

ECONOMIC GROWTH AND RIGHT-TO-WORK LAWS

By Michael Hicks, Ph.D. and Michael LaFaive



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By Michael Hicks, Ph.D. and Michael LaFaive

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Executive Summary*

Michigan’s new right-to-work law has reignited several debates about whether or not such policies are beneficial to states that adopt them. Casual observers, journalists and policy pundits have tried to weigh in on the impact that right-to-work laws have on everything from the ability of unions to organize to state-to-state migration to changes in economic growth rates. Academic scholars, too, have examined such laws in great detail and from seemingly innumerable angles.

This study aims to measure the impact of right-to-work laws on states’ economic performance. It uses average annual growth rates in employment, real (inflation-adjusted) personal income and population to measure the economic well-being of right-to-work states. On the whole, the results of this analysis show that right-to-work laws have a statistically significant and economically meaningful positive impact, although the results vary.

There are research challenges to studying the impact of right-to-work laws. One such problem is timing. For instance, it may take a significant period of time, perhaps more than a decade, for the impact of certain policies like right-to-work laws to generate any demonstrable impact on a complex state economy. For these reasons, this study analyzes data from a 64-year period — from 1947, when federal law changed to allow for right-to-work laws, through 2011, the most recent year for which data are available.

Another challenge related to timing is that the effect of right-to-work laws may change as economies and government policies evolve over time. For instance, most would agree that the economy of the 1991-2011 era is different in many ways than that of the 1971-1990 era. For this reason, this study analyzes the effect of right-to-work laws over the entire aforementioned 64-year period, but also in three distinct periods: 1947-1970, 1971-1990 and 1991-2011.

Lastly, there is the research challenge of reverse causation, also known as “endogeneity” — an issue that makes it difficult to test the effects of right-to-work laws experimentally. There may be factors intrinsic to a state that influence the adoption of right-to-work laws and that may be correlated with economic growth. This study attempts to control for this issue and uses a methodology that tries to mimic a natural experiment.

The results of this study show that from 1947 through 2011, right-to-work laws increased average real personal income growth by 0.8 percentage points and average annual population growth by 0.5 percentage points in right-to-work states. From 1970 through 2011, these laws also boosted average annual employment growth by 0.8 percentage points. All of these findings are statistically significant.

The results vary by period. From 1947 through 1970, there was no measured statistically significant effect of right-to-work laws for states with such laws. From 1971 through 1990, however, right-to-work laws increased average annual employment and real personal income

* Citations are provided in the main text.

growth by about 0.9 percentage points and increased average annual population growth by 1.3 percentage points. Further, from 1991 through 2011, the effect in each category was slightly smaller than in the previous period, but each was still statistically significant.

These results suggest that right-to-work laws have a positive and sometimes very positive impact on the economic well-being of states and their residents. Indeed, the study's findings show that right-to-work laws, on average, cause a one-time, permanent increase in the rate of economic growth in states. Since this study deploys a new econometric model to measure the impact of right-to-work laws, it should be an important contribution to the growing research on this issue. Policymakers interested in improving their state's economic performance should take note of the study's findings.

Introduction

No other legislation in Michigan garnered as much public attention last year than that commonly known as “right-to-work.”¹ It was passed in December over significant opposition from organized labor and became law in 2013, making Michigan the 24th state with such a law.* Right-to-work laws prohibit employers from requiring their employees to join or financially support a labor union as a condition of employment.

A key element of the debate in Michigan over right-to-work laws was the dispute over whether these laws have a positive or negative impact on a state’s economy. But determining the impact of right-to-work laws statistically is no small task. Many scholars have tackled the issue with varying methodologies, analyzing different data sets and time periods.

This study adds to that body of research and examines the economic consequences of right-to-work laws in detail. It analyzes average annual growth in a state’s employment, real personal income and population from 1947 through 2011 as a means to capture the economic impact of right-to-work laws. These data are divided into three distinct time periods: 1947 through 1970, 1971 through 1990 and 1991 through 2011. This approach attempts to capture the evolving impact of right-to-work on different states over time.

This analysis begins with a brief history and overview of right-to-work laws, follows with a discussion of the challenges of studying such laws, reviews the existing body of relevant academic research and then provides a short description of the study’s methodology and key statistical findings.

Right-to-Work Laws

By amending the National Labor Relations Act of 1935 (also known as the “Wagner Act”), the 1947 Taft-Hartley Act allowed states to forbid “agency shop” collective bargaining agreements.[†] These types of contracts require all employees, as a condition of their lawful employment, to financially support a union — either through membership dues or “agency fees.”[‡] Right-to-work laws enable employees to continue their employment without regard for their status in or financial support of a union.

