventually regularized the accident compensation process by establishing strict liability in the form of workers' compensation laws. Limits were established for child labor and women's hours. Some states passed laws that promoted unionization by outlawing "yellow dog" contracts and protecting union trademarks and labels. On the other hand, other states seem bent on limiting unionization with the passage of anti-enticement laws and laws that limited picketing and were specifically targeted at reducing intimidation of non-union workers.

There has been a growing literature examining the quantitative impact on labor markets of the leading progressive laws in the late 1800s and early 1900s.[1] While each of the studies provides invaluable evidence on how the individual laws influence specific aspects of the labor market, they do not capture the broad range of labor laws that were established during the period. On several occasions the U.S. Commissioner of Labor and later the Bureau of Labor Statistics documented the extent of state labor legislation in the various states in a series of reports. In these reports, the Labor Department reported on roughly 135 laws that influenced labor markets and workplace conditions. After combining the information from the Labor Department reports with additional information on the timing of legislation from the Legislative Acts in the various states, we use the information on the presence of these labor laws in each state to develop a series of summary measures that characterize the regulatory climate in the various states and how that climate changed over time. We then examine how the regulatory climate influenced input choices in manufacturing using a panel data on input shares from the Censuses of Manufacturing between 1899 and 1919.

Predictions for Progressive Era Labor Legislation

The Progressive Era has received a tremendous amount of attention in the social science literature, in part because the states and municipalities experimented with so many types of reforms. In essence, the United States might be seen as a laboratory with an enormous variety of projects going on simultaneously. There is no consensus on the exact timing and boundaries of the Progressive Era nor on the driving force behind the Progressive Era. Some emphasize muckraking reformers, while others emphasize the role of middle class, social conservatives who were dissatisfied with an existing political system that seemed to be controlled by political bosses. Many see a role for religious attitudes that press for egalitarian reforms. Some see the Progressive reforms as a response to increased industrialization, modernization, and urbanization.[2]

In examining the introduction of Progressive Era labor legislation, we have found it most useful to think of the driving forces as being a complex interaction of interest groups and coalitions that pressed for specific legislation. In the area of labor legislation, the key broad interest groups would be workers, employers, and social reformers. These groups could be further divided into subgroups. For example, workers might be divided along union and nonunion lines or into men and women. Large and small employers often had different attitudes, as did employers in unionized versus nonunion industries.

The impact of labor legislation was likely to be influenced by the groups who were central to the passage of the legislation. If Progressive Era social reformers, workers, and unions were the key coalitions that led to the passage of the legislation, the laws might be seen as beneficial to workers at the expense of employers.[3] Therefore, the laws might act as a "tax" on the employers, raising the nonwage costs to them of hiring labor, and thus reducing the demand for labor. Such changes might also cause employers to shift towards inputs that are substitutes for labor while reducing inputs that are complementary to labor. Safety legislation might require employers to use more capital or to choose labor saving devices that lead to higher capital expenditures. The introduction of labor legislation likely increased supervision requirements, particularly in cases where safety laws required increased monitoring, and the extent of paperwork involved in reporting information to state authorities. Thus, we might see a rise in the number of salaried managers and clerical workers. On the labor supply side, we might expect such legislation lead to an increase in the supply of labor as the nonwage working conditions for workers improved.

On the other hand, Robert Wiebe (1962), Gabriel Kolko (1963), James Weinstein (1967), Roy Lubove (1967), David Moss (1996), Price Fishback and Shawn Kantor (2000), and many others have found substantial evidence that employers and businessmen played important roles in the passage of Progressive Era legislation. A survey of quantitative studies of child labor laws, women's hours laws, and safety legislation suggests that the laws generally had small effects on child labor, women's hours, and accident. Based on this information Fishback (1998) suggested that the reasons for these small effects was that employers were powerful enough in state legislatures that they could significantly change the legislation proposed by reformers. In consequence, many of the laws that passed the majority of legislatures were ones, like workers' compensation, where employers anticipated a gain from passage. For other laws , like the child labor laws, womens' hours laws and safety legislation, to pass, they probably had to obtain the support of leading employers as well as workers and reformers. Therefore, in the give and take of the legislative process that led to the ultimate compromise, this meant that the laws might well have codified the existing practices of leading employers. Thus, the "tax" on employers might have really been imposed only on the remaining employers who had not yet adopted these practices. In such a situation the reduction in the demand for labor described above might have been lessened since only a subset of employers found the new regulations binding.

At the other extreme, would be a situation where employers had essentially captured the legislature and the regulatory body and established regulations that benefited the employer at the expense of workers.[4] Union leaders at times in the early 1900s suggested that business interests controlled politics and therefore they distrusted some political solutions (Weinstein, 1967, 159; Skocpol 1992, 205-47; Asher 1969, 457). These fears were confirmed in some states where anti-union legislation was passed or when they saw federal antitrust legislation applied more to busting unions than to busting trusts (Puth

1993, 485). The introduction of anti-union legislation, which reduced the probability of unionization, employers were likely freer to develop new technologies. The introduction of new technologies might have increased the demand for labor if the new technologies complemented labor or reduced labor demand if the new technologies were substitutes for labor.

Finally, there is the possibility that labor legislation benefited both employers and workers. For example, Fishback and Kantor (2000) suggested that workers' compensation laws were passed because employers, workers, and insurers (in states without state funds) anticipated gains from the new law. The question then arises as to why employers and workers did not privately contract on their own for the changes enacted by the labor legislation. In the case of workers' compensation, private contracting for workers' compensation type policies in which workers waived their rights to negligence suits in advance had been disallowed by a mixture of private legislation and court decisions. With respect to other regulations, there may have been situations where employers and workers in many states thought the changes would be a good idea but that they would have been put at a competitive disadvantage within their own state if they unilaterally made the move on their own. Thus, the legislation may have helped prevent a "race to the bottom." When we extend the discussion outside the borders of a single state, many employers argued against labor legislation in their own state on the grounds that they would be placed at a competitive disadvantage with respect to employers in other states (Moss, 1996). So it is certainly possible that the inter-state argument might have extended to private contracting by firms within states. Had both employers and workers anticipated benefits from the legislation, we may well have seen an increase in labor demand associated with the labor legislation.

The Patterns of State Labor Legislation

State labor legislation came in several waves. In the late 1800s a number of northeastern and eastern midwestern states began establishing bureaus of labor, created positions for factory inspectors and set up a series of factory regulations, passed the early child labor laws, refined the nature of accident liability for employers, provided political protections for workers as voters, and established a series of laws that gave unions more legal status. Meanwhile, a number of mining states established the early regulations for mines and the first mining inspectors. In the first decade of the 20th century, the early forms of labor legislation spread to a majority of states, and many of the existing laws were refined and updated. The next wave of legislation followed in the 1910s as states became more involved with social insurance, introducing mothers' pensions and replacing the employer liability system with the statutory rules of workers' compensation. Nearly half of the states passed women's hours laws during this period and about 20 percent established some form of minimum wages for women and children.[5] At the same time the leading labor legislative states reorganized their state labor bureaucracies into industrial commission and some established child labor commissions.

The waves of legislation can be seen in Table 1, which shows the number of states that had adopted each type of law as of 1894, 1908, 1918, and 1924. There were 135 labor laws that were reported on by the Commissioner of Labor (1896, 1904, 1908) and the U.S. Bureau of Labor Statistics (1914, 1925) in their volumes on "Labor Laws in the United States." A law is listed in the table if it was adopted in at least one state. We then went back to the original state legislative acts to fill in gaps in our knowledge about the timing of the laws.

Since the number and range of state labor laws are mind-boggling, we sought effective ways to summarize the information in just a few variables. Our goal is to develop measures that give a sense of the labor regulatory climate in the various states. One possibility was to just add up the number of laws in each category and use the sums for each category. However, this procedure gives equal weights to all of the laws in a category, which is likely to be incorrect because the laws varied in character, enforcement, and scope. As an alternative, we turned to principal component analysis to create a series of factor scores (or indexes) that allow us to group laws that appear in clusters in various states.[6]

The main goal in principal components analysis is to describe the variation that is observed in a large number of variables using a smaller number of variables. The procedure assumes that all of the variation observed in the variables is due to common factors, and the principal components that are developed summarize this variation. In this analysis, a varimax rotation and principal components analysis was used. The rotation aids in the interpretation of the factors by seeking to assign a high loading to only one factor for each variable. The method is an orthogonal rotation, so that the factors remain uncorrelated after the rotation. Uncorrelated factors are desirable in this analysis since the factor scores will be used as dependant variables in later regression models. Because the primary goal in developing these factors was to reduce the dimensionality of the data while still expressing all of the variability (shared and unique) that is present in the 135 laws, principal components analysis was chosen over factor analysis.[7]

There are several methods that scholars have followed in selecting the optimal number of factors based on the eigenvalues from the correlation matrix of labor laws. The process is somewhat subjective, and there is a trade-off between choosing enough factors to explain all of the variation in laws and choosing a limited number of factors so that our degrees of freedom are not diminished too much when we examine the impact of the laws. Table 1 lists the top 37 eigenvalues from the correlation matrix of labor laws; they are listed in descending order, and the proportion of the total variability in the data that is explained by each eigenvalue is listed in the column labeled "Proportion". The remainder of the eigenvalues are less than one and are available from the authors. One commonly used rule for determining the correct number of factors is to choose the number of eigenvalues with values greater than one. An eigenvalue less than one indicates that the factor that corresponds to this eigenvalue would explain less of the variance present in the data than any given law by itself. Therefore, including a factor with an eigenvalue less than one would not help in the goal of reducing the dimensionality of the problem. In this analysis, there were 37 eigenvalues greater than one and together they account for approximately 80 percent of the total variability present in the data. The analysis of these 37 factors is difficult, with many of the 37 factors having no obvious interpretation.

We therefore chose an alternative method that selects only the factors with the largest eigenvalues that make up the largest proportion of the total variance. In essence, the change in eigenvalues is examined to see when the additional explanatory power from adding factors drops off substantially.[8] Using these methods, it appears that 4, 5, 11, 15, 20, or 27 factors are potentially appropriate for this model. We decided to limit the analysis to four factors for several reasons. First, it is clear from Table 1 that there is a major drop-off in the eigenvalues after about 4 or 5 eigenvalues. Although four factors only capture 29 percent of the total variance, each additional factor adds relatively little in terms of explaining the additional variance. No eigenvalue after the fifth accounts for more than 3 percent of the total variance, and no eigenvalue after the 13th accounts for more than 2 percent. Second, to see how the interpretation of factors would change, we have run the PCA analysis with 4, 5, 11, 15, 20, 27, and 37 factors (results are available in Holmes' dissertation (2002)). Generally, the laws that load onto the first four factors in a statistically significant fashion tend to remain the same as in situations when we increase the total number of factors in the analysis. Third, for the most part, as more factors were added, the new factors that emerged were subcategories of earlier factors; therefore, we would gain more refinement without adding any new categories.

Interpretations of the Four Factors

Table 3 shows the laws with statistically significant loadings on each of the four factors.[9] Inspection of the laws that loaded on to each of the factors leads to some clear interpretations. Factor 1 identifies the states that had adopted the fundamental labor legislation from the first major wave of labor regulations during the late 1800s and the first few years of the 1900s. For most of the laws that loaded on Factor 1, more than half of the states that eventually adopted the law had already adopted the law by 1908 (see Table 1). As seen in Table 3, 52 of the 135 laws loaded on this factor in a statistically significant fashion. The laws included the establishment of a state labor administrative body, an arbitration board and provision for a state free employment office. Factor one is strongly associated with nearly all of the laws that were the backbone of the safety movements for factories and railroads at the turn of the century, the initial wave of child labor laws enacted prior to 1910, the convict labor law, and a series of early pro-union laws (including laws allowing incorporation of unions, protection of union trademarks and union cards, and banning yellow-dog contracts). A series of occupational licensing laws also load onto factor one. Several laws with roots in the period after 1908 also load onto this factor, including the womens' hours laws that were introduced in a few states prior to 1910 and then became more widespread later, and the social insurance legislation establishing mothers' pensions and workers' compensation. In essence, states with a high score on Factor One would probably be considered to be among the leaders in the development of state labor legislation through 1908. Table 4 shows a listing of the factor scores for each state as of 1919. The states with the 15 highest scores for each factor are listed in bold type, and they tend to be concentrated in the industrial states in the Northeast and eastern Midwest.

Factor Two was associated primarily with the wave of labor legislation adopted in the 1910s. As can be seen in Tables 1 and 3, the social insurance laws providing mothers' pensions and workers' compensation from the 1910s loaded more heavily on to this factor than to the first factor. The various minimum wage laws for women and children and public employment from the 1910s were strongly associated with Factor 2, as were the development of child safety commissions and expansions in the general hours laws for children and women. Other factors that loaded significantly on Factor 2 include a series of hours laws for males in specific industries and a series of laws giving more rights to unions. States with high Factor 2 scores were likely to be considered progressive states circa 1920. Generally, the states that scored highest on this factor tended to be the Western states, along with Massachusetts and the highly progressive states of Wisconsin and Minnesota, where so many of the leading institutional economics scholars influenced state policies (Moss 1996).

The third factor was associated primarily with mining laws. As can be seen in Table 3, nearly every law with a statistically significant loading on Factor 3 was associated with mining. All of the major mining regulations loaded on to this factor. The convict labor law had a strong mining connection because mining was one of the primary jobs done by convict workers. The laws related to cash wages, forced contributions and political protections were often responses to issues that arose in mining towns (Fishback 1992). Generally, as seen in Table 3, the mining laws were found primarily in mining states, but even among the mining states there remained significant variation in the factor scores.

The fourth factor is described best as an anti-union factor. The laws with strong positive loadings included legislation that limited union activities by banning interference with workers by third parties and through anti-conspiracy and anti-intimidation laws. A number of laws that were strongly favored by unions were negatively associated with the fourth factor, including the hours laws for children, street railroads and railroads; the incorporation of labor unions, company store legislation, and laws establishing miners' homes and hospitals. Among the employer liability laws, the main employer liability law actively supported by unions had a negative relationship with the factor, while the virtually meaningless laws that restated the common law had a positive relationship (Fishback and Kantor 2000, 251-5). The states that were strong on this factor were generally southern states and the Plains states.

Expenditures by States on Labor Issues

The presence of state laws offer only one indication of the regulatory climate for labor markets in the states. Laws on the books have little impact if they are not enforced and administrative bodies are likely to have greater impact in making decisions with more resources available to them. As an additional measure of the labor regulatory climate, we have collected information from the legislative statutes on the appropriations for the state labor department, board of arbitration, free employment offices, mining inspection, boiler inspection and other factors related to labor markets.

