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THE COSTS OF PREVAILING WAGE:
EVIDENCE FROM STATE SPENDING ON ROAD CONSTRUCTION

MICHAEL J. HICKS

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The Mackinac Center for Public Policy

The Costs of Prevailing Wage: Evidence From State Spending on Road Construction

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Midland, Michigan

MACKINAC CENTER FOR PUBLIC POLICY

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Executive Summary

Michigan lawmakers passed the state's Prevailing Wage Act in 1965. The law mandated that workers hired on taxpayer-funded construction projects be paid the wages and fringe benefits which were prevailing in the locality where the project was to be built. This prevailing wage was tantamount to union-scale compensation because the law required wage rates to be based on the union contracts covering construction workers operating in the city, township or school district where the work was to be done.

The law covered a wide range of projects, including "new construction, alteration, repair, installation, painting, decorating, completion, demolition, conditioning, reconditioning, or improvement of public buildings, schools, works, bridges, highways, or roads."[*] The purpose of the law is to artificially raise the cost of labor on government construction projects. This benefits unionized construction firms that can more easily compete for these bids. But prevailing wage also increases the costs to taxpayers of public construction.

The federal government similarly mandates prevailing wages on construction projects it funds through the Davis-Bacon Act of 1931. Many state construction projects involve both federal and state dollars, which complicates attempts to analyze the cost-benefit of these laws. According to a 2016 Congressional Budget Office report, however, repeal of the Davis-Bacon Act could have saved taxpayers some $13 billion between 2018 and 2026.[†]

The economic and fiscal impacts of Michigan's prevailing wage law have long been of interest to Michigan policymakers and to scholars at the Mackinac Center for Public Policy. Indeed, the Mackinac Center has weighed in on the debate over prevailing wage mandates since 1990.[‡] This study represents our third major analysis of the impact of prevailing wage laws, with a specific focus on Michigan and the law's impact on road construction and repair.

The Mackinac Center's first study on prevailing wage involved a unique dataset created incidentally by a federal court decision. That ruling effectively suspended Michigan's prevailing wage law from December 1994 to June 1997. The temporary change provided a natural experiment that Ohio University economist Richard Vedder used to measure the law's economic impact for the 30 months before and the 30 months after its suspension.[§]

Vedder found that suspending Michigan's prevailing wage law made possible at least 11,000 construction jobs that would not otherwise have been created. He also calculated a likely savings of 10% on public construction costs, equal to about $275 million, or 5% of the money generated by Michigan's personal income tax in 1995. Vedder noted at the time that this 10-percent estimate

* "Prevailing Wages on State Projects: Act 166 of 1965" (State of Michigan, 2018), https://perma.cc/M7RT-7V85.

† "Options for Reducing the Deficit: 2017 to 2026" (Congressional Budget Office, Dec. 8, 2016), https://perma.cc/2393-XTTV.

‡ George Leef, "Michigan's Prevailing Wage Act: A Disaster for the Taxpayers" (Mackinac Center for Public Policy, March 5, 1990), https://perma.cc/2JWS-UFYE.

§ Richard Vedder, "Michigan's Prevailing Wage Law and Its Effects on Government Spending and Construction Employment" (Mackinac Center for Public Policy, 1999), 8, https://perma.cc/H8MT-FBDC.

"accords with several studies of the impact of prevailing wages on construction costs" and may "actually be conservative."[*]

In 2007, then-Director of Labor Policy Paul Kersey authored the Mackinac Center's second major prevailing wage study. He compared prevailing wage rates to nonunion wages in different regions in Michigan and estimated that the law increased the cost of construction projects by 10% to 15%. These additional costs are passed along to taxpayers. Measured in 2007 dollars, Kersey calculated that state taxpayers could have saved up to $250 million by repealing the state's prevailing wage.[†]

In 2018, voter-initiated legislation that was passed by the Michigan Legislature repealed the state's prevailing wage law.[‡] The change was short-lived, however, as the current Legislature voted to reinstate a prevailing wage law, which was signed by Gov. Whitmer on March 24.[§] This study — the Mackinac Center's third full study on the matter — suggests that doing so will significantly raise the cost of road construction for Michigan taxpayers.

In this report, Ball State University economist Michael Hicks examines the impact of prevailing wage laws across the country on the cost per quality-adjusted mile of road construction from 2004 to 2019. He also reviews the impact of these laws on the labor share of road construction costs. Hicks relies on data from the Federal Highway Administration, the Bureau of Economic Analysis and the Bureau of Transportation Statistics.

His research demonstrates that prevailing wage laws increase the cost of road construction by 8.5% to 14.3%, in line with previous Mackinac Center estimates and other scholarship. These results are both economically and statistically significant.

As the table below shows, Hicks finds that Michigan's additional cost per quality-adjusted road mile ranged from a low of $5,932 to $9,205 due to the presence of a prevailing wage law. Other states that recently repealed their own prevailing wage laws were also demonstrably overpaying for road work.

* Richard Vedder, "Michigan's Prevailing Wage Law and Its Effects on Government Spending and Construction Employment" (Mackinac Center for Public Policy, 1999), 11-15, https://perma.cc/H8MT-FBDC.

† Paul Kersey, "The Effects of Michigan's Prevailing Wage Law" (Mackinac Center for Public Policy, 2007), https://perma.cc/SY2L-94XX.