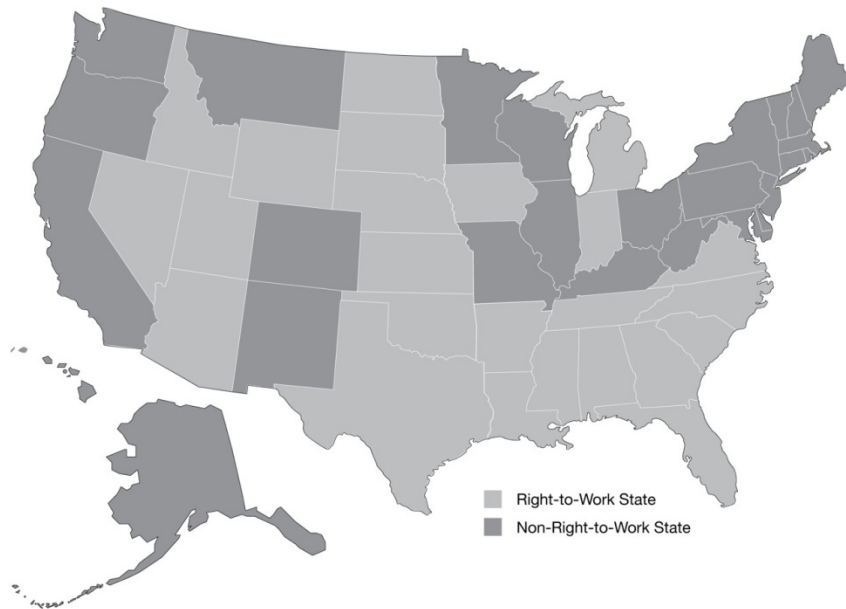
* The first right-to-work legislation introduced in Michigan was Senate Bill 1217 of 1955.

† For more information about the NLRA, see: Robert P. Hunter, “Michigan Labor Law: What Every Citizen Should Know,” (Mackinac Center for Public Policy, 1999), 9-11, <http://goo.gl/zDxxDU> (accessed July 30, 2013).

‡ For more information about agency shop agreements, see: Robert P. Hunter, “Compulsory Union Dues in Michigan,” (Mackinac Center for Public Policy, 1997), 10-11, <http://goo.gl/SXxOFP> (accessed July 30, 2013).

The first states to pass right-to-work laws did so in the 1940s and 1950s and were located primarily in the Southeast and Great Plains.* Altogether, 24 states have passed right-to-work laws (see the light gray states in Graphic 1). The two most recent adopters were Indiana and Michigan, the latter of which has one of the highest unionization rates in the nation.²

Graphic 1: States With Right-to-Work Laws, 2013



The Research Challenges of Right-to-Work

There are several challenges to isolating and measuring the impact right-to-work laws have on state economies. The first of which is timing. It may require several years for the effect of right-to-work to show up in a meaningful way in the state's economic statistics.[†]

This theory is supported by William Moore and Robert J. Newman, scholars who have both empirically studied right-to-work laws. In a 1998 review of the research literature on the impact of right-to-work laws on "state industrial development," Moore dismisses findings from one study that only examined a short time frame.³ In defending his critique, he points to a 1983 paper by Newman that argues that one should examine a period of at least 10 years to best measure the effects of right-to-work laws on state economies.⁴ This theory aligns with the

* Some state legislatures registered their displeasure with the Wagner Act by passing ineffectual right-to-work laws before the 1947 Taft-Hartley Act. For the purposes of this study, states that have right-to-work laws will be referred to as "right-to-work states." States without such laws will be referred to as "non-right-to-work states."

† In the recent example of Michigan, for instance, hundreds of unions negotiated new "agency shop" collective bargaining agreements before the state's right-to-work law went into effect. This effectively ensures that the new right-to-work law will have little or no effect for these unions and employees' ability to choose whether or not to financially support a union as a condition of their employment. For more information, see: Jack Spencer, "Count Update: 145 School Districts Have Deals That Dodge Right-to-Work," Michigan Capitol Confidential, May 28, 2013, <http://goo.gl/4DnhHN> (accessed July 31, 2013).

findings of Thomas J. Holmes, who, according to Moore, observed no “significant effects of [right-to-work] laws prior to 1963,” 16 years after the 1947 Taft-Harley Act.⁵

A second challenge to measuring the effect of right-to-work law on state economic performance is disentangling this effect from other factors. A study which examines the role of right-to-work absent such issues as tax policy, weather and other variables that may impact a state’s aggregate economic performance will be unable to tease out the influence of right-to-work laws specifically.

Still another challenge is “endogeneity,” or reverse causation — an issue that has particularly plagued many right-to-work studies. There may be factors that influence the adoption of right-to-work laws, such as high levels of union membership or traditional union antipathy, and these may be correlated with underlying economic growth.

To effectively account for the effect of right-to-work laws, scholars can use measures of these two factors, such as the 1947 share of manufacturing employment, or whether or not a state was part of the Old South, to create a model which more closely mimics a natural experiment. This technique is akin to ensuring that participants in a randomized drug trial share common existing health characteristics. Without doing so, a medical researcher could not be sure that any beneficial effects were due to the medication itself or to pre-existing conditions.

Considering these challenges, it comes as no surprise that there is no single dominant theoretical structure upon which to statistically model the effects right-to-work laws have on state economic performance. Typically when scholars begin trying to answer a research question they posit a thesis on the best available theory and then examine the available data to see if hard evidence supports the theoretical underpinnings. But right-to-work laws may change firm and worker behavior in ways that make these types of theoretical predictions unclear.*

Research on the Economic Effects of Right-to-Work

Mackinac Center scholars have analyzed the differences between right-to-work and non-right-to-work states on several occasions.[†] The most recent data suggests that right-to-work states perform better than non-right-to-work states on several different metrics. For instance, James Hohman, the Mackinac Center’s assistant director of fiscal policy, has found:[‡]

* For an excellent review of the complexity of the economic theory on right-to-work laws, please see: W. Robert Reed, “How Right-to-Work Laws Affect Wages,” *Journal of Labor Research* 24, no. 4 (2003). Reed reviews and develops differing theoretical arguments regarding the wage effects of right-to-work laws. These are further discussed in “Appendix A: Theoretical Reasoning Behind the Model.”