Table 5 shows for each state for the years 1899, 1909, and 1919 the state labor appropriations per person gainfully employed in 1967 dollars. The general patterns in the table show that in nearly every state between 1899 and 1919 there was a substantial rise in appropriations for administering labor regulations. On average the real state labor appropriations per worker rose 35.3 percent between 1899 and 1919. To highlight the differences across states, we have marked the top 15 states in each year in bold type. The leading states in terms of state labor appropriations per establishment by 1919 tended to be the northeastern industrial centers like Massachusetts, New York, and Pennsylvania. Ohio and Illinois were early leaders in labor legislative spending, and there were very large amounts spent per capita in the West.

Measuring the Impact of the State Labor Regulations

According to classical production theory, in an unregulated market for inputs to production, firms choose profit-maximizing levels of inputs according to their production function and relative input costs. As regulation of industry increases, the firm's profit maximizing choice of inputs may change either due to constraints on inputs, changes in input prices, or both. Most of the studies that have been done focus on the impact of specific labor regulations in specific setting. These studies have taken a focused approach, looking at the impact of one class of laws on the specific factor that they expected would be influenced by the laws. As the number and complexity of regulations increases, the impact of any given new regulation will depend on the cumulative impact of all of the previous laws. The goal of this study is to examine the cumulative impact of labor legislation on input choice by firms.

The Model:

We use a structural translog cost function approach to analyze the impact of the labor regulatory climate on input demands by manufacturing firms. This approach allows us to go beyond looking at changes in employment and wages to look at the simultaneous choice of labor and nonlabor inputs in the manufacturing process(As one example, see Cain and Patterson, 1981) In this approach, the total cost of the firm is estimated as a function of the input prices that the firm faces and the labor regulatory climate in a given year. We incorporate the regulatory climate faced by the manufacturing firms using the information on state labor spending per worker and labor law indexes for three of the four principal factors: first-wave legislation (Factor 1), second-wave legislation (Factor 2), and antiunion legislation (Factor 4). Since the cost data are confined to manufacturing establishments, a mining labor law index based on the mining law factor (Factor 3) was not used in the model.

The *US Census of Manufacturers* of 1899, 1904, 1909, 1914, and 1919 provided information on costs and four major inputs: production workers, salaried workers, materials, and capital. Costs for each manufacturing establishment were assumed to be a function of the regulatory climate variables and four input prices: the average wage, the average salary, the price of materials, and the price of capital. The cost function was assumed to have the standard translog form as follows:

$$\ln C^* = \alpha_0 + \sum_{i=1}^{4} \alpha_i \ln P_i + \sum_{k-1}^{3} \beta_k \ln F_k + \sum_{m-1}^{2} \delta_m \ln Z_m + \frac{1}{2}\sum_{i=1}^{4}\sum_{j=1}^{4} \alpha_{ij} \ln P_i \ln P_j +$$

$$(1)\quad \frac{1}{2}\sum_{k=1}^{3}\sum_{l=1}^{3} \beta_{kl} \ln F_k \ln F_l + \frac{1}{2}\sum_{m=1}^{3}\sum_{n=1}^{3} \delta_{mn} \ln Z_m \ln Z_n + \sum_{i=1}^{4}\sum_{k=1}^{3} \eta_{ik} \ln P_i \ln F_k + \sum_{i=1}^{4}\sum_{m=1}^{3} \tau_{im} \ln P_i \ln Z_m +$$

$$\sum_{k=1}^{4}\sum_{m=1}^{3} \kappa_{km} \ln F_k \ln Z_m + \varepsilon$$

Where:

$F_{k,l}$ k,l = 1…3 are the three state legislative factors
$P_{i,j}$ i,j= 1…4 are the input prices
$Z_{m,n}$ m,n= 1…2 output and state expenditures per establishment on labor legislation
C^* = profit-maximizing total cost per establishment
ε = classical error ~ iid $N(0,\sigma^2)$

Restrictions:

If the firms are choosing inputs to meet the profit-maximizing total cost, the cost function will be symmetric. These symmetry restrictions require that $\alpha_{ij} = \alpha_{ji}$, $\beta_{kl} = \beta_{lk}$, and $\delta_{mn} = \delta_{nm}$ for all i,j 1,k, and m,n pairs. In addition, the cost function should be homogeneous of degree one in prices. The homogeneity condition imposes the following restrictions on the coefficients:

$$\sum_{i=1}^{4} \alpha_i = 1; \quad \sum_{i=1}^{4} \alpha_{ij} = 0; \quad \sum_{j=1}^{4} \alpha_{ij} = 0; \quad \sum_{i=1}^{4} \delta_{iY} = 0; \quad \sum_{i=1}^{4} \eta_{ik} = 0; \quad \sum_{i=1}^{4} \tau_{im} = 0; \textit{for all } j, i,$$

The model leads to the following four share equations:

$W_s = \alpha_1 + \alpha_{11}\ln P_w + \alpha_{12}\ln P_c + \alpha_{13}\ln P_s + \alpha_{14}\ln P_m + \eta_{11}\ln F_1 + \eta_{12}\ln F_2 + \eta_{13}\ln F_3 + \tau_{11}\ln Y + \tau_{13}\ln E$
$K_s = \alpha_2 + \alpha_{12}\ln P_w + \alpha_{22}\ln P_c + \alpha_{23}\ln P_s + \alpha_{24}\ln P_m + \eta_{21}\ln F_1 + \eta_{22}\ln F_2 + \eta_{23}\ln F_3 + \tau_{21}\ln Y + \tau_{23}\ln E$
$S_s = \alpha_3 + \alpha_{13}\ln P_w + \alpha_{23}\ln P_c + \alpha_{33}\ln P_s + \alpha_{34}\ln P_m + \eta_{31}\ln F_1 + \eta_{32}\ln F_2 + \eta_{33}\ln F_3 + \tau_{31}\ln Y + \tau_{33}\ln E$
$M_s = \alpha_4 + \alpha_{14}\ln P_w + \alpha_{24}\ln P_c + \alpha_{34}\ln P_s + \alpha_{44}\ln P_m + \eta_{41}\ln F_1 + \eta_{42}\ln F_2 + \eta_{43}\ln F_3 + \tau_{41}\ln Y + \tau_{43}\ln E$

Where

W_s = Wage share of total cost,
S_s = Salary share of total cost,
M_s = Material share of total cost,
K_s = Capital share of total cost,
$F_1..F_3$ = Labor Law Indexes.
Y = Output per establishment(value of products),

E = State expenditures per establishment on labor legislation.

In order to make the model operational in estimation, one of the factor share equations must be dropped. In order to impose the adding-up restrictions, the input price from the share equation that is dropped is used as the numeraire for input prices and costs in the four remaining equations that are estimated. We estimate three of the four factor-share equations and the cost function as a system of equations. The error terms of the equations that are estimated are not independent due to the cross-equation symmetry restrictions. Also, all of the share equations may share the same left out variables that influence firm input choice. The error terms are assumed to have the following structure:

$$\boldsymbol{\varepsilon} = [\boldsymbol{\varepsilon}_1', \boldsymbol{\varepsilon}_2', \boldsymbol{\varepsilon}_3', \boldsymbol{\varepsilon}_4']'$$
$$\mathbf{E}[\boldsymbol{\varepsilon}] = \mathbf{0}$$
$$\mathbf{E}(\boldsymbol{\varepsilon}\boldsymbol{\varepsilon}') = \mathbf{V}$$

V is the standard variance-covariance matrix in a seemingly unrelated regression. The SUR regression is appropriate here due to the cross-equation restrictions required by the symmetry requirements and the requirement of homogeneity of degree one in prices. Errors are assumed to be correlated across equations but not across observations. The seemingly unrelated regression model was used because restrictions were placed on the system. Because of these restrictions, OLS is no longer efficient.

Data:

The data on input shares and prices are determined from information on the total wage payments and number of wage workers, total costs for materials, total salary payments and the number of salaried workers, and the value of the capital stock reported for the 1899, 1904, 1909, 1914, and 1919 Manufacturing Censuses in the Statistical Abstract of the United States.[10] The cost function specification requires prices as the exogenous inputs and cost shares as the dependent variable in each share equation. Input prices were derived for wage labor by dividing total wage payments by the average number of wage workers that year to obtain average annual earnings. For salaried workers the input price was obtained by dividing the reported total salary payments by the number of salaried workers. The materials input price is the national wholesale price index; therefore, it only changes from year to year and not across states within the same year. The values for total wage payments, payments to salaried workers, and payments for materials are all used in developing the cost shares.

Measuring both the price of capital and the share of total cost going to capital required some assumptions. The Census reports the value of the capital stock but neither the rental price of capital nor the current year share of capital in total cost. We have followed two different procedures in developing measures of the rental price of capital and the cost share of capital. In the first procedure, we assumed perfect competition, such that total costs equal the total revenue of a company. Using total value of product as a proxy for the total revenue, the total cost of capital was derived using a "remainder" method, where the cost of capital is assumed to be equal to the total value of products minus the cost of salaries, wages, and materials.[11] Using this measure of current spending on capital, we then calculated the cost shares for materials, wage labor, salaried workers, and capital. To obtain the capital price, we then divided our measure of the current spending on capital by the reported value of the capital stock in the census. (For examples of others who have used this technique, see Filippini, 2001, Friedlaender and Wang, 1983)

As an alternative method, we assumed that the capital rental price was equal to the yield on AAA corporate bonds. Similar to the case with the materials price, we only have a single national rate, so there is variation in the rental price across time but not across states. To calculate the cost shares for the four inputs, we then calculated the current cost of capital as the product of the AAA corporate bond rate and the reported value of the capital stock. We then summed the materials costs, salary costs, wage labor payments, and the estimate of the current spending on capital to obtain a measure of total cost and then calculated the cost shares. It turns out that both methods yielded similar results.

Estimation Procedure

To estimate the model, we estimate the wage labor share equation, the salaried labor share equation, the capital share equation and the cost equation as a system of seemingly unrelated equations using Full Information Maximum Likelihood (FIML) in the SAS software package. [12] The materials share equation is the left-out equation and the materials price is used as the numeraire for input prices in the remaining equations.[13] The use of a maximum likelihood method ensures that the estimated parameters, standard errors, and log-likelihood values are invariant to the choice of which equation is dropped. To be consistent with the theoretical analysis of cost functions, linear homogeneity of degree one in prices and cross-equation symmetry restrictions were imposed. Errors are assumed to be independent, normally distributed, with mean zero and variance **V.** We estimated a series of different specifications: a base analysis with no controls for years or state effects, an analysis with a year counter, one with year fixed effects, one with a year counter and state fixed effects, one with state fixed effects and no year controls, and one with both state and year fixed effects. In the specifications with a year counter, the year counter is included in all of the share equations and the cost equation. The inclusion of a time counter is common in translog models. The time counter variable is treated as another non-price input to the cost function and is typically interpretated as representing the impact of Hicks-neutral technological change. (Ray, 1982, Binswanger, 1974) In estimates using year effects and/or state effects, the year and state effects are included only in the cost equation. Had they been included in the share equations as well, we would have had to interact each of the continuous variables with each fixed effect in the cost equation. This would have eliminated all of the degrees of freedom in the analysis.[14]

After estimating the share equations and cost function, we use the parameters to calculate a series of elasticities based on sample means (See Appendix A for the description of how elasticities were derived from the cost function analysis). Our primary focus is on the input partial demand elasticities with respect to the labor law factors and state expenditures on labor issues. We also calculate the input demand elasticities with respect to input prices, the partial input cross-price elasticities, and the elasticities of substitution between inputs.

To limit problems with simultaneity bias between the labor regulatory climate factors and the input share choices, we lagged the factor values for one year. The use of lagged factors tended to reduce the significance of the coefficients on the factors, but did not result in any substantial changes in the signs or magnitudes of the coefficients. There may also be endogeneity bias for the wage labor demand in particular because the legislation was likely to influence labor supply. The cross-equation restrictions in the cost function estimation help to identify the labor demand function. However, we can't be sure that we have eliminated all of the endogeneity bias. To the extent that the legislation improved working conditions for workers, we would have expected that the legislation would have contributed to an increase in labor supply and thus impart a positive bias to the legislative coefficients.

The elasticities derived from the various specifications are reported in Tables 6 through 9 with the p-values for two-tailed t-tests of the hypothesis that the elasticity was equal to zero. The cost function and share equation estimates on which the elasticities are based are available in Appendix B. Although we report the elasticity estimates from all specifications, we will focus the discussion of the estimates on elasticities derived from specifications with both year and state fixed effects in the far right column of Tables 6 through 9. By controlling for year effects and state effects we are reducing problems with endogeneity and unmeasured heterogeneity

In general the elasticities are consistent with expectations. The input demand elasticities in Table 6 are all negative and statistically significant. The positive elasticities of substitution in Table 7 for materials with respect to the other three factors suggest that materials are substitutes for each of the other three factors. This is also confirmed by the positive cross-price elasticities in Table 8 between materials and the other three inputs.[15] Wage labor appears to have a complementary relationship with capital . Capital and salaried workers also have a statistically significant substitute relationship. Finally, the elasticities of the inputs with respect to changes in output in Table 9 are all positive.

The impacts of the various labor law indices on input demands are shown in Table 9. The various types of labor legislation had quite different effects on the demand for wage labor. The First-Wave labor legislation that set up the basic factory inspection laws and early child labor laws may have had a positive effect on the demand for wage labor with a statistically insignificant elasticity of 0.288. Based on a summary of studies that showed a relatively small impact of safety-legislation on accident rates by a variety of scholars, Fishback (JEL 1998) suggested that many of the Progressive Era laws may have codified existing practices for many firms or been legislative changes that both workers and employers found useful. The absence of a statistically significant negative effect might well be consistent with this view for the first wave laws. On the other hand, the second-wave labor legislation that expanded the social insurance network, set up minimum wages for women, increased the bargaining power of unions and expanded the role of various state labor administrations had a much stronger elasticity of -0.673, with an impact that is statistically significant. This strong negative finding for the second-wave laws suggest that they had more impact in changing the practices of employers. The anti-union labor law index also was associated with reductions in labor demand with an elasticity of -0.41, but was statistically insignificant in the state and year fixed effects version. Although imprecisely estimated, the coefficient suggests that given greater protection from unionization, firms may have been freer to select production methods and technologies that allowed them to replace workers.