‡ "Initiation of Legislation" (State of Michigan, 2018), https://perma.cc/Y34R-YJ65.

§ "2023 Michigan Public Acts Table" (Michigan Legislative Service Bureau, March 27, 2023), https://perma.cc/JL85-KX6R.

Estimated Fiscal Effects of Changes to Prevailing Wage Laws

State (year PW repealed)	Estimated additional cost per mile of acceptable road due to Prevailing Wage legislation	
	Low	**High**
Arkansas (2017)	$3,122	$4,845
Indiana (2015)	$4,424	$6,866
Kentucky (2017)	$4,625	$7,177
Michigan (2018)	$5,932	$9,205
West Virginia (2016)	$5,967	$9,260
Wisconsin (2017)	$10,106	$15,682

That is not all. Hicks also examined labor's share of road construction spending that flows to workers. When examining the proportion of highway spending that accrues to workers as income and benefits, he "found no compelling evidence that a prevailing wage law reduces the labor share of road construction."

Hicks creates a two-way, fixed-effects model to control for many of the variables that impact the cost of road construction in states. He uses several specifications of the model to add confidence to the findings and tests the validity of the results. A full description of the model is provided in the full text of the study below.

The results of the modeling efforts confirm that prevailing wage laws raise the cost of road construction and maintenance. This suggests that Michigan lawmakers have made it more expensive to fix the state's roads, impairing the goal of improving Michigan's public infrastructure.

Prevailing wage laws are expensive and unfair. They force taxpayers to pay more than they otherwise would for construction projects like road construction. They harm taxpayers at the expense of a select group of unionized construction workers fortunate enough to land government-supported projects. In other words, these laws benefit a few at the expense of the many.

Introduction

Policymakers are keenly interested in the effect of state-level prevailing wage legislation on the costs and labor markets of road construction and maintenance. Federal, state and local spending on highways and streets averaged $87.2 billion per month during the last expansion (July 2009 to January 2020). And as of January 2020, heavy and civil engineering construction employment peaked at over 1.1 million.[1] This is a large industry that provides significant employment and attracts substantial federal, state and local spending each year.

State prevailing wage laws mandate that a minimum wage be paid to workers on public construction projects. This prevailing wage is set by a survey of wages paid by contractors on similar projects in the local geographical area. The legislation establishes a detailed mechanism by which state and local governments must set wages for some classes of construction workers employed on publicly funded projects. Today, 29 states have prevailing wage laws, eight of which have no lower-bound thresholds for project size and apply the mandate to all publicly financed construction projects. There are substantial policy debates over the effect and efficacy of state legislation.

This research seeks to evaluate how the presence of a state prevailing wage law affects the cost of constructing and maintaining roads and the labor share of production on road construction projects. The labor share is that proportion of road spending that flows to workers in the form of wages and benefits. To accomplish this analysis, we review the relevant research literature on these questions, highlighting the sparse nature of that work. We then present the data we use to define maintenance construction costs and labor share.

Following that, we present two basic models to test, with two specifications each, along with robustness tests for the two-way, fixed-effect model with heterogeneous timing. We also test potential bias introduced by high project cost thresholds in states with a prevailing wage law in place. Because some states exempt some projects, using the prevailing wage legislation as a dummy variable may not appropriately treat the legislation. We also separately test the six states that changed their prevailing wage laws during the sampled period.

We follow this with a description of our results, and how they may be used, along with cautions on their use. We end with a summary of our findings. We begin with a discussion of modelling issues surrounding the analysis of state prevailing wage legislation.

Modeling Prevailing Wage Legislation Effects

The prevailing wage elements of the Davis-Bacon Act and the state versions of prevailing wage legislation are designed to increase wages for construction workers involved in publicly financed construction projects. Federally financed projects are controlled by Davis-Bacon, while state-funded ones are governed by state prevailing wage laws. Most jointly funded projects are also subject to Davis-Bacon requirements for prevailing wage.

An inescapable aspect of prevailing wage laws is that to affect wages they must be set above the market equilibrium. In other words, they always artificially raise the cost of labor on public construction projects. That there is concentrated opposition by labor interests to repealing these laws offers compelling evidence that they set prices above market equilibrium.

However, this does not mean that these wage rates depart significantly from market equilibrium. Nor does it mean that in the absence of prevailing wage laws these labor markets would be in competitive equilibrium. There are surely some local construction markets in which monopsony power sustains wages beneath the competitive equilibrium. These factors affect the empirics of tests of PWL on wages, costs and labor share of production. Indeed, the Davis-Bacon Act has faced a longstanding debate over its intent. Goldfarb and Morrall provide a good discussion of that debate regarding the presence of federal monopsony.[2]

The actual effect of PWL, including Davis-Bacon, is an empirical matter.