† The Mackinac Center for Public Policy first published on this subject in 1992. George Leef, “Protecting the Political Freedom of Workers,” (Mackinac Center for Public Policy, 1992), <http://www.mackinac.org/183> (accessed Aug. 20, 2013). Since then, it has produced hundreds of articles, studies, blog posts, press releases and videos on the topic. A keyword search for “right-to-work” on its Web site generates 781 matches.

‡ These statistics are based on the latest available data at the time of this writing. Oklahoma, which became a right-to-work state in 2001, was not included in the analyses.

- According to the Bureau of Economic Analysis, right-to-work states showed a 42.6 percent gain in total employment from 1990 to 2011, while non-right-to-work states showed gains of only 18.8 percent.
- According to the U.S. Census Bureau, population increased in right-to-work states by 39.8 percent and only 16.7 percent in non-right-to-work states from 1990 to 2011.
- According to the U.S. Census Bureau, 4.9 million people moved from non-right-to-work states to right-to-work states from 2000 to 2009.*
- According to the Bureau of Economic Analysis, nominal personal income grew by 209.3 percent in right-to-work states and by 148.5 percent in non-right-to-work states from 1990 to 2011.

A large body of empirical research has been performed regarding the effects of union membership changes, union organizing and right-to-work laws. Work by such scholars as William Dickens and Jonathan Leonard, Richard Freeman, Henry Farber, Edward Lazear, Melvin Reder, and Paul Jarley and Jack Fiorito offer a fairly clear conclusion that right-to-work legislation reduces measures of private-sector unionization and union-related activities such as organizing.⁶

Much of this work is described by Moore (referenced above) in a study titled “The Determinants and Effects of Right-to-Work Laws: A Review of the Recent Literature.”[†] In this review, Moore zeros in on research designed to explain the impact of right-to-work laws. He describes the literature, examines methodologies and notes the findings on the impact of right-to-work laws on unionization, wages, economic development and other issues. Moore found both anecdotal and empirical evidence that right-to-work laws have a positive effect on state economic development, though not universally.[‡]

Newman (referenced above) tested the effect of right-to-work laws on the economic growth in manufacturing industries in southern states in roughly the two decades following the Taft-Hartley Act. The study, which controlled for taxation and unionization rates, found that right-to-work laws were a significant contributor to growth, and that this effect was more pronounced in labor-intensive industries.⁷

* For more information, see: Michael LaFaive, "Right-to-Work Laws Influence Migration," (Mackinac Center for Public Policy, 2012), <http://goo.gl/xxIA4> (accessed July 30, 2013).

† William J. Moore, "The Determinants and Effects of Right-to-Work Laws: A Review of the Recent Literature," *Journal of Labor Research* 19, no. 3 (1998). This was Moore's second literature review of the effects of right-to-work laws. His first was published in in 1985 with co-author Robert Newman. William J. Moore and Robert J. Newman, "The Effects of Right-to-Work Laws: A Review of the Literature," *Industrial and Labor Relations Review* 38, no. 4 (1985).

‡ As mentioned above, Moore effectively dismissed results that did not find a significant positive effect, because they examined short time frames.

A 1998 study by Holmes (referenced above) measured the effect right-to-work laws had on firm location decisions at the county level. This study attempted to isolate the effect of right-to-work laws by controlling for other policies that may have impacted firm location decision, such as business tax rates and geographical setting. It found as large as a 33 percent increase in manufacturing employment in border counties in right-to-work states.*

The most recent research on the impact of right-to-work laws is more mixed. A 2009 study by Lonnie K. Stevans — which carefully attempted to control for endogeneity — analyzed state data from 1990, 1995, and 2000 through 2005. He found that there were no wage or employment effects of right-to-work laws.⁸

In 2011, however, Richard Vedder, Matthew Denhart and Jonathan Robe studied the impact of right-to-work using a model that analyzed the lower 48 states from 1977 through 2008. They found that right-to-work laws increased economic growth rates by 11.5 percent.⁹

In 2012, this co-author (Hicks) estimated the impact of right-to-work on manufacturing employment, manufacturing incomes and the share of manufacturing income in states from 1929 through 2005. This study examined the actual effect of right-to-work laws using an identification strategy which isolated southern states and 1947 manufacturing employment to account for political factors which may have contributed to the passage of right-to-work. This analysis found no impacts on aggregate manufacturing employment, manufacturing incomes or the share of manufacturing income. However, right-to-work laws produced a statistically meaningful contribution to manufacturing income growth in the majority of states which had adopted the legislation since 1950.¹⁰

Findings

The statistical model used in this study attempts to measure the impact of right-to-work laws on states with such laws from 1947 through 2011. It measures the size of these effects with a technique that includes not only the effect of passing right-to-work laws in a state, but also the effect of some spatial dependence (the likelihood of adjacent states adopting right-to-work, for example). The model also attempts to mitigate the impact of endogeneity. A full description of the model can be found below in “Appendix B: The Model.”