The various labor law indexes also served to reduce the demand for capital, although none of the elasticities were statistically significant in the year-and-state fixed effects version of the model. The first-wave labor laws that established many of the early safety standards had the strongest negative effect on capital expenditures with an elasticity of -0.383, while the second-wave social insurance and minimum wage laws had a substantially weaker and imprecisely estimated effect of –0.017. The anti-union indices also served to reduce our measured amount of capital with an elasticity of –0.330. We were somewhat surprised by these findings because we thought that the labor legislation would induce more capital expenditures for machine safeguards similar to the types of capital expenditures required by safety legislation in the railroads and the mines (see Aldrich (1997) for good descriptions). On the other hand, the substitution elasticities show that labor and capital were complimentary, so that to extent the labor legislation reduced the demand for labor, the demand for capital might also decline. There is yet another consideration based on our method of determining the amount of capital. Since the amount of capital is measured as a residual, it also incorporates some aspects of the returns to the entrepreneur, so that the negative impact of the laws may be reflecting to some degree a decline in the profits going to the owners associated with these laws.

One of the most interesting findings is the impact of the labor law indices on the demand for salaried workers. Both the first-wave and second wave laws contribute to a statistically significant increase in the demand for salaried workers, while the antiunion laws are associated with a much smaller and statistically insignificant effect on demand. It appears that the major effect of the first-wave and second-wave laws was to increase both the number of supervisory personnel and administrative staff at these firms. The increase in supervisory personnel may have been required to more closely monitor safety activity and the practices of workers. In the coal industry, Fishback (1992, 117 and 1986) found that one of the most successful clauses in coal mine safety laws at reducing accidents was the requirement of an increase in the number of visits by foreman to miners' workplaces. James Chelius's findings of a reduction of accidents in manufacturing associated with workers' compensation laws may well have been associated with a rise in supervisory personnel. In addition, as with many regulatory mandates in the modern era, the safety legislation led to increased reporting requirements and thus more clerical staff. Certainly, the strong impact of the first-wave safety laws on the demand for salaried workers would be consistent with this hypothesis. The demand elasticity for salaried workers with respect to the first-wave laws was 2.154, the largest elasticity in the analysis. The second wave of social insurance legislation also had a relatively strong elasticity of 1.084. We might expect the effect of the second wave legislation to have been smaller because it was typically building on the first-wave legislation. Given that some supervisory and clerical staff were already in place, the additional requirements from the newer legislation might have soaked up some of the existing staff's time and have required the hiring of as much new staff. In contrast to the first-wave and second-wave legislation, the anti-union legislation essentially reinforced the status quo and would not have contributed much to an increase in staffing.

Another feature of the labor legislation was that all three types of labor laws were associated with a substitution of inputs toward the use of more materials. The substitution elasticities and partial demand elasticities all suggest that materials were substitutes for both labor and capital, and we have already seen the mostly negative (although at times statistically insignificant) impact of the labor legislation on the demand for wage labor and capital. The first-wave legislation that was oriented toward safety legislation and child labor had a statistically significant materials demand elasticity of 0.505, while the second wave of labor legislation was also associated with a positive estimated elasticity of 0.617. Both types of legislation might have sought to improve safety and replace lost capital and labor with more use of the raw materials. Finally, the anti-union legislation that potentially gave firms more flexibility in choosing production techniques raised the materials demanded with an elasticity of 0.687.

Table 9 also lists elasticities for each input with respect to state spending per worker on labor law administration and enforcement. We had hypothesized that state spending per worker would act as a proxy for enforcement levels, and should reflect the additional impact of enforcement of the existing legislation since we were holding the presence of labor legislation constant. Interestingly, the coefficients related to the expenditure variable were almost universally insignificant, and were all extremely small. The estimated elasticities for wage and capital labor were negative, indicating that firms seemed to substitute away from these inputs as states increased their level of spending on labor issues (values of –0.18 and –0.003, respectively). The elasticity for materials was the only statistically significant elasticity for the spending variable in the in the state-and-year fixed effects version, with a value of +0.018, indicating that higher levels of per-employee spending resulted in a very small increase in manufacturers' use of materials.

Table 10 lists the output elasticities with respect to the labor law variables Cost elasticities are the negative of the elasticities listed in Table 10. These elasticities all have a negative sign, indicating that increases in the state's level of labor legislation or spending on labor legislation contributed to a reduction in output and consequently an increase in the cost per unit produced (We have not yet calculated the standard errors for these elasticities). The sizes of the elasticities are similar for all three factors, with first-wave laws having the largest elasticity, at –0.362, followed by second-wave laws (-0.292) and antiunion laws (-0.286). As with the input elasticities, the estimated impact of state per-employee spending on labor legislation has an extremely small impact on output, with an estimated elasticity of –0.008.

To give a better sense of the historical explanatory power of the effects of labor regulation for the entire United States, we developed the calculations in Table 11. Column one shows the percentage change in each of the exogenous variables between 1899 and 1919. Columns 2 through 5 show the predicted change in the quantity demanded for each input associated with the change in column 1 and calculated using the elasticities reported in Tables 8 and 9. For example, the average measured change in the labor climate for the first wave of labor laws between 1899 and 1919 was 9.8 percent. This contributed to an increase in the quantity demanded for materials of 4.9 percent and an increase for salaried labor of 21 percent. The effect of this average rise in the first wave legislation contributed to an increase in wage labor demanded of 2.84 percent and of our measure of capital of –3.7 percent.

The most important feature of Table 10 is the combined impact of the three forms of labor legislation and labor law expenditures per worker. The changes in the labor law climate over the period from 1899 to 1919 are associated with a 7.1 percent decline in the demand for labor. The negative impact of the laws on labor demand growth were overshadowed by other changes over the period as the actual change in the amount of wage labor demanded rose 29.7 percent over the period. The change in the labor regulatory climate would have contributed to a 5.3 percent decline in the demand for capital, but this was also swamped by other factors that contributed to a substantial increase in capital. The labor laws had the strongest effect on the demand for salaried labor, raising the demand for salaried workers by 34.1 percent, which accounts for roughly one-third of the actual rise in the number of salaried workers. The change in the labor law climate also was associated with a 15.3 percent increase in the demand for materials, compared with a 40.1 percent rise in the amount of materials.

Using a Reduced Form Approach to Examine the Impact of Legislation on Labor Supply.

The analysis so far has used a structural approach to examine the impact of the regulations on employers choices for inputs. However, we are also interested in assessing the impact of labor legislation on labor supply. As an alternative approach we have estimated reduced-form equations for real annual earnings for manufacturing workers and the number of manufacturing workers from which we can draw inferences about the changes in labor supply.

From the responses of employment and wages to labor legislation in the reduced form equations, we can draw inferences about the directions of the shifts in labor supply and labor demand. For example, if the legislation leads to an increase in labor supply and a reduction in labor demand, we would expect a decline in average annual earnings in manufacturing; meanwhile, employment might rise if the labor supply shift dominates the labor demand shift. We can then use information from our estimates of the impact of legislation on labor demand to describe the direction of the shift in labor supply.

The reduced form equations take the following forms:

$$\ln (W_{it}) = a_0 + a_1 \ln F_{1t-1} + a_2 \ln F_{2t-1} + a_4 \ln F_{4t-1} + a_5 \ln E_{t-1} + \Sigma\, b_t\, yd_t + \Sigma\, c_i\, sd_{ii} + e_{it}.$$

$$\ln (A_{it}) = a_0 + a_1 \ln F_{1t-1} + a_2 \ln F_{2t-1} + a_4 \ln F_{4-1} + a_5 \ln E_{t-1} + \Sigma\, b_t\, yd_t + \Sigma\, c_i\, sd_{ii} + e_{it}.$$

Where, as before, the F's are the indexes for state labor legislation, W is the amount of wage labor, E is state labor administration expenditures per gainful worker as before. A is annual earnings per wage worker in 1967$. We have incorporated fixed effects for years (yd) and for states (sd) as we did in the cost function analysis.

The results of the analysis using OLS and OLS with fixed effects are reported in Table 12. We focus on the fixed effects analysis because the effects serve to control for both unmeasured heterogeneity and to some extent for endogeneity of the labor laws. We can say the most about the second-wave legislation. In the reduced form analysis we see that the second-wave legislation was associated with a decline in real annual earnings and an increase in the average number of manufacturing wage earners. The labor demand analysis suggested that the second-wave legislation contributed to a reduction in the demand for labor. The only way the amount of labor could have risen was if the second-wave legislation was popular with workers and was associated with greater labor supply in states with more second-wave legislation.

The first wave legislation had a positive and statistically insignificant relationship with real average annual earnings and a positive and statistically insignificant relationship with employment. When we combine this with a positive and statistically insignificant effect on labor demand in the structural analysis, it suggests that the first-wave legislation might not have had much impact on manufacturing labor demand or on manufacturing labor supply. This may be consistent with arguments that the first-wave legislation may have been codifying the practices of a substantial number of employers.

The anti-union legislation was associated with a negative although statistically insignificant effect on real annual earnings but a positive effect on employment. The structural analysis suggested a negative (although not statistically significant) effect on labor demand. The rise in employment combined with a possible decline in annual earnings suggests that labor supply may have increased in response to the anti-union legislation. We might expect such a labor supply response if the anti-union legislation weakened the unions' ability to limit labor supply.

Finally, the expenditures on labor administration and regulation in the states are associated with a negative but statistically insignificant effect on real annual earnings and a positive and statistically significant effect on manufacturing employment. Our estimate of the labor demand effect of the state labor expenditures suggested no additional effect on labor demand beyond the presence of the laws. The imprecisely estimated decline in annual earnings and the rise in employment associated with the labor expenditures suggests that they contributed to a rise in labor supply.

At this point in the reduced form analysis we have controlled for endogeneity of the labor laws by using two procedures. First we use the fixed state and year effects to perform the equivalent of a difference-in-difference analysis. Second, we use the values of the labor law indices and state labor expenditures lagged by one year, because differences in the current year manufacturing variables could not influence choices about the labor laws and labor spending. We are exploring taking another step to control for endogeneity by developing a series of instruments for the lagged value of the labor law indices and the labor spending per gainfully employed worker. Potential candidates for instruments include the percent voting for the Republican presidential candidate, the Socialist candidate, and the progressive candidate in the most recent election, (1900 for the 1903 labor law variables associated with the 1904 manufacturing values, 1908 for the 1908 labor law variables for the 1909 manufacturing values, 1912 for the 1913 labor law variables for the 1914 manufacturing values, and 1916 for the 1918 labor law values for the 1919 manufacturing values), the percentage of years that the state had a Democratic governor in the years since the prior manufacturing census and through the year for the labor law variables, the average percent democrat in the lower house and the upper house of the legislature, the number of legislative shifts in power in the lower house and the number of shifts in the upper house of the legislature in the years since the prior manufacturing census and through the year for the labor law variables (1900-1903 for the 1903 labor law variables, 1905-1908 for the 1908 labor law variables, 1910-1913 for the 1913 labor law variables, 1915-1918 for the 1918 labor law variables). We also could include information for the entire population from the most recent census for the following: the percent black, percent foreign-born, percent illiterate, percent of the gainfully employed in agriculture, the percent in mines, and the percent in manufacturing (1900 census for the 1903 labor law variables, 1900 census for the 1908 labor law variables, 1910 census for the 1913 labor law variables, and 1910 census for the 1913 labor law variables.) We are currently working on setting up the data to allow for these controls.[16]

Conclusions

Our goal has been to investigate the impact of the broad labor regulatory climate on input demands in manufacturing during the Progressive Era. Prior quantitative work has focused on specific forms of legislation without controlling for the wide range of changes in labor legislation that occurred simultaneously. Thus, some of the effects measured in those studies may have been capturing the impact of unmeasured labor legislation. By developing aggregate measures to capture the broad regulatory climate, we have helped to reduce the potential for bias by omitting other forms of labor legislation, although we lose the opportunity to speak to the effects of specific forms of regulation.

The estimation of the parameters suggested that the input own-price elasticities in manufacturing were all negative, as might be expected. There was possibly a weak complementary relationship between wage laborers and capital, while there were strong substitute relationships between materials and each of the other three inputs.

One striking result is the strong positive effect of labor legislation on the demand for salaried workers. The labor legislation appears to have contributed extensively to the bureaucratization of manufacturing firms, as the more supervisors and clerical workers were needed to meet the monitoring and reporting requirements of the legislation. The rise in salaried worker demand associated with the labor legislation contributed to roughly one-third of the rise in salaried workers that actually occurred.

Of special interest is the impact of the labor laws on the demand for wage laborers. The wage laborer demand was most negatively affected by the second wave of legislation associated with womens' hours laws, social insurance legislation, expansions of the powers of the regulatory bodies, and more favorable treatment of unions. Labor demand might have been positively influenced in the states that had adopted first wave of legislation that established the backbone of safety regulations and served to reduce child labor, but we cannot reject the hypothesis of no effect. It may well be that the first-wave laws served to codify the practices of a significant number of progressive employers and thus have lead a weaker effect on labor demand than might have been anticipated. Finally, anti-union legislation may have been associated with declines in labor demand, although we cannot reject the hypothesis of no effect. In general, the labor laws contributed to increasing the cost of production for employers.

The evidence shows that some of the labor laws might have essentially become a "tax" on employers, but that does not mean that the overall effects on society were uniformly negative. The overall negative effect on labor demand of the various forms of labor legislation was more than offset by other changes in manufacturing that led to an increase in the use of labor. Whereas labor legislation would have reduced labor demand by 7.1 percent on average in the U.S., the actual change in labor hired was 29.7 percent. When we combine the evidence on the response of demand for wage laborers with the information from reduced form estimation of annual earnings and employment, it appears that many of the laws contributed to an increase in labor supply. In the case of anti-union legislation, the rise in labor supply may have resulted from the greater inability of unions to restrict labor supply to enhance bargaining power. In the case of the second-wave laws and state labor expenditures, workers may have increased their labor supply in response to improved working conditions. Thus, a substantial number of workers might have thought that the regulations improved working conditions enough for them to increase their labor supply to the states with more regulations.