Higher wages, due the presence of a prevailing wage law, motivate firms to alter the capital-labor ratio in construction. Supra-normal wages would result in more capital-intensive production and reduce the labor share of production. Importantly, this clouds the interpretation of wage studies on this issue, since relaxing the provisions of prevailing wage would potentially change the skill mix of employees. O'Connell outlines this issue well.[3]

Nonwage compensation may also be affected by the provisions in prevailing wage legislation. This could include benefits, which are often invisible to empirical analyses, as well as investment by firms in such matters as worker training or safety. Phillips et al. provides a review of this issue.[4]

Prevailing wage requirements affect the procurement process, motivating researchers to analyze several issues as disparate as the effects on bidding practices and the advantages of incumbent firms. This latter effect has also been studied with some rigor since the protection of incumbent construction firms was a likely intent of the Davis-Bacon Act.[5]

The diversity of state prevailing wage laws motivates researchers to look at a wide variety of empirical tests on wages, construction costs, labor share of production, bidding practices, workplace training and safety. This paper addresses two of these, but before moving to our tests, we provide a review of the literature.

Literature Review

Economic analyses of state prevailing wage laws and road construction costs are sparse.[*] Only four studies make direct comparisons in this area. So, we must rely on a broader suite of research to evaluate the role state-level prevailing wage laws play in construction costs. The following review focuses on three types of studies. First, there are case studies or small sample studies with either specific data on bids or costs. These weakly mimic a natural policy experiment. That is not a critique, since there are often important policy questions at issue, and few research options that permit clear identification of PWL effects.[†]

Second, we examine studies that have microdata on construction costs for non-highway projects and use it to construct a causal estimate of the effects of prevailing wage laws on costs. These studies use several different methods, which we describe briefly. Finally, we review the effects on road construction costs that are directly assessed in four studies.

Two studies of bids for large samples of public construction projects report no wage differences between prevailing and non-prevailing wage bids.[6] These are within a single state (Ohio) and illustrate the challenges of interpreting single-state estimates. Ohio has a larger than typical threshold for contract costs to trigger prevailing wage rates, but the presence of prevailing wage laws may affect all construction markets in the same regions. This is a common problem in evaluating projects within the same labor markets.

Studies which make comparisons of contract costs for projects uniformly report higher costs for prevailing wage projects. The first of these studies reported large geographic and prevailing wage costs disparities in New York state. The prevailing wage comparison most applicable to this research is a 28% cost differential.[7] Kersey performs a similar study comparing median wage rates and legally established prevailing wage rates in Michigan, finding 10% to 15% added cost to public construction projects.[8] Rosaen and Taylor updated their 2013 study reporting cost increases of roughly 10% for school construction.[9] They were strongly criticized by Philips for, among other things, overestimating the labor share of workers affected by prevailing wage.[10] The Vermont Legislature commissioned a study that estimated the internal costs of prevailing wage to be in the 5% to 12.5% range.[11]

Estimates of prevailing wage include Vedder, who estimated a 10% cost increase in those occupations affected by state prevailing wage legislation.[12] Glassman et al. examined wage level differences in prevailing and nonprevailing wage markets of 9.9%, with the prevailing wage markets facing the higher wages.[13] Kessler and Katz use Employment Security 202 administrative

* This is not the first time Mackinac Center scholars have performed reviews of reports relating to prevailing wage. Of recent note are a series of papers produced by the Midwest Economic Policy Institute. These reports analyze prevailing wage laws in a variety of states and produce similar results in each case: states with prevailing wage laws benefit from them and those without are harming workers, tax revenues and whole communities. For more information, see: Michael D. LaFaive and Ronald Klingler, "Prevailing Wage Repeal Critiques: Cookie Cutter Criticism" (Mackinac Center for Public Policy, March 3, 2020), https://perma.cc/4PMM-7DL9.

† For additional commentary on recent prevailing wage studies, see: Michael Thom, "Do Construction Wages Fall after Ending a Prevailing Wage Mandate?" (Mackinac Center for Public Policy, May 6, 2021, https://perma.cc/EG5M-ZSED; Michael Thom, "The Weak Case Against Repealing Prevailing Wage" (Mackinac Center for Public Policy, May 13, 2021), https://perma.cc/T3TC-WGHL; Michael Thom, "What Do We Know About the Impact of Prevailing Wage Laws?" (Mackinac Center for Public Policy, June 4, 2021), https://perma.cc/9BHS-CYKC.

data to test the effect of prevailing wage on union wage premiums in affected regions.[14] This is the most important of the studies we review, both for its method and its depth of analysis. I impute their construction cost estimates from their union wage premium to be from 2% to 5% of public projects, using labor share of 20% to 30%.*

Studies with micro data on nonroad construction projects focus primarily on schools, where data are more readily available. These studies include Azari-Rad, Phillips and Prus, who report no effect of prevailing wage laws on school construction costs in a large sample of contracts during the 1990s.[15] Bilginsoy and Philips perform a similar test in Canada, which has comparable prevailing wage legislation in its provinces, and also found no effect.[16] Duncan, Philips and Prus report no differences in construction costs when comparing private and public school construction costs.[17] This natural experiment in cost differences would appear useful in identifying the effects of prevailing wage. However, prevailing wage may influence construction wages market-wide, which would bias these results.[18]

Keller and Hartman provided a review of multiple types of projects and estimates for their own analysis of school projects.[19] They report that prevailing wage laws increase school construction costs by 2.2%. The most extensive study of the issue was performed by Vincent and Monkkonen, which examined 3,000 school projects between 1995 and 2004.[20] This study used state variation in thresholds for projects, types of wage-setting agreements and state and local building requirements in their analysis. They report school costs in projects affected by prevailing wage laws are 13% higher than in those not affected.