A state’s economic performance is represented in the model by average annual growth rates for employment, real (inflation-adjusted) personal income and population. Data for personal income and population are included from 1947 through 2011 and provided by the Bureau of Economic Analysis. Total employment, also provided by the BEA, is only analyzed from 1971

* Thomas J. Holmes, "The Effect of State Policies on the Location of Manufacturing: Evidence from State Borders," *Journal of Political Economy* 106, no. 4 (1998): 668. This large increase in manufacturing employment was only evident in counties that had no geographical complications and exhibited policies that could be considered “business-friendly.”

through 2011 as that is the only time period for which data are available.* Data from the 48 contiguous states and the District of Columbia were used.

The model's results indicate that right-to-work laws have a statistically meaningful and positive impact on the economic performance of right-to-work states. Measured over the course of the entire 64-year period (1947-2011), states with right-to-work laws had higher economic growth rates than they otherwise would have based on the results of the statistical model. Specifically, the average right-to-work state had annual growth rates that were 0.8 percentage points higher for real personal income and 0.5 percentage points higher for population growth. Right-to-work laws boosted average annual employment growth rates by 0.8 percentage points measured from 1970 through 2011.

An important component of this study is its unique temporal analysis, which measures the effects of right-to-work laws in three distinct time periods: 1947 through 1970, 1971 through 1990 and 1991 through 2011. This breakdown attempts to capture the change in the use of economic development programs by state and local governments. During this first period (1947-1970), very few governments had active economic development policies. The start of the middle period (1971-1990) marks a time when these programs were beginning to be used by governments — a sort of transitional period. Finally, the last period (1991-2011) begins when nearly all states were actively making use of economic development programs.

These time-based distinctions matter. For instance, from 1947 through 1970 right-to-work laws were associated with very little change, on average, in real personal income and population growth for states with such laws. From 1971 through 1990, however, right-to-work laws boosted average employment and real personal income annual growth by 0.9 percentage points and increased average annual population growth by 1.3 percentage points — all of which were statistically significant. From 1991 through 2011, the effect of right-to-work on these three economic factors was smaller than the previous period, but still statistically significant. Average annual growth rates for employment were 0.4 percentage points higher; for real personal income, 0.7 percentage points higher; and for population, 0.6 percentage points higher.

Graphic 2 below displays all the tested impacts on right-to-work states for employment, real personal income and population over each time period analyzed. All the impacts of right-to-work laws were statistically significant and positive, except for the impacts on real personal income and population over the 1947-1970 period.

* The impact of right-to-work laws on employment, therefore, is not measured during the 1947-1970 period.

Graphic 2: Change in Percentage Points of Average Annual Growth Rates as a Result of Right-to-Work Laws, 1947-2011

Employment	
1971-1990	0.90
1991-2011	0.43
1970-2011	0.76

Real Personal Income	
1947-1970	0.46*
1971-1990	0.93
1991-2011	0.67
1947-2011	0.75

Population	
1947-1970	-0.35*
1971-1990	1.30
1991-2011	0.56
1947-2011	0.54

* Not statistically significant.

Summary and Conclusion

This study examines the impact of right-to-work laws on three measures of state-level aggregate economic activity (employment, real personal income and population) from 1947 through 2011. It deploys a careful temporal analysis of these effects and attempts to isolate the specific effect right-to-work laws had on individual states.

This research suggests that from 1947 through 1970 (the period immediately following the Taft-Hartley Act), right-to-work laws had very little meaningful statistical impact on overall economic performance in right-to-work states. However, from 1971 through 1990, when manufacturing employment in the United States began to languish, right-to-work laws demonstrated a statistically significant effect on these measures. Finally, over the course of roughly the last two decades, from 1991 through 2011, right-to-work laws' impact on state economic well-being has moderately slowed, but remains considerable.

These findings suggest that right-to-work laws may have a positive — at times very positive — impact on the economic well-being of a state and its residents.

Appendix A: Theoretical Reasoning Behind the Model

As mentioned above, there is not a single best statistical model to use when attempting to measure the impact of right-to-work laws on state economic performance, and right-to-work is thought to impact the behavior of businesses and workers in ways that make it difficult to theorize the effects. W. Robert Reed, in his 2003 paper in the *Journal of Labor Research*, titled “How Right-to-Work Laws Affect Wages,” provides an excellent review of the complexity of economic theory on this subject.¹¹

Reed reviews and develops differing theoretical arguments regarding the wage effects of right-to-work laws. For instance, the presence of right-to-work may permit so-called “free riding” by non-union workers, which may erode the strength of unions to bargain and potentially reduce the wage premium for workers. Further, right-to-work laws may increase the need for unions to demonstrate their effectiveness to current and potential members by securing higher wages and benefits and providing members with better overall representation. These two arguments, both of which are plausible, may even occur simultaneously.

Also of interest is the role that right-to-work plays in firm relocation decisions. This is especially relevant to research questions which address the time differences in right-to-work effects. The impact right-to-work laws may have on firm productivity is also important to consider. Some argue that right-to-work laws weaken unions, lessen their influence at work sites and make work arrangements more flexible, efficient and productive. By contrast, others propose that higher wages purportedly paid to workers in non-right-to-work states draw in more skilled and productive workers.

Finally, it is likely that wages and benefits are not the primary cost differential between union and non-unionized firms. Other matters may play a bigger role in firm location decisions, including the costs of negotiating with unions and abiding by onerous work rules involving everything from hiring to firing and worker flexibility.