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Table 1
Number of States with Each Type of Law, 1894, 1908, 1918

Law	**1895**	**1908**	**1918**	**1924**
Employer Liability Law				
Restates Common Law	15	28	23	21
General	21	47	48	47
Railroads	16	31	32	32
Street Railroads	1	8	7	7
Mines	1	4	4	4
Can't require employees to sign contracts waiving damages	14	25	28	28
Social Insurance				
Workers' Compensation Law	0	0	37	42
Mother's pension	0	4	30	43
Factory Safety				
Rehabilitation commission	0	0	0	4
Industrial safety commission	0	0	9	17
Sanitation/bathroom regulations	11	22	34	35
Ventilation	10	22	25	26
Guards required on machines	12	22	34	35
Electrical Regulations	0	0	6	8
Building Regulations	5	13	23	24
Other	1	3	10	11
Bakery Regulations	7	14	27	32
Sweatshop Regulations	9	11	14	14
Fire escapes	23	30	36	37
Factory Inspector	15	29	39	41
Occupational disease reporting	1	1	16	17
Steam boiler inspector/violation of safety laws.	15	17	15	17
Reporting of Accidents				
Mine accidents	19	26	33	32
Railroad accidents	3	21	36	39
Factory accidents	10	14	22	23
Railroad Regulations				
Safety Regulations	20	32	45	45
Street Railroad safety regulations	7	28	30	30
Railroad Inspectors	4	7	6	6
Mining Regulations				
Mine inspectors	23	30	33	33
Mine Safety Regulations: Employees/Individuals	18	23	30	32
Mine Safety Regulations: Companies	22	30	33	35
Fine for failure to weigh coal-no screening	14	21	22	23
Fine for mine inspector failing to do his job	9	13	17	18
Miners' Hospital and or Home	4	5	5	5
No Women and Children in Mines	25	31	35	35
Law	**1894**	**1908**	**1918**	**1924**
Child Labor				
Child safety commission	0	1	10	14
Child labor inspector	13	30	40	41
Children in manufacture/mercantile/mechanical jobs	20	42	42	44
Minimum Age	17	33	40	42

Penalty for false certificate of age	16	36	38	38
Certificates of Age required for employment	19	38	45	46
Fine for children working to support idle parents.	1	7	7	7
No children cleaning or handling moving parts	10	20	36	39
No children in immoral jobs (acrobat) Is this street jobs?	25	30	34	34
No women and children in bars	6	23	5	6
Child hours law				
General	7	18	30	35
Mercantile	6	15	22	22
Mechanical	18	30	30	28
Textile	15	27	27	26
Other	2	8	10	10
Minimum Age for night labor for children	7	29	42	45
Women's Regulation				
Special accomodations (seats)	23	33	44	44
Earnings of married women belong to her	31	43	46	46
Women's Hours				
Night labor	3	4	11	13
General/All Employment	2	6	24	28
Mercantile	3	8	24	27
Mechanical	12	16	25	28
Textiles	8	13	25	27
Holidays				
No work on legal holidays	0	0	3	3
Labor Day a holiday	29	48	51	51
Sunday labor fines	43	48	49	50
Hours Laws				
Textiles	6	6	6	6
Mines	5	13	15	15
Manufacture	7	7	8	9
Railroads	8	26	27	27
Street Railroads	8	10	10	10
Public Employment	14	22	29	30
Other	5	5	11	11
General Hours Law	13	12	11	11
Public Roads	2	23	16	16
1 hr for meals	6	9	17	19
Law	**1894**	**1908**	**1918**	**1924**
Unionization and Bargaining				
False use of union cards or employers' certificates	1	10	12	13
Incorporation of labor unions.	9	9	10	11
Labor organizations exempt from antitrust	5	5	10	14
Enticement fines	11	11	11	11
Interfere with or intimidate in railroads or workers abandoning trains or obstructing track	25	11	9	9
Interference with railroad employees	14	9	9	9
Interference with street railroad employees	4	1	1	2
No intimidation of miners	4	6	7	7
Illegal to interfere with a business or the employment of others	15	16	19	21
Anti-picketing	0	2	2	6

Anti-boycott	3	7	5	5
Strikes: Agreements not to work allowed	3	5	7	10
Conspiracy vs. workmen (conspiring to prevent someone from working	11	14	15	17
Labor agreement is not a conspiracy	6	8	8	10
Anti-intimidation	19	23	26	27
No blacklisting	14	23	25	25
Yellow dog contract (Not allowed to join a union as a condition of employment) (illegal for anyone to coerce to join or not to join a union)	11	16	12	12
Prohibition on hiring armed guards	17	12	9	9
Industrial police are legal	1	9	19	22
Misrepresentation about a strike or other job characteristics	2	7	12	13
Limits on injunctions	0	1	4	8
Criminal Syndicalism (advocating violence or sabotage for political or industrial ends)	0	0	7	19
Labor organizations--embezzlement of funds by officers	2	2	3	3
Combinations of employers to fix wages illegal	0	1	0	0
Trespass on mines, factories, without consent of owner	1	1	0	0
Union trademark fine	25	42	43	44
Convict Labor				
Convict Labor Regulations	22	27	32	33
Bribery, Coercion, or Gouging				
Foreman accepting fees for employment illegal	1	4	12	14
Bribing Employees	0	13	17	17
Coercion of Employees is illegal	10	13	19	19
Company Stores Cannot Gouge	6	8	8	8
Political Protections				
Coercing the votes of employees illegal	30	33	38	38
Time off to Vote	18	22	24	24
Law	**1894**	**1908**	**1918**	**1924**
Administrative				
Bureau of labor Statistics or Department of Labor	28	34	43	44
State board of arbitration	20	26	32	33
Free employment offices	0	14	23	32
Alien Labor				
Importing alien labor illegal	2	1	0	0
No aliens in public employment	5	12	14	17
Chinese labor illegal	3	3	3	3
Employment Agents				
Emigrant agent license	3	6	11	12
Regulation of Employment Agencies	11	25	35	42
Occupational Licensing				
Railroad telegraph operators (also minimum age)	3	1	1	2
Plumbers	9	19	22	23
Horseshoers	2	5	6	6
Chauffers	0	1	27	36
Aviators	0	0	2	6
Other	0	0	2	2
Motion Picture Operator	0	0	8	8
Barbers	1	13	16	16

Steam engineers (firemen)	11	16	17	17
Mine manager	7	11	13	16
Elevator operators	1	2	2	2
Railroad employees	1	1	1	1
Electricians	0	1	2	4
Stevedores	2	2	2	2
Anti-discrimination				
Cannot fire due to age only	0	1	1	1
Sex discrimination	3	3	4	6
antidiscrimination	1	1	1	1
Wage Payments				
Nonpayment	1	1	3	4
Wages in cash	19	29	28	30
Wage payment frequency	20	26	32	37
Repayment of advance made by employer	1	9	9	12
No forced contributions by employers	5	6	7	8
Railroad workers: Notice of reduction of wages required	1	2	2	2
Fine for no notice of discharge if employee has to give notice too	6	9	10	10
Minimum Wages				
Minimum wage for public work	1	4	9	10
Minimum wage for women/children (<18)	0	0	12	14
Minimum Wage Commission	0	0	9	10
Miscellaneous				
illegal to desert a ship	5	1	0	0

Includes all states as of 1912, Alaska, Hawaii, and the District of Columbia. **Yes.**

Table 2: Eigenvalues of the Correlation Matrix				
Number	Eigenvalue	Difference	Proportion	Cumulative
1	18.731	9.943	13.9%	13.9%
2	8.788	2.570	6.5%	20.4%
3	6.218	1.175	4.6%	25.0%
4	5.043	0.753	3.7%	28.7%
5	4.291	0.485	3.2%	31.9%
6	3.806	0.249	2.8%	34.7%
7	3.558	0.421	2.6%	37.4%
8	3.136	0.034	2.3%	39.7%
9	3.102	0.180	2.3%	42.0%
10	2.922	0.067	2.2%	44.1%
11	2.855	0.092	2.1%	46.3%
12	2.763	0.099	2.1%	48.3%
13	2.664	0.085	2.0%	50.3%
14	2.578	0.099	1.9%	52.2%
15	2.480	0.180	1.8%	54.0%
16	2.299	0.096	1.7%	55.7%
17	2.203	0.035	1.6%	57.4%
18	2.168	0.108	1.6%	59.0%
19	2.060	0.147	1.5%	60.5%
20	1.913	0.074	1.4%	61.9%
21	1.840	0.118	1.4%	63.3%
22	1.722	0.067	1.3%	64.6%
23	1.655	0.068	1.2%	65.8%
24	1.587	0.040	1.2%	67.0%
25	1.546	0.021	1.2%	68.1%
26	1.525	0.041	1.1%	69.2%
27	1.484	0.074	1.1%	70.3%
28	1.410	0.083	1.0%	71.4%
29	1.327	0.013	1.0%	72.4%
30	1.313	0.072	1.0%	73.3%
31	1.242	0.076	0.9%	74.2%
32	1.166	0.006	0.9%	75.1%
33	1.160	0.035	0.9%	76.0%
34	1.125	0.038	0.8%	76.8%
35	1.087	0.015	0.8%	77.6%
36	1.072	0.066	0.8%	78.4%
37	**1.007**	**0.033**	**0.8%**	**79.2%**

Table 3

Laws that Loaded on to the Four Factors in a Statistically Significant Fashion

	Factor			
Law	1	2	3	4
Employer Liability Law				
Restates Common Law				0.35
General		0.42		-0.33
Railroads				0.47
included in RR variable (if the state had either street RR or regular RR EL Law, this =1)				
Mines				
Can't require employees to sign contracts waiving damages				
Social Insurance				
Workers' Compensation Law	0.35	0.59		
Mother's pension	0.35	0.6		
Factory Safety				
Rehabilitation commission				
Industrial safety commisssion		0.52		
Sanitation/bathroom regulations	0.68			
Ventilation	0.62			
Guards required on machines	0.62			
Electrical Regulations		0.62		
Building Regulations	0.57	0.32		
Other				
Bakery Regulations	0.63			
Sweatshop Regulations	0.68			
Fire escapes	0.69			
Factory Inspector	0.72			
Occupational disease reporting	0.5			
Steam boiler inspector/violation of safety laws.	0.48			
Reporting of Accidents				
Mine accidents			0.79	
Railroad accidents	0.38	0.43		
Factory accidents	0.64			
Railroad Regulations				
Safety Regulations	0.54	0.43		
Street Railroad safety regulations	0.54			
Railroad Inspectors				
Mining Regulations				
Mine inspectors			0.83	
Mine Safety Regulations: Employees/Individuals			0.81	

Mine Safety Regulations: Companies			0.8	
Fine for failure to weigh coal-no screening			0.8	
Fine for mine inspector failing to do his job			0.65	
Miners' Hospital and or Home				-0.39
No Women and Children in Mines			0.73	
Law	**1**	**2**	**3**	**4**
Child Labor				
Child safety commission		0.58		
Child labor inspector	0.67			
Children in manufacture/mercantile/mechanical jobs	0.68			
Minimum Age	0.57			
Penalty for false certificate of age	0.58			
Certificates of Age required for employment	0.64			
(dropped)				
No children cleaning or handling moving parts	0.63			
No children in immoral jobs (acrobats or street trades)	0.53			
dropped				
Child hours law				
General	0.32	0.31		
Mercantile	0.41			-0.44
Mechanical	0.54			
Textile	0.54			
Other				
Minimum Age for night labor for children	0.54			
Women's Regulation				
Special accomodations (seats)	0.56			
Earnings of married women belong to her				
Women's Hours				
Night labor	0.46			
General/All Employment	0.36	0.42		
Mercantile	0.46			
Mechanical	0.54			
Textiles	0.49			
Holidays				
No work on legal holidays				
Labor Day a holiday	0.44			
Sunday labor fines	0.32			
Hours Laws				
Textiles				
Mines		0.43		
Manufacture				
Railroads		0.35		

Street Railroads	0.39			-0.42
Public Employment		0.42	0.36	-0.41
Other		0.41		
General Hours Law	0.4			
Public Roads				
variable was dropped				
Law	**1**	**2**	**3**	**4**
Unionization and Bargaining				
False use of union cards or employers' certificates	0.35	0.46		
Incorporation of labor unions.	0.34			-0.33
Labor organizations exempt from antitrust				
Enticement fines				
Interfere with or intimidate in railroads or workers abandoning trains or obstructing track		-0.31		
Interference with railroad employees				
Interference with street railroad employees				
No intimidation of miners				
Illegal to interfere with a business or the employment of others				0.49
Anti-picketing				
Anti-boycott			0.34	
Strikes: Agreements not to work allowed				
Conspiracy vs. workmen (conspiring to prevent someone from working				0.49
Labor agreement is not a conspiracy				
Anti-intimidation				0.53
No blacklisting		0.33		0.41
Yellow dog contract (Not allowed to join a union as a condition of employment) (illegal for anyone to coerce to join or not to join a union)	0.37			
Prohibition on hiring armed guards				
Industrial police are legal				
Misrepresentation about a strike or other job characteristics		0.46		
Limits on injunctions		0.49		
Criminal Syndicalism (advocating violence or sabotage for political or industrial ends)		0.51		
Labor organizations--embezzlement of funds by officers				
Combinations of employers to fix wages illegal				
Trespass on mines, factories, without consent of owner				
Union trademark fine	0.49			
Convict Labor				
Convict Labor Regulations	0.38		0.31	
Bribery, Coercion, or Gouging				
Foreman accepting fees for employment illegal		0.39		
Bribing Employees	0.41			

Coercion of Employees is illegal			0.39	
Company Stores Cannot Gouge	0.3			-0.34
Political Protections				
Coercing the votes of employees illegal			0.38	
Time off to Vote			0.54	
Law	**1**	**2**	**3**	**4**
Administrative				
Bureau of labor Statistics or Department of Labor	0.54			
State board of arbitration	0.46		0.32	
Free employment offices	0.48	0.32		
Alien Labor				
Importing alien labor illegal				
No aliens in public employment				-0.62
Chinese labor illegal		0.4		
Employment Agents				
Emigrant agent license				
Regulation of Employment Agencies	0.57			
Occupational Licensing				
Railroad telegraph operators (also minimum age)				
Plumbers	0.48			
Horseshoers			0.31	
Chauffers	0.41	0.43		
Aviators				
Other				
Motion Picture Operator	0.33			
Barbers	0.3			0.44
Steam engineers (firemen)	0.44			
Mine manager			0.6	
Elevator operators				
Railroad employees				
Electricians				
Stevedores				
Anti-discrimination				
Cannot fire due to age only				
Sex discrimination		0.33		
Antidiscrimination			0.31	
Wage Payments				
Nonpayment				
Wages in cash			0.34	
Wage payment frequency	0.45			
Repayment of advance made by employer				
No forced contributions by employers			0.3	

Railroad workers: Notice of reduction of wages required				
Fine for no notice of discharge if employee has to give notice too	0.46		-0.33	
Minimum Wages				
Minimum wage for public work		0.38		
Minimum wage for women/children (<18)		0.71		
Minimum Wage Commission		0.68		