In a unique study of state projects that used confidential state administrative data, Clark found a 28% wage difference in prevailing wage versus non-prevailing wage projects.[21] I impute that this results in a roughly 5% to 10% increase in project costs.† Kelsay, Wray and Pinkham studied project costs across a 12-state region in the Midwest and found no difference in construction costs across prevailing wage and non-prevailing wage states.[22]

Four studies of construction costs offer a modest level of analysis on a large cost issue. Fraundorf, Farrell and Mason study nonresidential building construction projects in 1977-78, finding a 26.1% difference between prevailing wage and nonprevailing wage projects.[23] Duncan offers two studies of highway contracts in Colorado, comparing costs on state and federal roads. Colorado repealed its prevailing wage legislation in 1985, offering an identification opportunity in that state.[24] He reports no impact on costs, and no differences in effects on disadvantaged businesses. Vitaliano estimates state highway and maintenance productivity, finding that using prevailing wages adds roughly 10% to the cost of construction.[25]

This literature does not provide a clear picture of consensus or method of analysis. Of the 22 studies cited here, 10 report no effects on construction costs due to PWL. There is considerable

* This is calculated simply by multiplying their estimated wage rate differential by these labor share estimates.

† As with the Katz and Kessler imputation, I multiply the wage premium by the labor share to estimate total cost differences.

overlap in the study teams here, with only three wholly separate groups of authors. They employ case comparisons and econometric studies of large samples to draw these conclusions.

Those who report higher construction costs due to prevailing wage use the same methods as those who do not. There are notably large sample sizes on both sides, and unique data sets employed across all methods. In terms of journal reputation, the better studies all find some prevailing wage effect on costs.* However, much high-quality work by well-known scholars with highly varied findings was prepared for policy debate, not for the academic literature. Moreover, the specificity of the research question biases the journal placement of prevailing wage work toward field journals in labor economics.

These studies do not provide clear evolution over time. There is no evidence that later or earlier studies report different effects, as is the case with other labor market regulations, such as right-to -work laws.[26] Also, there are a wide variety of prevailing wage studies that examine issues not relevant to this study, such as those related to worker demographics, productivity and compensation. Duncan and Ormiston provide a very well-organized review of the multiple research questions posed about the effects of prevailing wage.[27]

We provide a table review of the literature cited above in two tables. Graphic 1 summarizes those studies that report a cost effect of prevailing wage, and Graphic 2 summarizes those studies that find no cost effect. A graphic of effect sizes is reported in Graphic 3.

Graphic 1: Selected Literature Reporting Cost Effects of Prevailing Wage

Study	Description	Findings	PW effect on construction costs
Clark, 2005	State level (Kentucky) study of wage rates paid to workers in both prevailing wage and non-prevailing wage work. This was a peer-reviewed study sponsored by the Program Review and Investigations Committee of the Kentucky legislature.	Reported a 28% wage difference for the average worker between PW and non-PW highway projects in Kentucky. This translated into $3.68 per hour wage increase for workers across all PW construction projects in the state.	Imputed 5%-10%
Duncan and Ormiston, 2019	Review of the prevailing wage literature	Reports mixed effects of prevailing wage laws.	
Fraundorf, Farrell and Mason, 1984	Primary data collection and analysis of construction projects in 1977-8	Found construction costs of prevailing wage projects were roughly 26.1% higher than non-prevailing wage projects.	26.1%
Gardner and Ruffner, 2008	Comparison of wages in New York between prevailing wage and non-prevailing wage projects. This was done using comparison communities with individual construction costs.	Found significant regional variation in the prevailing wage premium in New York. Overall, the authors found a 28% premium on prevailing wages.	28%

* These include Martha Norby Fraundorf, John P. Farrell and Robert Mason, “The Effect of the Davis-Bacon Act on Construction Costs in Rural Areas” (The Review of Economics and Statistics 66, no. 1, February 1984): 141-146, https://doi.org/10.2307/1924706; Daniel P. Kessler and Lawrence F. Katz, “Prevailing Wage Laws and Construction Labor Markets” (ILR Review 54, no. 2, January 2001: 259-274, https://perma.cc/QD7Z-9SVB; D.F. Vitaliano, “An Econometric Assessment of the Economic Efficiency of State Departments of Transportation” (International Journal of Transport Economics 29, no. 2, June 2002): 167-180, https://www.jstor.org/stable/42747624.