These types of influences would be captured in a statistical model as a function of the cost of production, and may be more pronounced in those industries with higher levels of human capital, such as government and the service sector. Including these differences in our statistical models is relatively straightforward.

Suppose the following simple production technology $\theta(L)$ which is solely dependent on labor. As described above, suppose that unionization levels affect productivity, then $\theta(L[u])$, but the direction of effect is unclear so $d\theta(L[u])/du \gtrless 0$. Also, the wage determination feature of unionization $w(u)$ is such that $dw(u)/du \gtrless 0$. From this we can construct a familiar labor-demand function such that:

$$\pi = p\theta(L[u]) - w(u)\hat{L} \quad (1)$$

where profit, π , for a firm is comprised by the product of the price of production, p , and a labor-only production function $\theta(L)$ minus the wage rate w , times employed labor units \hat{L} . The first order conditions with respect to unionization are then:

$$\frac{\partial \pi}{\partial u} = p\theta'(L[u])L'(u) - w'[u]\hat{L} \quad (2)$$

Assuming $\theta'(L[u]) > 0$ yields some straightforward results. If $\partial\theta(L[u])/\partial u \geq 0$ and $\partial(w[u])/\partial u \leq 0$ then $\partial\pi/\partial u \geq 0$. Likewise if $\partial\theta(L[u])/\partial u \leq 0$ and $\partial(w[u])/\partial u \geq 0$ then $\partial\pi/\partial u \leq 0$.

The uncertainty surrounding the direction of the impact of unionization which has led to such unclear theoretical reasoning is not merely cause for an exercise in labor-demand modeling. It is likely that productivity and wage effects of unions vary by industry and time. So, the conditions outlined above provide strict relationships, which in their aggregate may vary significantly. This paper seeks to help answer the temporal aspects of these strict relationships.

As we model the effect of right-to-work laws, we suppose that it affects unionization negatively, but transmits to the aggregate economy through an uncertain pathway. This leaves the effect of right-to-work laws largely an empirical question, for which considerations on the identification of a model is of paramount importance.

For example, right-to-work laws may well have been influenced by initial union conditions (or local preferences). Thus, strong unions in industrialized states may have blocked the legislation, while less industrialized states would be more likely to endorse right-to-work legislation.

These heavily industrialized states may enjoy manufacturing clusters that continued to attract new firms seeking the benefits of agglomeration, so may incidentally result in $\partial\theta(L[u])/\partial u \geq 0$. Also, during periods of rapid employment growth in heavily unionized sectors, unions may have served as employee screening tools for employers, and so boosted profitability. Later, as employment declined, unions may have aided in the retention of low productivity workers thus reducing productivity.

Conversely, the convergence of state-level industrial structure in the past half century would tend to increase the amount of unionized industries (primarily manufacturing and transportation since mining, a heavily unionized industry, is not particularly footloose) in states that had historically low levels of manufacturing. This well could have occurred without any consideration of right-to-work laws.

So, the benefit of theoretical reasoning to model the impact of right-to-work on wages, firm location decision, and industrial composition legislation will necessarily be subordinated to the empirics of the matters. The research findings in this area are important to the analysis offered in this paper.

Appendix B: The Model

The high degree of interstate variability with regard to right-to-work and the presence of changes within individual states would point towards an ideal natural experiment with which to test the effect of right-to-work laws on employment earnings and population.

Unfortunately, as discussed above, there is little expectation that right-to-work laws devolve upon states in a random fashion. Moreover, it is not clear that right-to-work laws are uncorrelated with other policies which might lead to firm relocation or alter the wage structure of employees. Using a blunt right-to-work dummy variable might capture effects generated by other, concomitant variables.

For example, we might observe that a possible policy variable, such as the effective business tax rate, would be highly correlated with right-to-work laws. Data on these variables is available only after the period of interest. Its exclusion would limit the analysis and introduce omitted variable bias. Its inclusion may lead to concomitant variable problems, and so a resolution must be attempted.

Indeed, we observe that the tax share from the national income accounts, measured in five-year increments from 1957 through the present, offers mixed evidence as to cointegration with right-to-work. An augmented Dickey-Fuller test fails to reject evidence of cointegration across the sampled lower 48 states, while cross-sectional specific Philip-Perron tests find a handful of states where cointegration may be rejected.¹² This argues for an econometric treatment of the problem.

As for endogeneity, we observe that places which were relatively poor in the middle of the 20th century also possessed a latent anti-union sentiment which may have led to early passage of right-to-work laws. The ensuing half century has seen many of these places grow faster than the nation as a whole, for reasons as diverse as expanded political freedom for minority groups to the widespread adoption of air conditioning. Consequentially, a model which treats the introduction of right-to-work laws as a random event would bias any estimate of its impact.

For that reason, we must suspect endogeneity within the right-to-work laws and topline measures of economic performance such as population, personal income and employment growth. To do so, we employ an identification strategy for the adoption of a right-to-work law, with an eye towards isolating right-to-work and other unobserved variables which may affect our economic variables of interest.