Table 4

Factor Scores for States, 1899-1919

	Factor 1			Factor 2			Factor 3			Factor 4		
	1899	1909	1919	1899	1909	1919	1899	1909	1919	1899	1909	1919
New England												
CT	**104.8**	**116.2**	**115.5**	92.4	96.1	106.7	86.1	90.4	86.7	95.5	97.9	93.6
ME	**99.7**	**107.2**	**113.7**	94.2	94.2	99.6	87.0	85.3	83.7	**103.5**	93.1	91.8
MA	**110.1**	**114.9**	**114.1**	94.2	101.5	**131.7**	94.7	89.6	77.9	88.3	87.3	78.9
NH	**104.4**	103.8	**111.1**	92.2	93.8	105.2	85.1	85.3	81.7	101.2	101.5	97.1
RI	**105.3**	**110.3**	**111.7**	91.6	93.8	97.8	85.3	85.2	83.8	**105.8**	**106.0**	105.1
VT	92.2	96.0	105.5	94.0	96.5	101.8	85.1	85.7	86.4	**103.1**	**106.0**	105.1
Mid-Atlantic												
DE	90.8	96.4	104.0	94.7	93.1	102.4	91.6	91.8	88.6	95.7	97.6	99.1
NJ	**113.5**	**111.7**	**113.3**	92.2	88.9	102.3	99.9	97.4	98.3	87.4	88.3	80.8
NY	**108.5**	**117.9**	**119.0**	95.1	**106.3**	**113.2**	103.2	100.7	95.9	99.0	87.6	82.9
PA	**113.7**	**113.3**	**115.8**	95.4	98.0	103.4	**105.7**	105.1	103.9	76.4	79.3	76.6
Midwest												
IL	**102.6**	**112.6**	**110.7**	92.7	94.4	101.8	**114.5**	**115.7**	**111.5**	**109.1**	**115.9**	**114.2**
IN	**103.0**	**108.2**	107.2	89.3	94.1	106.5	**119.2**	**121.1**	**119.8**	83.6	89.8	92.7
MI	**109.1**	**114.3**	**115.7**	97.6	100.2	108.4	99.3	101.4	101.0	**109.6**	**108.0**	105.1
OH	**107.6**	**108.9**	**113.9**	96.7	98.0	108.5	**108.4**	**107.9**	**107.3**	100.0	99.9	88.7
WI	**103.8**	**110.9**	**111.5**	**102.1**	**105.1**	**122.2**	93.2	96.4	91.7	**109.6**	**110.0**	**108.3**
Plains												
IA	97.4	104.6	104.5	92.2	97.5	106.1	**113.8**	**110.6**	**108.7**	98.9	95.8	99.5
KS	88.3	104.5	101.8	97.4	97.5	**114.6**	**107.3**	**109.8**	**109.0**	92.8	101.0	**106.9**
MN	**109.4**	**109.0**	107.2	98.0	**107.2**	**129.0**	101.6	**106.0**	105.3	**116.0**	**114.3**	**115.1**
MO	**105.5**	**111.8**	**113.6**	94.6	97.2	100.3	**112.3**	**110.6**	**108.3**	**109.4**	**116.8**	**114.6**
NE	97.6	103.2	107.8	**100.1**	99.2	109.1	88.9	90.0	87.6	93.9	103.5	104.2
ND	94.1	97.5	97.2	98.1	100.7	**121.3**	87.5	91.1	96.0	**106.1**	**115.9**	**118.6**
SD	91.7	94.2	96.9	96.6	97.8	108.8	95.6	100.3	100.9	**102.2**	**111.4**	**111.9**
South												
VA	93.7	100.8	102.8	93.8	94.5	98.6	89.5	91.2	99.2	98.8	101.1	102.4
AL	84.4	93.6	93.6	**100.6**	99.0	103.5	103.1	103.4	104.1	**102.1**	**113.6**	**112.1**
AR	81.5	90.2	91.8	**99.7**	100.7	108.7	**104.8**	104.3	**109.3**	93.0	99.8	99.8
FL	85.4	94.1	96.9	**100.8**	**102.1**	101.8	90.2	88.9	88.7	**103.0**	103.8	**105.8**
GA	89.0	93.2	100.2	**101.2**	99.6	99.9	89.3	88.3	88.5	**110.3**	**111.2**	**114.5**
LA	99.4	**108.5**	**108.7**	98.2	98.9	99.3	88.8	88.7	92.0	86.8	88.3	83.9
MS	86.3	92.3	94.1	99.2	99.2	102.4	87.7	86.4	87.2	**103.2**	**108.2**	**105.5**
NC	82.7	91.1	94.5	97.2	97.6	102.5	100.9	101.8	97.1	98.7	**106.3**	**109.6**
SC	85.4	91.5	100.7	98.1	98.3	96.9	89.4	90.2	89.6	100.6	104.3	100.8
TX	89.1	90.2	104.0	99.0	98.0	107.6	90.6	103.0	103.9	**103.6**	**108.8**	**110.4**
KY	88.6	100.9	104.2	93.1	92.6	97.2	100.5	103.5	102.4	93.3	100.9	99.1
MD	96.2	101.1	**108.8**	91.3	94.2	105.9	**109.7**	**118.3**	**112.0**	84.2	101.0	98.0
OK	86.6	86.4	102.3	99.4	**102.1**	109.2	88.4	98.8	**113.3**	100.6	105.1	**110.2**
TN	94.1	99.7	105.7	93.9	92.5	95.9	**108.7**	**110.0**	**108.7**	96.8	97.1	97.9
WV	88.8	97.3	98.7	96.0	95.7	99.7	**108.0**	**113.0**	**111.6**	91.0	95.6	100.1
Mountain West												
AZ	81.9	84.0	88.2	**99.6**	**103.1**	**122.7**	90.5	97.3	105.2	89.9	93.8	97.7

CO	91.1	99.1	108.3	**104.4**	**105.3**	**119.4**	**112.8**	**114.5**	**114.2**	95.9	**108.7**	**118.2**
ID	82.4	96.3	98.9	**102.1**	101.0	**113.3**	96.9	101.5	98.6	84.4	88.0	85.9
MT	91.7	91.3	94.4	**100.3**	**116.2**	**126.8**	**103.4**	**109.0**	**107.4**	98.8	101.2	102.3
NV	80.3	82.3	91.5	**105.0**	**114.5**	**132.7**	90.9	95.7	102.6	92.5	91.2	98.7
NM	83.2	81.1	83.3	99.3	**101.9**	105.5	94.8	97.3	105.1	93.5	88.7	96.4
UT	83.5	85.2	93.8	**106.8**	**108.8**	**128.4**	101.4	**109.8**	**110.5**	89.9	91.2	101.7
WY	83.4	84.5	94.1	**101.8**	**102.1**	106.9	**110.4**	**110.7**	**113.5**	84.3	83.3	88.4
Pacific												
CA	92.4	100.3	97.7	**103.4**	**115.5**	**145.2**	99.0	95.8	92.7	76.1	78.2	83.5
OR	84.1	97.6	98.9	98.0	**109.2**	**134.7**	88.8	95.1	92.2	93.5	103.4	104.0
WA	89.4	100.0	95.4	**101.8**	**106.5**	**141.7**	**106.4**	**106.0**	100.1	93.7	100.2	103.6

Source: The scores are indexed such that the national average as of 1909 is equal to 100. Before indexing the scores were developed as predicted factor scores based on the parameters from the principal component analysis and the laws in place in the state in 1919. The scores for the 15 states with the highest values in each year for each factor are in bold type.

Table 5

State Appropriations for Labor Issues per Gainfully Employed Worker, 1899-1919 (1967$)

Labor Appropriations per Gainfully Employed Worker					
	1899	1904	1909	1914	1919
New England					
CT	**$0.069**	**$0.073**	**$0.069**	$0.062	$0.071
ME	$0.018	$0.017	$0.034	$0.032	$0.034
MA	**$0.097**	**$0.101**	**$0.148**	**$0.202**	**$0.273**
NH	$0.017	$0.016	$0.016	$0.063	$0.093
RI	**$0.047**	**$0.038**	$0.049	$0.083	$0.089
VT	$0.000	$0.000	$0.000	$0.034	$0.034
Mid-Atlantic					
DE	$0.004	$0.004	$0.013	$0.054	$0.063
NJ	**$0.040**	$0.037	$0.049	**$0.092**	$0.092
NY	**$0.057**	**$0.042**	$0.053	**$0.208**	**$0.287**
PA	**$0.072**	**$0.099**	**$0.109**	**$0.138**	**$0.281**
Midwest					
IL	**$0.054**	**$0.057**	**$0.073**	**$0.091**	$0.103
IN	$0.036	$0.034	$0.038	$0.075	$0.077
MI	**$0.039**	**$0.038**	$0.044	$0.046	$0.065
OH	**$0.070**	**$0.073**	**$0.102**	**$0.215**	**$0.252**
WI	$0.036	**$0.042**	**$0.056**	**$0.095**	**$0.152**
Plains					
IA	$0.015	$0.019	$0.024	$0.029	$0.044
KS	$0.033	$0.030	$0.044	$0.045	$0.043
MN	$0.025	$0.023	**$0.074**	**$0.121**	**$0.134**
MO	$0.037	$0.036	**$0.054**	$0.056	$0.055
NE	$0.014	$0.013	$0.012	$0.017	$0.027
ND	$0.027	$0.025	$0.045	$0.054	**$0.226**
SD	$0.016	$0.013	$0.012	$0.019	$0.035
South					
VA	$0.005	$0.004	$0.011	$0.016	$0.024
AL	$0.008	$0.007	$0.009	$0.032	$0.035
AR	$0.004	$0.005	$0.004	$0.012	$0.035
FL	$0.000	$0.000	$0.000	$0.008	$0.008
GA	$0.000	$0.000	$0.000	$0.007	$0.009
LA	$0.009	$0.008	$0.007	$0.009	$0.015
MS	$0.000	$0.000	$0.000	$0.005	$0.005
NC	$0.005	$0.005	$0.005	$0.005	$0.008
SC	$0.000	$0.000	$0.011	$0.012	$0.017
TX	$0.000	$0.000	$0.003	$0.014	$0.034
KY	$0.025	$0.019	$0.024	$0.023	$0.022
MD	$0.023	$0.037	$0.046	$0.069	$0.067
OK	$0.034	$0.011	**$0.059**	$0.090	$0.111
TN	$0.008	$0.012	$0.030	$0.039	$0.059
WV	**$0.054**	**$0.053**	**$0.096**	**$0.187**	**$0.349**
Mountain					
AZ				**$0.161**	**$0.129**
CO	**$0.117**	**$0.100**	**$0.126**	**$0.210**	**$0.191**
ID	**$0.126**	**$0.084**	**$0.108**	**$0.130**	**$0.224**
MT	**$0.233**	**$0.182**	**$0.179**	**$0.205**	**$0.308**
NV			**$0.204**	**$0.246**	**$0.430**

NM	**$0.052**	$0.038	$0.029	$0.036	$0.035
UT	$0.017	**$0.072**	$0.049	$0.080	$0.322
WY	**$0.056**	**$0.107**	**$0.101**	**$0.097**	$0.089
Pacific					
CA	$0.017	$0.013	$0.016	$0.034	$0.032
OR	$0.000	$0.013	$0.011	$0.026	$0.039
WA	$0.028	$0.023	$0.048	$0.065	**$0.282**

The fifteen highest figures in each year are in bold type.

Source: State government spending on labor programs includes spending on factory inspection, labor bureaus, mining inspection, bureaus of labor statistics, boards of arbitration, boiler inspector, and free employment bureaus. The data were collected from appropriations to state labor departments reported in the states' volumes of statutes. For each state-year observation we collected the appropriations for factory inspection, boards of conciliation and arbitration, bureaus of labor, bureaus of labor or industrial statistics, free employment bureaus, boiler inspection (but not ship boiler inspection), mining inspection, industrial welfare commissions, and industrial commissions from the states' session laws. In many states appropriations were given for all labor spending without separating out what share went to each division. In a few states, Iowa for example, the statute volumes offered the exact amounts spent by the state treasurer. Some states were either missing appropriations volumes or the appropriations were unnecessarily obtuse. In those states we used interpolations to fill any gaps. In interpolating we tried to be sensitive to the fact that many states were on a two-year cycle and often gave the same amount of appropriations in both years of the cycle. Maryland and Michigan offered extremely uninformative appropriations information. For Michigan we collected the appropriations data from the Michigan Auditor General's Annual Report for years between 1900 and 1920. For Maryland we collected information from the Maryland Bureau of Statistics and Information, Annual Reports.

We deflated the expenditures using the CPI (1967=100) and then divided the real expenditures by an estimate of the number of workers gainfully employed in the state. The employment estimate was determined by calculating the share of total U.S. gainfully employed in each state for the years 1900, 1910, 1920, 1930, and 1940 from series D-26 in U.S. Bureau of Census (1975, 129-31). The shares between the census years were calculated using straight-line interpolations. We then multiplied the shares for each state and year by total employment in the U.S. in each year (series D-5 in U.S. Bureau of Census 1975, 126) to create an estimate of employment in each state.

Table 6: Elasticity of Demand

Input	Base	Time Counter	Year Effects	State Effects, Time Counter	State Effects	State, Year Effects
Materials	-0.316	-0.490	-0.424	-0.651	-0.581	-0.518
p-value	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Salary Workers	-0.870	-0.597	-0.482	-0.712	-0.859	-1.037
p-value	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Wage Workers	-0.602	-0.736	-0.671	-0.772	-0.700	-0.640
p-value	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Capital	-0.459	-0.693	-0.577	-0.885	-0.576	-0.655
p-value	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

Elasticities and standard errors are calculated according to Binswanger, page 380-383 . See Appendix ??. Bold p-values are ones less than 0.10 in a two-tailed test.

Table 7: Elasticity of Substitution

Inputs	With Respect To:	Base	Time Counter	Year Effects	State Effects, Time Counter	State Effects	State, Year Effects
Capital	Salary Workers	1.121	0.844	-0.533	1.324	0.527	1.466
	P	**0.003**	**0.013**	0.124	**0.004**	0.189	**0.001**
Capital	Wage Workers	0.046	-0.533	0.057	-1.573	-1.616	-0.988
	P	0.896	0.107	0.814	**0.000**	**0.000**	**0.004**
Capital	Material	0.676	1.240	0.977	1.818	1.363	1.280
	P	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Wage Workers	Material	0.932	1.359	1.139	1.711	1.658	1.355
	P	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Wage Workers	Salary Workers	0.731	0.389	-0.643	0.570	-0.173	0.287
	P	0.202	0.524	0.303	0.384	0.797	0.683
Materials	Salary Workers	0.885	0.616	1.155	0.608	1.298	1.183
	P	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

Elasticities are symmetric and are best used to evaluate substitute-complement relationships between inputs. Elasticities and standard errors are calculated according to Binswanger, page 380-383. Bold p-values are ones less than .10 in two-tailed test.