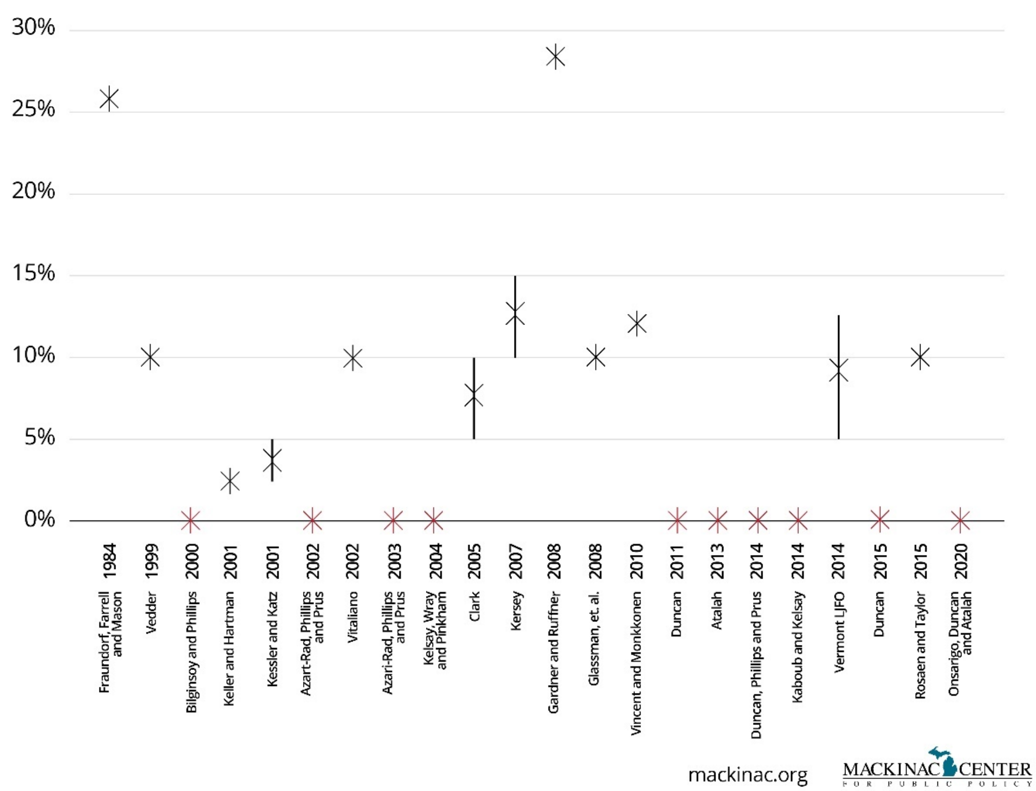
Study	Description	Findings	PW effect on construction costs
Glassman et. al., 2008	Extensive comparison of prevailing wage determinations versus market wages in construction occupations.	Reports wage differences between market and prevailing wages for the same occupation of 22%, or $4.43 per hour. This raises construction costs 9.9% overall in prevailing wage projects.	9.9%
Keller and Hartman, 2001	Critical review of PW research, and separate analysis of 461 school construction projects	Found PW projects wages were 17% higher, or $2.87 per hour, with benefits 21.5% higher, at $1.62 per hour. Total cost of PW was 2.2% of construction costs, or $74 million over 6 years.	2.2%
Kersey, 2007	Review of Michigan's prevailing wage costs on construction	Finds PW decreases the share of construction employment and increases construction costs from 10%-15%.	10%-15%
Kessler and Katz, 2001	Econometric study of individual worker data in the US, incorporating changes to PW. Study uses microdata, such as ES202 and CPS.	The presence of PW increases union wage premium by 10%, or 2-4% of overall wages, and increases the black to non-black wage differences in construction occupations.	Imputed 2%-5%
Rosaen and Taylor, 2015	Updates Rosaen 2013 with newer data and using a more conservative approach.	Reports 10% increase in construction cost attributable to prevailing wage, or $127 million per year in Michigan.	10%
Vedder, 1999	Reports analysis of the 1994-1997 suspension of Michigan's prevailing wage law on employment and construction costs.	Reports total cost of PW on construction projects roughly 10%, or $275 million total per year, an 11,000 increase in employment and a 50% increase in the African-American share of employment in construction.	10%
Vermont LJFO, 2014	Fiscal note from the Vermont Legislative Joint Fiscal Office.	Estimated PWL increased construction costs by 5% to 12.5%.	5%-12.5%
Vincent and Monkkonen, 2010	Study of 3,000 school projects between 1995 and 2004, evaluating several state construction cost policies. These include prevailing wage, project labor agreements and rules about local and school funding from states.	Prevailing wage added roughly 13% to school construction costs.	13%
Vitaliano, 2002	Study of state-level highway construction and maintenance productivity using a stochastic frontier method.	Reports inefficiencies and prevailing wage laws add an average of 10% to construction costs, or roughly $10 billion annually across the U.S.	10%

Graphic 2: Selected Literature Reporting No Cost Effects of Prevailing Wage

Study	Description	Findings
Atalah,2013	Study of over 8,000 bids in Ohio for variety of public construction projects.	Found no statistically significant evidence of prevailing wage impacts on construction bids.
Azari-Rad, Philips and Prus, 2002	Interstate evaluation of school construction costs examining types, season, year and other factors, including prevailing wage, from 1991 to 1999.	Found no statistically significant effect of prevailing wage laws on cost of school construction.
Azari-Rad, Philips and Prus, 2003	More intensive analysis of prevailing wage using F.W. Dodge school construction cost data from 1991 to 1999.	Found no statistically significant effect of prevailing wage laws on cost of school construction.
Bilginsoy and Philips, 2000	Evaluation of Canadian prevailing wage legislation on school construction costs in a	Reported existing literature finds 1.5% to 3.0% increase in costs due to PW, but found no