Here we posit that the adoption of a right-to-work law would be influenced by the importance of manufacturing within a state at the time the 1947 Taft-Hartley Act was passed and the political environment surrounding unions at that time. To represent these variables we use manufacturing income in 1947 and a binary variable representing the old southern states (those states which seceded from the union in 1860 or 1861). The latter of these has been used as independent variables in earlier unionization studies. The identifying equation for right-to-work is:

$$E(R_{i,t} | M_i, S_i) = \alpha + \beta_1(M) + \beta_1(S) + u_{i,t} \quad (3)$$

where $dM/dt = 0$; $dS/dt = 0$. The resulting estimate $\hat{R}_{i,t}$ is conditioned on two variables which do not vary with time. This equation offers two consequences regarding the endogeneity and concomitant policy concerns above. We believe the endogeneity concern is addressed through the identification of factors which would contribute to a decision to adopt right-to-work laws in states. The time invariant nature of the regressors in this first stage estimate introduces a first stage fixed effects estimate to $\hat{R}_{i,t}$ in a technique introduced by Fernandez-Val and Vella.¹³

This approach captures any time invariant heterogeneity from which concomitant policy variables would have their greatest source. To correct for time varying heterogeneity (unequal variances), we employ a feasible generalized least squares estimate (FGLS) since each of the sub-estimates are on short periods which potentially suffer from small, sample-related problems as well as period-specific heterogeneity.* These two steps provide a safeguard against the incidental variable concern.

For our estimation we examine the conterminous 48 states and the District of Columbia from 1947 through 2011. We construct a very basic treatment model from which to estimate impacts of right-to-work laws.

$$\log\left(\frac{dY_{i,t}}{dt}\right) = \alpha + \beta(\hat{R}_{i,t}) + \beta\tilde{W}(\hat{R}_{j,t}) + \delta\tilde{W}Y_{j,t} + \theta\gamma_{i,t-n} + \epsilon_{i,t} \quad (4)$$

where the dependent variable Y comprises one of our three measures of growth in aggregate economic activity (population, personal income or total employment in state i , in year t . These are estimated as a function of a common intercept (α), a presence variable for right-to-work laws, right-to-work, in state i , in year t , and the weighted average of that variable in contiguous states, weighted with a first order contiguity matrix which is:

$$\tilde{W} = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix} \forall 1 = \text{adjacency}, 0 \text{ otherwise.}$$

This is designed to account for cross-border effects of right-to-work laws in adjacent states. These two elements are corrected with the expected value of right-to-work from equation (1) above, which is designed to identify the adoption of a right-to-work law. The regression includes a first order spatial contiguity element to correct for spatial autocorrelation ($\delta\tilde{W}Y_{j,t}$), a temporal autoregressive element ($\theta\gamma_{i,t-n}$) with optimal lag lengths selected through an informational criterion.† We include an error term, $\epsilon_{i,t}$, *iid*, $\rightarrow (0, \sigma^2)$. All variables employed in the analysis pass individual and common unit root tests and so are assumed stationary. The

* For more information, see: Jeffrey M. Wooldridge, *Econometric Analysis of Cross-Section and Panel Data* (Cambridge, MA: MIT Press, 2002).

† This is recommended by Hamparsum Bozdogan, "Akaike's Information Criterion and Recent Developments in Information Complexity," *Journal of Mathematical Psychology* 44, no. 1 (2000): 62-91.

inclusion of the spatial elements for both autocorrelation and the adjacent effects of right to work legislation is a feature of the Spatial Durbin Model.*

There are some econometric considerations in the estimation process. The FGLS are estimated with White's heteroskedasticity invariate, variance-covariance matrix.¹⁴ The estimate of $E[R_{i,t}]$ does not appear to suffer from weak instrumentation concerns, with an F-statistic of 514.16, and both instrumental variables enjoying statistical significance far better than 0.01 percent.

Summary statistics appear in Graphic 3.

Graphic 3: Summary Statistics, 1947-2011

	Mean	Median	Maximum	Minimum	Std. Dev.
Total Employment	2297273	1546421	16289089	128042	2470954
Personal Income (\$1,000)	1.12E+08	50028137	1.65E+09	1180169	1.75E+08
Population	5151854	3547376	37691912	329000	5575238
RTW	0.411486	0	1	0	0.49222
RTW in Adjacent States	0.429982	0.4	1	0	0.345093

* See James P. LeSage and Matthew Dominguez, "The Importance of Modeling Spatial Spillovers in Public Choice Analysis," *Public Choice* 150, no. 3-4 (2012): 525-45; James P. LeSage and R. Kelley Pace, "Spatial Econometric Models," in *Handbook of Applied Spatial Analysis* (Heidelberg, Germany: Springer, 2010), 355-76.

Appendix C: Detailed Results

We estimate the relationship between right-to-work laws to three economic variables: growth in total employment, real personal income and population. These relationships are analyzed in three distinct time periods: 1947 through 1970, 1971 through 1990 and 1991 through 2011. The purpose of this approach is to evaluate both the impact of right-to-work on these variables and how this impact varied across time periods. These estimates are displayed in the graphics below.*

Graphic 4: Growth in State Total Employment, 1970-2011

	1970-2011	1971-1990	1991-2011
Intercept	0.019744*** (2.79)	0.021068*** (2.43)	0.01209* (1.85)
RTW	0.013423*** (3.16)	0.016336*** (2.64)	0.007805* (1.72)
Adjacent RTW	-0.00846 (-1.55)	-0.00722 (-0.92)	-0.00258 (-0.46)
Spatial Autocorrelation	-3.08E-09** (-2.14)	-2.05E-09 (-1.34)	-2.00E-09*** (-2.99)
AR(1)	0.52167*** (6.35)	0.471516*** (4.08)	0.557666*** (4.56)
Adjusted R-squared	0.31	0.25	0.34
S.E. of regression	0.019376	0.022153	0.015884
F-statistic	226.83	80.44	142.75
Durbin-Watson stat	1.80	1.84	1.77
Wald test on RTW coefficient			
H0 = 1970-2011 value	-	-0.55	-1.23
H0 = 1970-1990 value	-35.33***	-	-1.88*
H0 = 1990-2011 value	1.32	1.38	-

* The asterisks used in Graphic 4, Graphic 5 and Graphic 6 denote the level of significance for each statistic. One asterisk means the finding was significant to the 10 percent level, two the 5 percent level and one the 1 percent level.