Table 8: Partial Elasticities of Demand

Inputs with respect to prices of inputs		Base	Time Counter	Year Effects	State Effects, Time Counter	State Effects	State, Year Effects
Wage	Materials	0.566	0.823	0.684	1.039	1.008	0.816
p		**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Wage	Salary	0.027	0.015	-0.024	0.021	-0.006	0.011
p		0.202	0.524	0.303	0.384	0.797	0.683
Wage	Capital	0.009	-0.100	0.011	-0.290	-0.301	-0.186
p		0.896	0.107	0.814	**0.000**	**0.000**	**0.004**
Salary	Materials	0.538	0.373	0.694	0.369	0.790	0.712
p		**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Salary	Capital	0.210	0.158	-0.101	0.244	0.098	0.275
p		**0.003**	**0.013**	0.124	**0.004**	0.189	**0.001**
Salary	Wage	0.123	0.066	-0.111	0.097	-0.029	0.049
p		0.202	0.524	0.303	0.384	0.797	0.683
Materials	Salary	0.033	0.023	0.043	0.023	0.048	0.045
p		**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Materials	Wage	0.157	0.231	0.196	0.293	0.279	0.234
p		**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Materials	Capital	0.126	0.233	0.185	0.335	0.254	0.241
p		**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Capital	Wage	0.008	-0.091	0.010	-0.269	-0.272	-0.170
p		0.896	0.107	0.814	**0.000**	**0.000**	**0.004**
Capital	Materials	0.410	0.751	0.587	1.103	0.829	0.771
p		**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Capital	Salary	0.041	0.031	-0.020	0.050	0.020	0.055
p		**0.003**	**0.013**	0.124	**0.004**	0.189	**0.001**

These elasticities are not symmetric and should be interpreted as the elasticity of demand for the first column (i^{th}) input after a price change in the second column (j^{th}) input. **Notes:** See Appendix ?? for method of calculating elasticities based on Binswanger, 380-3. Bold p-values are ones less than .10 in two-tailed test

Wage is Wage Workers, Salary is Salary Workers.

Table 9: Partial Elasticities of Demand: Labor Laws

Elasticity of Inputs with respect to labor law indices, spending or output		Base	Time Counter	Year Effects	State Effects, Time Counter	State Effects	State, Year Effects
Wage	Factor 1	0.401	0.172	0.068	0.709	-0.051	0.288
p		0.306	0.682	0.851	0.137	0.901	0.468
Capital	Factor 1	-0.010	-0.389	-0.405	-0.062	-0.428	-0.383
p		0.968	0.146	**0.038**	0.826	**0.074**	0.133
Salary	Factor 1	2.249	1.506	1.754	1.796	2.164	2.154
p		**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Materials	Factor 1	-0.025	-0.207	-0.285	0.011	0.933	0.505
p		0.876	0.240	**0.045**	0.955	**0.000**	**0.003**
Wage	Factor 2	0.157	-0.709	-0.872	-0.188	-0.810	-0.673
p		0.740	0.148	**0.039**	0.720	**0.036**	**0.081**
Capital	Factor 2	0.794	-0.401	-0.513	0.361	0.428	-0.017
p		**0.029**	0.264	**0.093**	0.298	0.173	0.958
Salary	Factor 2	1.547	-0.140	0.311	0.237	1.246	1.084
p		**0.001**	0.715	0.441	0.602	**0.004**	**0.019**
Materials	Factor 2	0.642	-0.127	-0.032	-0.083	1.224	0.617
p		**0.002**	0.518	0.841	0.683	**0.000**	**0.000**
Wage	Factor 4	-0.841	-0.911	-0.790	-0.419	-0.529	-0.410
p		**0.005**	**0.007**	**0.012**	0.263	0.200	0.246
Capital	Factor 4	-0.347	-0.545	-0.454	-0.406	-0.307	-0.330
p		**0.091**	**0.024**	**0.041**	0.102	0.179	0.224
Salary	Factor 4	-0.093	-0.293	-0.142	-0.006	0.135	0.147
p		0.627	0.106	0.511	0.978	0.579	0.532
Materials	Factor 4	0.565	0.578	0.515	0.625	0.831	0.687
p		**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Wage	Spending	-0.072	-0.031	-0.033	-0.009	-0.009	-0.018
p		**0.001**	0.178	**0.083**	0.700	0.729	0.399
Capital	Spending	-0.053	-0.028	-0.033	-0.004	0.017	-0.003
p		**0.006**	**0.047**	**0.030**	0.788	0.325	0.868
Salary	Spending	-0.051	-0.029	-0.020	-0.009	0.008	0.007
p		**0.009**	**0.069**	0.270	0.611	0.703	0.758
Materials	Spending	-0.007	0.002	0.007	0.010	0.012	0.018
p		0.425	0.784	0.396	0.275	0.225	**0.034**
Wage	Output	0.799	0.742	0.776	0.743	0.814	0.742

p		**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Capital	Output	1.107	1.035	1.053	1.055	1.108	1.028
p		**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Salary	Output	0.810	0.737	0.729	0.732	0.789	0.746
p		**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Materials	Output	1.118	1.092	1.087	1.028	1.034	0.991
p		**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

These elasticities are not symmetric and should be interpreted as the elasticity of demand for the first column (i^{th}) input after a price change in the second column (j^{th}) input. Elasticities and standard errors are calculated according to Binswanger, page 380-383. Bold p-values are ones less than .10 in two-tailed test.

Wage refers to Wage Workers, Salary to Salaried Workers. Factor 1 is First-Wave Laws, Factor 2 is Second-Wave Laws, Factor 4 is Anti-Union Laws. Spending is State Labor Spending on Labor Issues per Gainfully Employed Worker.

Table 10
Elasticities of Output With Respect to Labor Laws

Inputs		Base	Time Counter	Year Effects	State Effects, Time Counter	State Effects	State, Year Effects
Output	Factor 1	-0.134	0.111	0.170	-0.182	-0.558	-0.362
Output	Factor 2	-0.622	0.278	0.255	0.009	-0.733	-0.292
Output	Factor 4	-0.133	-0.081	-0.082	-0.231	-0.364	-0.286
Output	Spending	0.028	0.010	0.009	-0.004	-0.009	-0.008

Note: Elasticities are the percent change in output resulting from a one percent change in factor scores or state spending per worker on labor legislation. Standard errors and p-values not available

Factor 1 is First-Wave Laws, Factor 2 is Second-Wave Laws, Factor 4 is Anti-Union Laws. Spending is State Labor Spending on Labor Issues per Gainfully Employed Worker.

Table 11:
Impact Analysis: State And Year Fixed Effects Version
Predicted Change in Input Quantities Attributable to Empirical Change in Exogenous Variables

Variable	Change 1899-1919	Impact of Observed Change in Price on Input Demand*			
		Materials	Wage Labor	Salary Labor	Capital
Non-Labor Variables					
Materials Price	97.2%	-50.4%	79.3%	69.2%	74.9%
Wage Price	16.9%	3.9%	-10.8%	0.8%	-2.9%
Salary Price	-13.4%	-0.6%	-0.1%	13.9%	-0.7%
Capital Price	-68.2%	-16.4%	12.7%	-18.8%	44.6%
Real Value of Products per Establishment	50.5%	50.1%	37.5%	37.7%	51.9%
Total Predicted Change: Non-labor Variables		**-13.4%**	**118.4%**	**102.8%**	**167.8%**
First Wave Laws	9.8%	4.9%	2.8%	21.0%	-3.7%
Second Wave Laws	11.3%	7.0%	-7.6%	12.3%	-0.2%
Antiunion Factor	3.9%	2.7%	-1.6%	0.6%	-1.3%
Labor Law Expenditures per Worker	39.2%	0.7%	-0.7%	0.3%	-0.1%
Total Predicted Change: Labor Variables		**15.3%**	**-7.1%**	**34.1%**	**-5.3%**
Total Predicted Change in Quantity of Input		**1.9%**	**111.3%**	**137.0%**	**162.5%**
Empirical Change in Quantity of Input		40.1%	29.7%	101.8%	123.1%

Table 12

Results of Reduced Form Estimation of Log(Real Average Annual Earnings for Wage Workers) and Log(Average Employment)

	Log(Wage Earners)				Log(Average Employment)			
	OLS		Fixed Effects		OLS		Fixed Effects	
Variable D	**Coeff.**	**t-stat.**	**Coeff.**	**t-stat.**	**Coeff.**	**t-stat.**	**Coeff.**	**t-stat.**
Intercept	-13.523	-4.87	6.132	3.66	6.230	10.06	8.975	10.53
First-Wave Laws	13.256	19.27	0.859	1.51	-0.418	-2.73	0.208	0.72
Second-Wave Laws	-0.320	-0.41	0.866	2.36	1.165	6.71	-0.613	-3.28
Anti-Union Laws	-1.945	-3.09	0.720	1.77	-0.282	-2.01	-0.281	-1.35
State Labor Expenditures per Gainfully Employed	-0.252	-4.87	0.041	2.05	0.080	6.93	-0.012	-1.18
Year Dummies								
1904			0.139	3.03			0.051	2.20
1909			0.362	6.82			0.132	4.88
1914			0.315	4.14			0.150	3.86
1915			0.576	6.90			0.284	6.68
State Dummies	Not Included		Included		Not Included		Included	
R-squared	0.632		0.985		0.393		0.891	
R-bar-Squared	0.626		0.984		0.382		0.859	

Appendix:

Elasticity Calculations

The elasticity calculations are based on methods used by Binswanger (1974, 380-83) and extensions thereof.

Assume the production function takes the form:

$Y = f(S,W,M,K,\mathbf{F},E,T)$

Where:

S=Quantity of salaried labor
W=Quantity of wage labor
M=Quantity of Materials
K=Quantity of Capital
F=Factor scores; proxy for level of legislation
E=State expenditures/labor force on labor laws
T=Time (proxy for technological change)

The cost function is

$C=f(\mathbf{P},\mathbf{X})$

Where:

P=vector of factor prices (P_S, P_W, P_M, P_K)
X=vector of inputs (S, W, M, K above)

The solution to the cost minimization problem minimize C subject to Y results in a set of factor demands:

S*=s(Y,P,F,E,T)
W*=w(Y,P,F,E,T)
M*=m(Y,P,F,E,T)
K*=k(Y,P,F,E,T)

In this model, prices, legal levels, expenditures, and the level of technology are exogenous to the firm. These variables affect the production technology, and are treated as equality constraints within the model.

The general form of the firm's minimum cost choices, given different levels of prices, factor scores, expenditures, technology, and output.

$C^*=\mathbf{P}'\mathbf{X}^*(Y,\mathbf{P},F,E,T))$, or since **X** can be expressed in terms of its components,
$C^*=f(Y,\mathbf{P},F,E,T)$ (1)

According to Shephard's lemma, cost-minimizing factor demands can be recovered from the cost function in the following way:

$X_i^* = \partial C(Y,\mathbf{P},F,E,T)/\partial P_i$, for i=1..4 inputs S, W, M, K

The translog cost function is a second-order Taylor series of the general cost function (1) above about the point $\ln \mathbf{p} = \mathbf{0}$. This function takes the form:

$$\ln C^* = \alpha_0 + \sum_{i=1}^{4}\alpha_i \ln P_i + \sum_{k-1}^{3}\beta_k \ln F_k + \sum_{m-1}^{3}\delta_m \ln Z_m + \frac{1}{2}\sum_{i=1}^{4}\sum_{j=1}^{4}\alpha_{ij}\ln P_i \ln P_j +$$
$$\frac{1}{2}\sum_{k=1}^{3}\sum_{l=1}^{3}\beta_{kl}\ln F_k \ln F_l + \frac{1}{2}\sum_{m=1}^{3}\sum_{n=1}^{3}\delta_{mn}\ln Z_m \ln Z_n + \sum_{i=1}^{4}\sum_{k=1}^{3}\eta_{ik}\ln P_i \ln F_k + \sum_{i=1}^{4}\sum_{m=1}^{3}\tau_{im}\ln P_i \ln Z_m +$$
$$\sum_{k=1}^{4}\sum_{m=1}^{3}\kappa_{km}\ln F_k \ln Z_m + \varepsilon$$

Where:

$Z_{m,n}$ m,n= 1…3 output, time, and state expenditures on labor legislation (Y, T, E)
$F_{k,l}$ k,l = 1…3 labor legal climate variables (**F**)
$P_{i,j}$ i,j= 1…4 input prices (P_S, P_W, P_M, P_K)
C* = profit-maximizing total cost (cost minimizing)
ε = classical error ~ iid $N(0,\sigma^2)$

The factor share equations are defined as $\partial \ln C/\partial \ln P_i$ for i=1..4. For this model, the factor shares take the following form:

$\partial \ln C/\partial \ln P_i = \alpha_i + \alpha_{ii}\ln P_i + \alpha_{ij}\ln P_j + \alpha_{ik}\ln P_k + \alpha_{il}\ln P_l + \eta_{i1}\ln F_1 + \eta_{i2}\ln F_2 + \eta_{i3}\ln F_3 + \tau_{iY}\ln Y + \tau_{iT}\ln T + \tau_{iE}\ln E$

By applying the rule that

$\partial \ln C/\partial \ln P_i = \partial C/\partial P_i * (P_i/C)$

The derivatives of the translog cost function with respect to the input prices become share equations. This is because $\partial C/\partial P_i = X_i$, so

$\partial \ln C/\partial P_i / \partial \ln P_i/\partial P_i = \partial \ln C/\partial \ln P_i = X_iP_i/C$, or s_i, factor i's share of total cost.