Study	Description	Findings
	single province (British Columbia). This was tested by the cost threshold of the legislation.	statistically significant effect of prevailing wage on school construction costs in its sample.
Duncan, 2011	Study of Colorado construction of highways, compares federal and state construction costs.	Qualitative portion of study found no effect of prevailing wage on differences between federal and state construction costs.
Duncan, 2015	Study of Colorado federal highway maintenance projects between 2000 and 2011. Focus on the effects of the legislation on disadvantaged businesses.	Found no cost differences between federal and state (non-prevailing wage) projects.
Duncan, Philips and Prus, 2014	An evaluation of public and private school construction costs before and after the administration of prevailing wage legislation.	Study found no statistically significant effect of the PWL implementation on construction costs.
Duncan and Ormiston, 2019	Review of the prevailing wage literature.	Reports mixed effects of prevailing wage laws.
Kaboub and Kelsay, 2014	Examines FW Dodge construction data for evidence of cost differentials by type of project size and prevailing wage.	Does not find statistically significant evidence of prevailing wage laws on construction costs.
Kelsay, Wray and Pinkham, 2004	Study of PW changes in Missouri, using FW Dodge data from a 12 state region.	Found no statistically significant difference in construction costs per square foot of all construction types in PW and non-PW states.
Onsarigo, Duncan and Atalah, 2020	Study of bid competition in Ohio schools.	Found no statistically significant effect of PW restrictions on bid costs or competition in bidding.

Graphic 3: Cost Effects (Percent) of Prevailing Wage Studies, 1984-2020



Model and Data

We are interested in the role state-level variation in prevailing wage legislation plays on key cost and labor market outcomes. This empirical test focuses on deriving causal inference on road construction costs per quality-adjusted mile, the labor share of spending, and the presence of a state prevailing wage law.

We pursue two parallel paths with identification of the prevailing wage effect on road cost and labor share. The first comes from Kessler and Katz, who argue the timing of changes to prevailing wage laws are exogenous due to unexpected court and legislative action.[28] Of the six states that saw changes to prevailing wage during our sample period, two passed legislation that immediately affected pay (e.g., emergency legislation in Kentucky). Given the high share of construction contracts awarded for lengthy periods, the legislative actions appear to be exogenous. If the timing of changes to prevailing wage legislation is wholly exogenous, then simple panel techniques are sufficient to provide unbiased estimates.

Still, among the challenges of this modeling effort are the potential endogeneity of prevailing wage legislation across states. In this setting, efforts to provide causal estimates are appropriate. The most common of these is the two-way, fixed-effect model, which is a generalized version of a difference-in-difference estimator when confronted with variation in timing. These models have been subject of considerable recent improvements.[29]

There are also concerns about the variation in construction costs between states that might be due to other factors such as climactic variation. The recent changes to prevailing wage laws in six states, which were enacted at different times, also influences the results across our observation period. We handle these through fixed effects in the initial panel, or through controls where possible.

Finally, we have the challenge of heterogeneity of the effects of prevailing wage, with different states using different thresholds of project eligibility. These variations compel a multiple estimation strategy to test robustness of our modeling. We accomplish this by estimating both a full sample and those states that change prevailing wage laws during this sample period. The heterogeneity in the prevailing wage threshold also argues for separate estimates that code a state with a prevailing wage when its minimum threshold for a project is either $100,000 or $1,000,000. The justification for these two thresholds is simply that $100,000 is the mode threshold, while there are no thresholds above $1,000,000. Thus, these threshold values were selected to provide reasonable basis for considering what impact thresholds may have on the effect of prevailing wage laws.

Our model estimates two observable outcomes of changes to state-level prevailing wage laws. The first of these is the quality-adjusted cost of road construction. Thus, our variable of interest is state-level spending, per dollar of road mile rated acceptable by the Federal Highway Administration. This measure includes both new construction and maintenance spending.

Formally it is:

$$\boldsymbol{R_{i,t}} = \frac{\sum \boldsymbol{s_{i,t}}}{\boldsymbol{\delta_{i,t}} \sum \boldsymbol{m_{i,t}}}$$

Quality-adjusted road spending ***R***, in state ***i***, in year ***t***, is a sum of spending across all highway/roadway types, ***s***, in state ***i***, in year ***t***. We divide this spending by the sum of road miles, **m**, in state ***i***, in year ***t***, times the share rated acceptable, ***δ***, for all roads. This is a quality-adjusted, cost-per-mile measure of construction and maintenance.

This measure is designed as a relatively straightforward approximation of cost per mile of maintenance and construction. Annual variation in spending on roads from traditional dedicated funds varies by state. Also, state general funds are often tapped for road construction and maintenance. Another source of annual variation is bonding of larger road projects. A bonding cycle and construction exhibit significant variability. Road spending is not a deterministic fiscal outcome as, say, the result of an excise tax only on gasoline is.

The lengths of available roads also vary significantly. States regularly build new roads and retire others. Municipalities regularly take control of private roads. Over our sample period the largest annual change of road miles in a state was a decline of over 3,500. There was also substantial variation in quality, with the largest annual change of the national mean being two nearly 6% declines in quality.

A potential issue in this specification is the value of including the road quality measure. Federal road quality measures are likely endogenous to previous and current levels of spending. Lagged "poor" ratings may incent higher levels of state spending, thus displaying a negative sign. Contemporaneous rankings may be positively correlated with current spending. Our primary concern is that low rankings may suggest states are spending too little to maintain roadways, and if omitted, may bias the effect of prevailing wage legislation and other coefficients.