Graphic 5: Growth in State Personal Income, 1947-2011

	1947-2011	1947-1970	1971-1990	1991-2011
Intercept	0.034109*** (4.51)	0.021958* (1.75)	0.026846** (2.34)	0.021475*** (3.48)
RTW	0.012717*** (3.97)	0.006326 (1.23)	0.014331** (2.48)	0.008106** (2.31)
Adjacent RTW	-0.00637 (-0.96)	0.015575 (1.23)	-0.00043 (-0.04)	0.0016 (0.25)
Spatial Autocorrelation	-4.80E-11* (-1.75)	9.06E-11 (1.30)	-3.04E-11 (-0.82)	-1.92E-11 (-1.45)
AR(1)	0.23198*** (2.68)	0.12183*** (2.68)	0.395032*** (3.22)	0.206506** (2.30)
Adjusted R-squared	0.09	0.03	0.18	0.06
S.E. of regression	0.037	0.046	0.033	0.025
F-statistic	74.95	8.62	57.93	18.87
Durbin-Watson stat	2.06	2.09	1.84	2.04
Wald test on RTW coefficient				
H0 = 1947-2011 value	-	-1.25	0.27	-1.13
H0 = 1947- 1970 value	1.98*	-	1.38	0.49
H0 = 1970-1990 value	-0.49	-1.56	-	-1.78*
H0 = 1990-2011 value	1.44	-0.34	1.08	-

Graphic 6: State Population Growth Rate, 1947-2011

	1947-2011	1947-1970	1971-1990	1991-2011
Intercept	0.00517*** (3.50)	0.012848*** (4.84)	-0.00512 (-1.04)	0.002554 (1.25)
RTW	0.009202*** (3.60)	0.000812 (0.18)	0.021499*** (-2.03)	0.007901* (2.04)
Adjacent RTW	-0.00074 (-0.28)	-0.00495 (-1.25)	-0.00013 (-0.015)	0.006129 (1.20)
Spatial Autocorrelation	2.05E-10** (2.23)	1.36E-10 (0.68)	8.66E-10*** (3.17)	8.18E-11 (0.75)
AR(1)	0.618251*** (6.38)	0.457225*** (4.77)	0.889034*** (37.76)	0.878903*** (35.98)

	1947-2011	1947-1970	1971-1990	1991-2011
Adjusted R-squared	0.53	0.34	0.82	0.86
S.E. of regression	0.00876	0.012372	0.005235	0.004357
F-statistic	910.39	158.38	1211	1653.86
Durbin-Watson stat	1.65	1.64	1.81	1.51
Wald test on RTW coefficient				
H0 = 1947-2011 value	-	-1.88*	1.76*	-.29
H0 = 1947- 1970 value	3.29***	-	2.91***	1.83**
H0 = 1970-1990 value	-80.66***	-4.65***	-	-3.51***
H0 = 1990-2011 value	-4.62***	-1.59	1.91*	-

Our analysis assumes that growth rates for employment, personal income and population are measures of overall economic well-being, and that right-to-work laws affect them through a labor-demand function. This labor-demand function yields conflicting theoretical possibilities as to the impact of unions, which has been the challenge to existing research in this area for some time.¹⁵

We also assume that the results above permit us to interpret that the right-to-work laws' dummy variable is clean in the sense that it does not capture other policy variables which are not perfectly coincident. While the estimation process leads to this assumption in our interpretations, the relaxation of this assumption simply alters the interpretation from a strict right-to-work effect to that of a combined suite of policies of the type offered by Holmes.¹⁶

The first observation from the results displayed above is that right-to-work laws have a positive and statistically meaningful influence on growth during the length of the observed period (the first column of results in each graphic). This varies from 1971-2011 for total employment, and from 1947-2011 for real personal income and state population growth.

Interpreting the size of these coefficients requires some assumptions about the spatial relationship of right-to-work laws. If we assume that the enactment of right-to-work laws holds no spatial relationship, then the coefficient estimates above may be directly applied to the growth rates in the estimates. While this might appear attractive due to the very low level of statistical inference directly attributable to the adjacent right-to-work variable, this is a very restrictive assumption. Moreover, a casual glance at Graphic 1, as well as a cursory reading of the debate surrounding Michigan's adoption of a right-to-work law, suggests that the presence of right-to-work laws in an adjacent state affects the adoption of these laws in other states. James LeSage and Matthew Dominguez offer a very clear approach to displaying the effects of a policy which is applied with some spatial dependence.¹⁷ In the case here, we find an effect of right-to-work laws in both the own state and the effect of right-to-work in adjacent states (first-order contiguity), which LeSage and Dominguez refer to as indirect or spillover effect. These estimates appear in Graphic 7.