Given this fact, you can recover the factor demand equations from the factor share equations by multiplying both sides of the share equation by C/P_i:

$s_i = \alpha_i + \alpha_{ii}\ln P_i + \alpha_{ij}\ln P_j + \alpha_{ik}\ln P_k + \alpha_{il}\ln P_l + \eta_{i1}\ln F_1 + \eta_{i2}\ln F_2 + \eta_{i3}\ln F_3 + \tau_{iY}\ln Y + \tau_{iT}\ln T$

$(X_iP_i/C)*(C/P_i) = (\alpha_i + \alpha_{ii}\ln P_i + \alpha_{ij}\ln P_j + \alpha_{ik}\ln P_k + \alpha_{il}\ln P_l + \eta_{i1}\ln F_1 + \eta_{i2}\ln F_2 + \eta_{i3}\ln F_3 + \tau_{iY}\ln Y + \tau_{iT}\ln T)*(C/P_i)$

$X_i = (\alpha_i + \alpha_{ii}\ln P_i + \alpha_{ij}\ln P_j + \alpha_{ik}\ln P_k + \alpha_{il}\ln P_l + \eta_{i1}\ln F_1 + \eta_{i2}\ln F_2 + \eta_{i3}\ln F_3 + \tau_{iY}\ln Y + \tau_{iT}\ln T)*(C/P_i)$,

or $X_i^* = s_i * C/P_i$ (2)

The general formula for the elasticity of demand is

$\varepsilon_{ii} = \partial X_i^*/\partial P_i * P_i/X_i^*$

Applying to (2)

$$\partial X_i^*/\partial P_i = C/P_i * \partial s_i/\partial P_i + s_i(-C/P_i^2 + \partial C/\partial P_i/P_i)$$
$$= C/P_i * \alpha_{ii}/P_i + s_i(X_i^*/P_i - C/P_i^2)$$
$$= C\alpha_{ii}/P_i^2 + s_i((P_iX_i^* - C)/P_i^2)$$
$$= C(\alpha_{ii} + s_iP_iX_i/C - s_i)/P_i^2$$
$$= C(\alpha_{ii} + s_i^2 - s_i)/P_i^2$$

Applying to the elasticity formula:

$$\varepsilon_{ii} = [C(\alpha_{ii} + s_i^2 - s_i)/P_i^2] * [P_i/X_i^*]$$
$$\varepsilon_{ii} = C(\alpha_{ii} + s_i^2 - s_i)/P_iX_i^*$$
$$\varepsilon_{ii} = (\alpha_{ii} + s_i^2 - s_i)/s_i$$

Applying this to the factors:
or $X_i^* = s_i * C/P_i$ (2)

$$\partial X_i^*/\partial F_k = 1/P_i * [s_i * \partial C/\partial F_k + C * \partial s_i/\partial F_k]$$
$$= [s_i F_k * \partial C/\partial F_k + C * \eta_{ik}] / P_i F_k$$

$$\varepsilon_{ik} = [s_i F_k * \partial C/\partial F_k + C * \eta_{ik}] / P_i F_k * F_k/X_i$$
$$= [s_i F_k * \partial C/\partial F_k + C * \eta_{ik}] / P_i X_i$$
$$= C[(s_i F_k * \partial C/\partial F_k) / C + \eta_{ik}] / P_i X_i$$
$$= [(s_i F_k * \partial C/\partial F_k)/C + \eta_{ik}] / s_i \qquad (3)$$

The problem here is that $\partial C/\partial F_k$ is unknown. We hypothesize that the factors influence cost through factor choice in the following way:

$C = \Sigma P_iX_i^*(P,Y,F,E,T)$, so that

$$\partial C/\partial F_k = \Sigma P_i * \partial X_i^*(P,Y,F,E,T)/\partial F_k$$

We can recover $\partial \ln C/\partial \ln F_k$ from the translog function in the same way that the factor shares were recovered, but again we are faced with the interpretation of $\partial C/\partial F_k$ on the left-hand side. Recall that in deriving the factor shares, $\partial C/\partial P_i$ is X_i, so that we cannot exploit the relationship $\partial \ln C/\partial F_k / \partial \ln F_k/\partial F_k = \partial \ln C/\partial \ln F_k = \partial C/\partial F_k*(F_k/C)$ to get some sort of "share equation" for factors.

We can, however, exploit the envelope theorem, which says that $\partial C/\partial F_k = \partial \mathcal{L}/\partial F_k$, where $\mathcal{L}$ is the Lagrangian of the cost minimization problem. Since the Lagrangian has the form

$\mathcal{L} = \Sigma P_i *X_i - \lambda(f(S,W,M,K,F,E,T)-Y)$, then

$$\partial C^*/\partial F_k = \partial \mathcal{L}/\partial F_k = -\lambda*\partial f/\partial F_k \quad (4)$$

Where $\partial f/\partial F_k$ is the marginal product of legislation. This can be thought of as the incremental impact of an increase in the level of labor legislation on output. Because legislation is believed to make production more expensive, we hypothesize that this term would be less than or equal to zero. Another application of the envelope theorem shows that λ can be interpreted as the marginal cost of production.

$$\partial C^*/\partial Y = \partial \mathcal{L}/\partial Y = \lambda$$

In a perfectly competitive world, a firm's output price equals marginal cost, so if perfect competition is accepted, then $\lambda = P_Y$. This allows a rewriting of (4) as

$\partial C^*/\partial F_k = - P_Y * \partial f/\partial F_k$, which we hypothesize to be greater than or equal to zero.

If you designate factor shares as

$\partial \ln C^*/\partial \ln F_k = s_{fk} = \beta_k + \Sigma_l \beta_{kl} \ln F_l + \Sigma_i \eta_{ki} \ln P_i + \Sigma_j \tau_{kj} \ln Z_j$, $l = 1..3$, $i = 1..3$, $j=1..3$

Then you can recover the elasticity response of output with respect to factors in the following way:

$\varepsilon_{fY} = \partial Y/\partial F_k * F_k/Y$

But

$\partial \ln C^*/\partial \ln F_k = s_{fk}$ and

$\partial \ln C^*/\partial \ln F_k = \partial C^*/\partial F_k * F_k/C$ and

$\partial C^*/\partial F_k = - P_Y * \partial Y/\partial F_k$ (from envelope theorem and perfect competition), so

$\partial \ln C^*/\partial \ln F_k = - P_Y * \partial Y/\partial F_k * F_k/C = s_{fk}$ or

$\partial Y/\partial F_k = -s_{fk} * C/F_k P_Y$. Applying to the elasticity definition:

$\varepsilon_{YFk} = -s_{fk} * C/F_k P_Y * F_k/Y$, or

$\varepsilon_{YFk} = -s_{fk} * C/P_Y Y$

Because of the assumption of perfect competition, profits are zero, so total revenues ($P_Y Y$) equal total costs (C), so the second term is one, and

$\varepsilon_{fY} = -s_{fk}$. We can therefore get estimates for ε_{fY} by estimating the cost function with the cost shares and then using the parameters from the cost equation to recover $\hat{\varepsilon}_{fY}$

Back to the estimation problem for $\eta_{ik} = \partial x_i/\partial F_k * F_k/x_j$.

From (3) we had.

$\varepsilon_{ik} = [(s_i F_k * \partial C/\partial F_k)/C + \eta_{ik}] / s_i$.

We now know that the factor share equation $s_{fk} = \partial C^*/\partial F_k * F_k/C$. So we can get an estimate of ε_{ik} by substituting in the estimated share equation:

$\varepsilon_{ik} = [(s_i s_{fk} + \eta_{ik}] / s_i$. Not a surprising result given the similarity to the factor share equations.

Appendix B

Coefficients for Share Equations and Cost Equations on Which Elasticities are Based

Wage Equation

		Model Version					
Coefficient	**Variable (p)**	**Base**	**Time Counter**	**Year Effects**	**State Effects, Time Counter**	**State Effects**	**State, Year Effects**
α_1		0.167	0.163	0.167	0.161	0.163	0.168
		<.0001	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**
α_{11}	Pw	0.027	0.016	0.027	0.010	0.022	0.032
		0.064	0.423	**0.064**	0.596	0.162	**0.050**
α_{12}	Pc	-0.031	-0.049	-0.031	-0.081	-0.082	-0.064
		0.000	**<.0001**	**0.000**	**<.0001**	**<.0001**	**<.0001**
α_{13}	Ps	-0.011	-0.004	-0.011	-0.003	-0.007	-0.005
		0.009	0.318	**0.009**	0.510	**0.081**	0.310
α_{14}	Pm	0.014	0.037	0.014	0.074	0.067	0.037
		0.337	0.147	0.337	**0.000**	**<.0001**	**0.029**
η_{11}	F1	0.041	0.048	0.041	0.090	-0.103	-0.013
		0.510	0.500	0.510	0.268	0.141	0.853
η_{12}	F2	-0.106	-0.073	-0.106	-0.031	-0.260	-0.166
		0.143	0.378	0.143	0.732	**<.0001**	**0.012**
η_{13}	F3	-0.150	-0.168	-0.150	-0.111	-0.150	-0.120
		0.006	**0.003**	**0.006**	**0.082**	**0.031**	**0.049**
τ_{11}	Y	-0.041	-0.045	-0.041	-0.039	-0.032	-0.035
		<.0001	**<.0001**	**<.0001**	**0.001**	**0.008**	**0.001**
τ_{12}	T	na	-3.273	na	-8.109	na	na
		na	0.215	na	**0.002**	na	na
τ_{13}	E	-0.004	-0.003	-0.004	-0.002	-0.003	-0.004
		0.201	0.367	0.201	0.592	0.492	0.230

Capital Equation

Coefficient	Variable (p)	Model Version					
		Base	Time Counter	Year Effects	State Effects, Time Counter	State Effects	State, Year Effects
α_2		0.189	0.184	0.189	0.175	0.185	0.186
		<.0001	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**
α_{12}	Pw	-0.031	-0.049	-0.031	-0.081	-0.082	-0.064
		0.000	**<.0001**	**0.000**	**<.0001**	**<.0001**	**<.0001**
α_{22}	Pc	0.044	0.022	0.044	-0.013	0.044	0.030
		<.0001	**0.010**	**<.0001**	0.102	**<.0001**	**0.001**
α_{23}	Ps	-0.011	-0.001	-0.011	0.002	-0.003	0.003
		<.0001	0.644	**<.0001**	0.477	0.237	0.286
α_{24}	Pm	-0.003	0.027	-0.003	0.091	0.041	0.032
		0.771	**0.056**	0.771	**<.0001**	**0.000**	**0.002**
η_{21}	F1	-0.044	-0.052	-0.044	-0.045	-0.184	-0.140
		0.229	0.299	0.229	0.388	**<.0001**	**0.004**
η_{22}	F2	-0.049	-0.023	-0.049	0.068	-0.057	-0.058
		0.396	0.732	0.396	0.286	0.332	0.337
η_{23}	F3	-0.102	-0.117	-0.102	-0.118	-0.125	-0.116
		0.016	**0.010**	**0.016**	**0.011**	**0.004**	**0.024**
τ_{21}	Y	0.008	0.005	0.008	0.015	0.020	0.015
		0.212	0.491	0.212	**0.037**	**0.004**	**0.041**
τ_{22}	T	na	-3.834	na	-11.221	na	na
		na	**0.041**	na	**<.0001**	na	na
τ_{23}	E	-0.005	-0.003	-0.005	-0.001	0.001	-0.002
		0.110	0.200	0.110	0.631	0.646	0.522

Salary Equation

Coefficient	Variable (p)	Model Version					
		Base	Time Counter	Year Effects	State Effects, Time Counter	State Effects	State, Year Effects
α_3		0.036	0.037	0.036	0.037	0.036	0.036
		<.0001	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**
α_{13}	Pw	-0.011	-0.004	-0.011	-0.003	-0.007	-0.005
		0.009	0.318	**0.009**	0.510	**0.081**	0.310
α_{23}	Pc	-0.011	-0.001	-0.011	0.002	-0.003	0.003
		<.0001	0.644	**<.0001**	0.477	0.237	0.286
α_{33}	Ps	0.018	0.014	0.018	0.009	0.004	-0.003
		<.0001	**<.0001**	**<.0001**	**0.002**	0.144	0.391
α_{34}	Pm	0.003	-0.009	0.003	-0.009	0.007	0.004
		0.199	**0.012**	0.199	**0.020**	**0.018**	0.166
η_{31}	F1	0.072	0.060	0.072	0.061	0.060	0.068
		<.0001	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**
η_{32}	F2	0.021	0.005	0.021	0.009	0.019	0.030
		0.162	0.719	0.162	0.589	0.231	**0.085**
η_{33}	F3	-0.008	-0.014	-0.008	-0.009	-0.009	-0.005
		0.301	**0.039**	0.301	0.284	0.346	0.554
τ_{31}	Y	-0.011	-0.010	-0.011	-0.009	-0.008	-0.008
		<.0001	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**0.000**
τ_{32}	T	na	1.937	na	1.995	na	na
		na	**<.0001**	na	**<.0001**	na	na
τ_{33}	E	0.000	-0.001	0.000	0.000	0.000	0.000
		0.528	0.238	0.528	0.475	0.983	0.959

Materials Equation

Coefficient	Variable (p)	Model Version					
		Base	Time Counter	Year Effects	State Effects, Time Counter	State Effects	State, Year Effects
α_4		0.608	0.617	0.608	0.626	0.616	0.610
		<.0001	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**
α_{14}	Pw	0.014	0.037	0.014	0.074	0.067	0.037
		0.337	0.147	0.337	**0.000**	**<.0001**	**0.029**
α_{24}	Pc	-0.003	0.027	-0.003	0.091	0.041	0.032
		0.771	**0.056**	0.771	**<.0001**	**0.000**	**0.002**
α_{34}	Ps	0.003	-0.009	0.003	-0.009	0.007	0.004
		0.199	**0.012**	0.199	**0.020**	**0.018**	0.166
α_{44}	Pm	-0.015	-0.058	-0.015	-0.156	-0.115	-0.073
		0.457	0.112	0.457	**<.0001**	**<.0001**	**0.001**
η_{41}	F1	-0.069	-0.058	-0.069	-0.104	0.228	0.086
		0.417	0.585	0.417	0.369	**0.014**	0.390
η_{42}	F2	0.134	0.091	0.134	-0.045	0.299	0.195
		0.161	0.443	0.161	0.714	**0.002**	**0.022**
η_{43}	F3	0.260	0.301	0.260	0.239	0.284	0.241
		0.001	**0.001**	**0.001**	**0.008**	**0.003**	**0.009**
τ_{41}	Y	0.044	0.051	0.044	0.033	0.020	0.027
		0.001	**0.001**	**0.001**	**0.033**	0.211	**0.065**
τ_{42}	T	na	5.448	na	17.303	na	na
		na	0.178	na	**<.0001**	na	na
τ_{43}	E	0.009	0.008	0.009	0.004	0.002	0.006
		0.049	0.149	**0.049**	0.470	0.784	0.215