Treating the quality ratings as endogenous means they must either appear in the dependent variable, as proposed here, or be instrumented in a first stage estimation. We focus on the first approach through the remainder of this paper. However, we also estimated a first-stage dependent variable where the state and local spending per road mile was regressed on the federal quality measure. Such that:

$$\frac{\sum \boldsymbol{s_{i,t}}}{\boldsymbol{\delta_{i,t}}} = \sum \boldsymbol{m_{i,t}} + \boldsymbol{e_{i,t}}$$

so,

$$\boldsymbol{\widehat{R}_{i,t}} = \frac{\sum \boldsymbol{s_{i,t}}}{\boldsymbol{\delta_{i,t}}} - \boldsymbol{e_{i,t}}$$

This measure yielded results that were statistically identical. The point estimates of the $\widehat{\boldsymbol{R}}_{i,t}$ estimates were marginally higher (1.5 log points) than the $\boldsymbol{R}_{i,t}$ estimates. We report the more conservative point estimates and prefer the dependent variable $\boldsymbol{R}_{i,t}$ viewing it as a more direct adjustment of the variable of interest (cost per mile of well-maintained roads) than is $\widehat{\boldsymbol{R}}_{i,t}$; though the empirical interpretations of both are effectively identical.

Our second model tests the labor share of heavy civil engineering and construction, or formally, total wages and salaries in this sector, divided by total state spending on road construction. This ratio is simply described as $\boldsymbol{L}_{i,t}$, the labor share of road construction in state $\boldsymbol{i}$, in year $\boldsymbol{t}$.

The cost variable $\boldsymbol{R}$ relies solely on data from the same source, without the potential for meaningful miscounting of values due to spending flows to non-construction activities. The labor share variable, $\boldsymbol{L}$, introduces more risk of dependent variable error since some share of heavy civil engineering and construction employment is spent on non-road construction projects. While our reported labor share estimates in Table 2 fall within reported levels, this is a weakness in the structure of the data we cannot resolve. We will discuss it in more detail in the results and summary sections.[*]

This offers two general specifications:

$$\boldsymbol{R}_{i,t} = \boldsymbol{a}_i + \boldsymbol{a}_t + \boldsymbol{\rho PW}_{i,t} + \boldsymbol{XB} + \boldsymbol{e}_{i,t} \qquad \textbf{(1)}$$

and

$$\boldsymbol{L}_{i,t} = \boldsymbol{a}_i + \boldsymbol{a}_t + \boldsymbol{\rho PW}_{i,t} + \boldsymbol{XB} + \boldsymbol{e}_{i,t} \qquad \textbf{(2)}$$

The dependent variables are state and year fixed effects ($\boldsymbol{a}$), with a prevailing wage dummy **PW,** in state $\boldsymbol{i}$ and year $\boldsymbol{t}$, and a matrix **X**, of explanatory variables and a white noise error term. The values $\boldsymbol{a}$, $\boldsymbol{\rho}$ and matrix **B** are to be estimated. This is a standard two-way, fixed-effect model.

The data we employ are from the Bureau of Economic Analysis, the Bureau of Transportation Statistics and the Federal Highway Administration. Construction worker incomes, as defined by the BEA, are placed into real terms using the Consumer Price Index, All Urban Consumers. Overall road spending is deflated using the Producer Price Index, Streets & Highways. Summary statistics appear in Graphic 4.

* The Vermont Legislative Joint Fiscal Office (2014) reported labor cost shares of 20% to 50% from testimony surrounding the prevailing wage legislation. Rosaen (2013) noted labor share as 25% and 30% in his study, citing earlier work, and in a critique of that work, Phillips (2013) reported labor share estimates of 23% (wages and benefits) for prevailing wage affected employees in all construction. These are germane to our analysis, solely because they frame the size of the potential error. We report the mean labor share of 28% and median of 26%. This is income (including some benefits) for all workers (whether or not they are subject to prevailing wage laws). This provides us comfort that our labor share is reasonably close, and that unusual variation in the share of heavy and civil engineering income spent in a state is random.

Graphic 4: Summary statistics, full sample

	Mean	Median	Maximum	Minimum	Std. Dev.
Heavy and Civil Engineering Wages ($1,000's)	1,455,087	950,678	16,122,155	99,065	1,829,655
State and Local Expenditures on Road Construction ($1,000's)	5,085,330	3,471,901	42,663,601	613	5,392,312
Prevailing Wage Law	0.59	1	1	0	0.49
Road Miles	83,549	82,447	315,445	1,500	53,212
Vehicle Miles Traveled (millions)	62,238	48,180	348,796	3,527	62,379
Quality-adjusted Spending per Mile	107,199	76,461	582,916	33.51	91,540
Labor Share	0.28	0.26	1.16*	0.14	0.12
Percent of Roads Rated Acceptable	0.81	0.84	1.00	0.03**	0.15

** This outlier maximum is Louisiana in the wake of Hurricane Katrina. **This outlier minimum is Washington, D.C.*

There are a few considerations that affect the econometrics of this. In September 2005, President Bush suspended the Davis-Bacon Act, the federal prevailing wage law, for four Gulf Coast states (Alabama, Florida, Louisiana and Mississippi) due to Hurricane Katrina (see Olam and Stamper, 2006). This occurred for less than 60 days. This period is both too brief and too clouded by other factors to provide an identification strategy. However, we did construct a Hurricane Katrina dummy (labeled PW Suspension) for those states in 2005 and included it in full models for each of our dependent variables.