Graphic 7: Spatial Dependence Estimates, 1947-2011

Total State Employment Growth			
	1970-2011	1971-1990	1991-2011
Direct	0.90	1.20	0.50
Indirect	-0.14	-0.30	-0.07
Total	0.76	0.90	0.43

State Personal Income Growth				
	1947-2011	1947-1970	1971-1990	1991-2011
Direct	0.90	1.20	1.30	1.00
Indirect	-0.15	-0.74	-0.37	-0.33
Total	0.75	0.46*	0.93	0.67

State Population Growth				
	1947-2011	1947-1970	1971-1990	1991-2011
Direct	0.80	-0.20	2.00	1.00
Indirect	-0.26	-0.15	-0.70	-0.44
Total	0.54	-0.35*	1.30	0.56

* Not statistically significant

These impacts are relatively large averaged over the entire period, with growth rates boosted by up to 0.76 percentage points for employment (1970-2011), 0.75 percentage points for real personal income and 0.54 percentage points for population, noting that the early periods of right-to-work laws were the least affected, with no statistically significant impact on population or income growth.

We believe these results are not sensitive to alternative specifications which address the gravest concomitant variable problem concerns. For example, we include real per-capita taxes as a proxy for concomitant fiscal variables in both the estimations presented above and in an FGLS estimate without the endogeneity correction. In the first case, the fiscal variable is not statistically meaningful at any significant level, in any of the three measures of aggregate economic activity. The coefficient on both right-to-work and adjacent state right-to-work rose slightly (0.02 to 0.03 in all three estimates).

These estimates were not statistically different from each of the original estimates using a Wald test. No other results from the original estimate varied meaningfully. There are other concomitant variables; most especially labor-related regulations which we must concede remain a problem. However, we feel that the estimation strategies described above relieve many of the larger concomitant variables and omitted variable bias. So, we interpret the right-to-work variables as representing the laws and a small set of closely associated labor market regulations in states.

Appendix D: Comparing the Results

Our findings differ from Stevans and Hicks, who found no effect of right-to-work on manufacturing income, employment or share of manufacturing income, but are suggestive of Holmes and Vedder, Denhart and Robe.¹⁸ However, none of these earlier studies made significant inter-temporal comparisons. This paper has done so, and where data is available examined the periods 1947-1970, 1971-1990 and 1991-2011. These areas appeal to the eye as times of employment growth, stability and decline, respectively (see Graphic 8).

Graphic 8: Manufacturing Employment in the United States (thousands), 1939-2011



Source: Bureau of Labor Statistics

The estimates in each of this category tell a similar story. From 1947 through 1970 the presence of right-to-work laws played no significant role in personal income or population growth (total employment was not available throughout much of that period). A Wald test confirmed that for population growth, the 1947 through 1970 period was lower than either the later period, 1971 through 1990, or over the entire period, 1947 through 2011. Moreover, the existence of right-to-work laws in adjacent states had no statistically meaningful effect during this period either.

The Wald test for personal income was outside the typical level of statistical significance, at just over the 11 percent level. This is consistent with a number of explanations. For example, during rapid employment growth, right-to-work might not matter to employers since they are using union membership as a screening tool for workers. Whatever the cause, it is clear that right-to-work laws did not affect either personal income or population growth during the more than two decades following the 1947 Taft-Hartley Act, a time when manufacturing employment rose briskly in the United States.

The period of nearly static employment growth in the most heavily unionized sectors, from 1971 through 1990, experienced a very different effect of right-to-work laws. In all three estimates, right-to-work laws had a very strong impact on average annual growth rates of employment, personal income and population — these were 0.90, 0.93 and 1.30 percentage points higher, respectively. In all three cases a Wald coefficient test found statistically different coefficient values for this period when compared to values in the other time periods.

By the final period, from 1991 through 2011, the effect of right-to-work laws on these three measures had lessened from the previous period, but remained both statistically significant in each case, and important in terms of the size of the impact — 0.43, 0.67 and 0.56 percentage points higher, respectively for employment, personal income and population. The adjacent right-to-work variable was neither economically nor statistically meaningful in any of our estimates.

Overall these results differ from the most contemporaneous work in this area in ways which merit discussion.

Holmes tested a two-period model to explain the role of right-to-work in county-level employment in contiguous cross-state borders where a difference in right-to-work was present.¹⁹ Stevans created a heavily parameterized model and examined only 1990, 1995 and 2001-2005 in his estimates. This is a period in which the aggregate impacts we measure were small, but still significant when compared to the earlier period.²⁰ His cross-sectional model yielded no economic consequences of right-to-work.

Vedder, Denhart and Robe tested a model of right-to-work on data from 1977-2008 on per-capita personal income.²¹ This research time found results that were very similar to those reported in this study, on a similar measure of aggregate economic activity. Hicks tested the period 1947 through 2005, finding no impact on industrial structure or manufacturing wages.²² What can be gleaned from this is that temporal choice plays a role in the impact of right-to-work laws.

This research suggests that in the early days following the 1947 Taft-Hartley Act, right-to-work laws had little meaningful impact on aggregate economic growth measures in states in which it had passed. During the beginning of the manufacturing employment stagnation (1971-1990) that changed, with right-to-work laws exerting a significant impact on growth of all three measures. In the period 1991-2011, the impacts of right-to-work on growth slowed modestly, but remained large enough that they should command economic policy attention.

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Endnotes

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