Cost Function (Coefficients not in share equations)		Materials Equation					
Coefficient	**Variable 1 Variable 2 (p)**	**Model Version**					
		Base	**Time Counter**	**Year Effects**	**State Effects, Time Counter**	**State Effects**	**State, Year Effects**
α_0		4.118	4.221	4.118	4.302	4.397	4.301
		<.0001	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**
β_1	F1	-0.193	-0.157	-0.193	0.223	0.580	0.359
		0.067	0.110	**0.067**	0.145	**0.001**	**0.074**
β_2	F2	-0.264	-0.268	-0.264	0.047	0.723	0.302
		0.062	**0.052**	**0.062**	0.765	**0.001**	0.169
β_4	F4	0.055	0.054	0.055	0.179	0.350	0.242
		0.511	0.519	0.511	0.110	**0.090**	0.141
δ_1	Y	1.010	1.011	1.010	0.968	1.001	0.946
		<.0001	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**
δ_2	T	na	25.956	na	19.560	na	na
		na	**<.0001**	na	**<.0001**	na	na
δ_3	E	-0.012	-0.014	-0.012	0.001	0.009	0.005
		0.141	0.104	0.141	0.921	0.480	0.686
β_{11}	F1F1	-0.601	-0.128	-0.601	-0.654	-2.400	-0.634
		0.732	0.946	0.732	0.641	0.199	0.729
β_{12}	F1F2	1.103	1.717	1.103	-0.865	-1.441	-0.819
		0.265	0.194	0.265	0.450	0.262	0.483
β_{14}	F1F4	-1.648	-1.770	-1.648	0.157	-1.084	-0.920
		0.125	0.112	0.125	0.845	0.429	0.410
β_{22}	F2F2	0.295	0.559	0.295	-0.543	-0.736	-0.198
		0.805	0.772	0.805	0.645	0.562	0.873
β_{24}	F2F4	-0.270	0.292	-0.270	0.719	-0.416	-0.071
		0.723	0.742	0.723	0.295	0.632	0.946
β_{44}	F4F4	-0.606	-0.416	-0.606	-0.907	-0.209	-1.440
		0.559	0.709	0.559	0.355	0.902	0.342
δ_{11}	YY	-0.151	-0.103	-0.151	0.008	0.010	0.008
		0.000	**0.024**	**0.000**	0.783	0.829	0.878
δ_{12}	TY	na	-0.610	na	-5.789	na	na
		na	0.914	na	**0.077**	na	na

δ_{13}	EY	0.011	0.011	0.011	0.000	-0.004	0.003
		0.175	0.263	0.175	0.944	0.618	0.744
δ_{22}	TT	na	4209.328	na	424.657	na	na
		na	**0.002**	na	0.661	na	na
δ_{23}	TE	na	-0.086	na	0.222	na	na
		na	0.967	na	0.839	na	na
δ_{33}	EE	-0.006	-0.004	-0.006	-0.002	0.003	-0.002
		0.284	0.581	0.284	0.692	0.685	0.801
κ_{11}	F1Y	0.412	0.255	0.412	0.145	0.372	-0.007
		0.020	0.258	**0.020**	0.379	**0.100**	0.979
κ_{12}	F1T	na	-43.309	na	12.586	na	na
		na	0.158	na	0.606	na	na
κ_{13}	F1E	-0.043	-0.042	-0.043	0.029	0.017	0.007
		0.553	0.660	0.553	0.645	0.848	0.927
κ_{21}	F2Y	-0.203	-0.320	-0.203	0.152	-0.154	-0.074
		0.387	0.306	0.387	0.387	0.468	0.719
κ_{22}	F2T	na	8.543	na	22.135	na	na
		na	0.855	na	0.518	na	na
κ_{23}	F2E	0.078	0.152	0.078	0.085	0.047	0.094
		0.227	**0.064**	0.227	0.102	0.560	0.131
κ_{41}	F4Y	0.117	0.221	0.117	-0.079	-0.133	-0.073
		0.522	0.242	0.522	0.589	0.540	0.693
κ_{42}	F4T	na	-32.869	na	-29.558	na	na
		na	0.184	na	**0.064**	na	na
κ_{43}	F4E	-0.045	-0.027	-0.045	-0.020	0.038	-0.021
		0.509	0.698	0.509	0.736	0.725	0.843
	1904	na	na	0.044	0.000	0.000	0.000
		na	na	**0.005**	**0.000**	**0.000**	0.983
	1909	na	na	0.126	0.000	0.000	0.007
		na	na	**<.0001**	**0.000**	**0.000**	0.761
	1914	na	na	0.193	0.000	0.000	0.027
		na	na	**<.0001**	**0.000**	**0.000**	0.383
	1919	na	na	0.306	0.000	0.000	0.147
		na	na	**<.0001**	**0.000**	**0.000**	**0.000**
	AL	na	na	na	0.006	0.006	-0.003
		na	na	na	0.847	0.847	0.958
	AR	na	na	na	-0.007	-0.007	-0.015
		na	na	na	0.762	0.762	0.681
	AZ	na	na	na	-0.067	-0.067	-0.138
		na	na	na	0.131	0.131	**0.077**

	CA	na	na	na	-0.058	-0.058	-0.107
		na	na	na	0.287	0.287	0.274
	CO	na	na	na	-0.135	-0.135	-0.168
		na	na	na	**<.0001**	**<.0001**	**0.004**
	CT	na	na	na	-0.031	-0.031	-0.016
		na	na	na	0.557	0.557	0.842
	DE	na	na	na	-0.017	-0.017	-0.029
		na	na	na	0.643	0.643	0.582
	FL	na	na	na	0.059	0.059	0.065
		na	na	na	**0.057**	**0.057**	0.140
	GA	na	na	na	-0.022	-0.022	-0.038
		na	na	na	0.546	0.546	0.500
	IA	na	na	na	-0.155	-0.155	-0.208
		na	na	na	**0.000**	**0.000**	**0.001**
	ID	na	na	na	-0.020	-0.020	-0.039
		na	na	na	0.303	0.303	**0.062**
	IL	na	na	na	-0.115	-0.115	-0.134
		na	na	na	**0.009**	**0.009**	**0.031**
	IN	na	na	na	-0.083	-0.083	-0.108
		na	na	na	**0.079**	**0.079**	0.108
	KS	na	na	na	-0.177	-0.177	-0.208
		na	na	na	**<.0001**	**<.0001**	**0.001**
	KY	na	na	na	-0.068	-0.068	-0.120
		na	na	na	**0.026**	**0.026**	**0.015**
	LA	na	na	na	-0.050	-0.050	-0.062
		na	na	na	0.255	0.255	0.292
	MA	na	na	na	-0.052	-0.052	-0.038
		na	na	na	0.434	0.434	0.704
	MD	na	na	na	-0.080	-0.080	-0.102
		na	na	na	**0.030**	**0.030**	**0.050**
	ME	na	na	na	-0.012	-0.012	-0.009
		na	na	na	0.729	0.729	0.885
	MI	na	na	na	-0.085	-0.085	-0.090
		na	na	na	0.116	0.116	0.130
	MN	na	na	na	-0.171	-0.171	-0.165
		na	na	na	**0.000**	**0.000**	**0.011**
	MO	na	na	na	-0.151	-0.151	-0.210
		na	na	na	**0.000**	**0.000**	**0.000**
	MS	na	na	na	0.009	0.009	0.004
		na	na	na	0.764	0.764	0.925

	MT	na	na	na	-0.108	-0.108	-0.153
		na	na	na	**0.001**	**0.001**	**0.006**
	NC	na	na	na	0.009	0.009	-0.005
		na	na	na	0.784	0.784	0.907
	ND	na	na	na	-0.220	-0.220	-0.299
		na	na	na	**<.0001**	**<.0001**	**<.0001**
	NE	na	na	na	-0.195	-0.195	-0.233
		na	na	na	**<.0001**	**<.0001**	**0.001**
	NH	na	na	na	-0.007	-0.007	0.021
		na	na	na	0.863	0.863	0.718
	NJ	na	na	na	-0.088	-0.088	-0.096
		na	na	na	0.153	0.153	0.244
	NM	na	na	na	0.013	0.013	0.036
		na	na	na	0.460	0.460	0.200
	NV	na	na	na	-0.076	-0.076	-0.124
		na	na	na	**0.011**	**0.011**	**0.025**
	NY	na	na	na	-0.116	-0.116	-0.151
		na	na	na	**0.039**	**0.039**	**0.016**
	OH	na	na	na	-0.097	-0.097	-0.106
		na	na	na	**0.046**	**0.046**	0.117
	OK	na	na	na	-0.167	-0.167	-0.233
		na	na	na	**<.0001**	**<.0001**	**<.0001**
	OR	na	na	na	-0.090	-0.090	-0.128
		na	na	na	**0.005**	**0.005**	**0.008**
	PA	na	na	na	-0.033	-0.033	-0.040
		na	na	na	0.612	0.612	0.656
	RI	na	na	na	0.002	0.002	0.026
		na	na	na	0.970	0.970	0.682
	SC	na	na	na	0.074	0.074	0.089
		na	na	na	**0.025**	**0.025**	**0.053**
	SD	na	na	na	-0.209	-0.209	-0.287
		na	na	na	**<.0001**	**<.0001**	**<.0001**
	TN	na	na	na	-0.074	-0.074	-0.106
		na	na	na	**0.033**	**0.033**	**0.031**
	TX	na	na	na	-0.113	-0.113	-0.151
		na	na	na	**0.001**	**0.001**	**0.005**
	UT	na	na	na	-0.106	-0.106	-0.158
		na	na	na	**<.0001**	**<.0001**	**0.001**
	VA	na	na	na	-0.032	-0.032	-0.050
		na	na	na	0.336	0.336	0.307
	VT	na	na	na	-0.040	-0.040	-0.054

		na	na	na	0.177	0.177	0.221
	WA	na	na	na	-0.077	-0.077	-0.097
		na	na	na	**0.007**	**0.007**	**0.075**
	WI	na	na	na	-0.096	-0.096	-0.101
		na	na	na	**0.012**	**0.012**	**0.053**
	WV	na	na	na	-0.018	-0.018	-0.031
		na	na	na	0.582	0.582	0.513

FOOTNOTES

[1]For example, see Moehling (1999), Sanderson (1974), Osterman (1979), Brown Christiansen, and Phillips (1982), and Carter and Sutch (1996a) on child labor, Goldin (1990) and Whaples (1990a, b) on women's hours laws, Fishback and Kantor (2000), Buffum (1992), Chelius (1976, 1977), Fishback (1986, 1987, 1990), and Aldrich (1997) on workers' compensation and employer liability laws, Fishback (1986, 1990) on coal mining regulations, Aldrich (1997) on safety regulations in manufacturing, mines, and railroads. For a summary of the research, see Fishback (1998). Child labor legislation had little impact on employment of children, but Margo and Finegan (1996) find that school attendance legislation did significantly raise the rate of school attendance.
[2] For general readings on the Progressive Era, see Hofstadter (1955), Burnham, Buenker, and Crunden (1977), Moss (1996), Gould (1974), Chambers (1992), Lubove (1968). There are a large number of studies of specific nonlabor Progressive Era regulations. On Food and Drug regulations, see Libecap and Marc Law (2002); for railroads, see Poole and Rosenthal, Gilligan, Weingast, and Marshall, Kolko, Zerbe, and a host of others.
[3] In a recent paper on the Progressive Era, Glaeser and Shliefer (2002) argue that Progressive Era regulations were often designed to more closely monitor and regulate businesses, who had essentially subverted the regulatory regimes at times overseen by judges in the 19th century. If the laws were successful in this regard, we might see such that employers faced such a tax.
[4]For economic models in which the political process may be captured, see Stigler (1971), Becker (1983), Pelzman (1976). For an analysis discussing the capture of judges, see Glaeser and Shleifer (2001).
[5] Attempts to legislate effective general minimum wages for men at the state level in the early 1900s were struck down by a series of court decisions. (See the Lochner case and some other citations)
[6] For a discussion of the procedures involved in principal component and factor analysis, see Corluy, R, *Factor Analysis and Cluster Analysis,* Center For Biomathematics, Brussels, 1982. For a recent analysis of a broader class of Progressive Era laws with an alternative technique, see Nonnenmacher (2002).
[7]We have also developed factor scores based on a factor analysis approach, and the results are quite similar to those for the principal components analysis. The factor analysis can be seen in Holmes's dissertation (2002).
[8] Often this is done by plotting the eigenvalues in a "scree" plot and searching for an "elbow" or bend in the plot.
[9] Following common practice, a factor loading was considered to be significant if the absolute value of the factor score exceeded 0.3.
[10]Data for 1899, 1904, 1909: United States Department of Commerce, *Statistical Abstract of The United States, 1913, Thirty-Six Number,* Government Printing Office, Washington DC, 1914, p. 208-213.
Data for 1914, 1919: United States Department of Commerce, *Statistical Abstract of The United States, 1923, Fourty-Sixth Number,* Government Printing Office, Washington DC, 1924, p. 315-322. The census data we used was confined to "factory system" industries, and excludes the household, hand trades, and neighborhood industries.
[11] This remainder method is problematic because it will assign the owner's returns to capital as well. To the extent that the owners are all earning a normal return that remains constant over time, our measure of the rental price of capital and the cost share of capital will be overstated by the same amount.
[12] In the translog model, the decision to include the cost function is optional and is often only done if parameters in the cost function that do not appear in the share equations are needed. In this case, parameters relating to the labor law factors and labor expenditure variables were needed to calculate factor-input elasticities, so the cost equation was added to the system of share equations.
[13] This explains why the year effects are not collinear with the wholesale price index used as the measure of the price for materials.
[8]By specifying the model with the fixed effects in the cost function, we are imposing the restriction of Hicks-neutral technical change with regard to states and time. (see Binswanger, 1974).

[15] The difference in the elasticity values between e_{ij} and e_{ji} depends on the share of total cost of each input in the pairing. In a pairing of two inputs *i* and *j*, when the input *i* makes up a relatively smaller share of total costs than input *j*, the elasticity e_{ij} will be larger than the elasticity e_{ji}

[16] We have also considered the following variables, although they might be correlated with wages and employment, so they might not be good candidates for instruments. The average number of strikes over the period between the years. An index of risk in manufacturing based on the distribution of workers across industries for which we have accident measures (1900, 1910, 1920, 1930), an index of unionization (1900, 1910, 1920, 1930) based on the distribution of workers across industries for which we have union information, the percentage of manufacturing establishments with fewer than 20 workers and the percentage with over 500 workers (1900, 1910, 1920, 1930).