A second concern is the treatment of prevailing wage legislation as a discrete dummy variable. There are states with no state-level prevailing wage laws, and most states with such a law have some minimum applicable cost threshold. For example, California Labor Code Article 2, Sect. 1771 states:

> Except for public works projects of one thousand dollars ($1,000) or less, not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which the public work is performed[30] [. . .]

Maryland, which also possesses an active prevailing wage law, has a much higher applicability threshold.

> The Prevailing Wage law applies to a public work project including school construction where the contract value is $250,000 or greater and (1) the State or an instrumentality of the State is the contracting body and there is any State funding for the project; (2) a political subdivision is the contracting body and 25% or more of the money used for the construction is State money; or (3) a political subdivision is the contracting body for the construction of an elementary or secondary school and 25% or more of the money used is State money.[31]

The $1,000 threshold in California is sufficiently low that its prevailing wage law functions no differently from laws without thresholds, such as exists in Illinois, Nebraska, New York and Texas, where all government-funded projects apply prevailing wage. We are concerned with the heterogeneity of the dummy and find no effective way to ascertain the size distribution of projects. These contracts are led by state and local governments, and they are made available sporadically across municipal, county, special and state government websites. There is no centralized repository of these data.

Including a small sample dummy variable introduces significant collinearity in our two-way, fixed-effects model. So, in order to test for a role in heterogeneous prevailing wage treatment, we reduce the sample of states. In this case, we provide two ranges to test. We simply omit from our test any state with a minimum prevailing wage contract threshold of $100,000 or less. We do this again based on a threshold of $1,000,000 or less in a state's legislation. This effectively removes all states with thresholds from our sample. This resulted in the sample size declining from the 48 conterminous states to 35 and then 29 states, respectively.

We omitted Washington, D.C., from the model of roadway costs because its roads have a quality rating that seems unrealistically low. We surmise this is due to factors related to sampling or characteristics, not necessarily related to maintenance issues. This omission significantly reduces the estimated effect of prevailing wage, since Washington, D.C., a prevailing wage jurisdiction, has such high costs per quality-adjusted mile. Not knowing if this is an irrelevant artifact of the data collection or actual data generation process leads us to omit this cross section.

An optimal modeling approach would be a spare treatment model, with both state and year fixed effects; the traditional two-way, fixed effect. Because we have no data preceding the passage of the Davis-Bacon Act, we are unable to evaluate pre-trends that would help us identify this estimation on all our data. However, as noted above, the prevailing wage literature argues against a strong identification problem in a traditional panel, versus difference-in-difference setting.[32] We believe this remains substantially correct.

However, there are reasonable cost elements that should be addressed with controls. The most obvious of these are traffic differentials, which could be included as a value per vehicle miles traveled. Likewise, cost differences include the effect of a federal share of road miles in a state. This fact bolsters the argument against including the District of Columbia in this estimate, since the entirety of that system is federal.

We also aim to have a fuller modeling of annual cost variation. In one version of our estimate, we add to the model a linear time trend, a recession dummy variable and a single series of total U.S. real road construction spending by year. We explain these results more fully in the results section.

Spatial autocorrelation is a concern. We address that problem a priori through the method recommended by Pesaran.[33] However, road work also has network characteristics that warrant direct modeling. The rationale for this is that some roadway funding may include interstate construction, modification or maintenance between two states that is federally funded for both states. The data generating process here is cross-border construction through agreements, such as the Lewis and Clark Bridge between Indiana and Kentucky. Thus, the spatially weighted dependent variable is appropriate, and we use a direct, local spillovers, specification model of the type recommended by LeSage.[34] For this estimation we construct a first-order, contiguity matrix,

$\widetilde{W}$, which provides a spatially weighted value of adjacent state road construction spending. The interpretation of these results will be discussed more fully in the results section.

These considerations add significantly to the parameters of our base model. We offer four specifications for each dependent variable. We vary the sample from the full 48 conterminous states to the 35 and 29 states (eliminating the high threshold states), and the six-state sample of those whose prevailing wage legislation changed over the period of study. We estimate the natural log of the dependent variable for ease of interpretation, noting that the labor share is expressed as a share [1,100].

Estimation Results

We provide four tables of results, with two dependent variables — quality-adjusted cost per mile and labor share — across four samples. The first sample includes estimates with the full 48 conterminous states (49 in the case of labor share). The second and third models reduce the sample by removing those states with a $100,000 or lower threshold and then those with a $1,000,000 or lower threshold of projects covered by the prevailing wage. Our fourth sample includes just those six states that changed their legislation during the observed period. In these samples, we test the more fully parameterized panel model with several controls.[*] Implicit in this is the assumption of exogeneity of the timing of the prevailing wage changes. This is our Kessler and Katz approach.[35]

In our two-way, fixed-effects estimate, we provide three specifications of our full, 48-state sample. The inclusion of the time-fixed effect reduces the availability of several control variables from our panel model through collinearity. The three specifications provided for the full sample of both our cost and labor share models are designed to illustrate the robustness of our estimate.

All of our models contain the spatial autocorrelation correction recommended by Pesaran and report standard errors treated by a panel version of White.[36] We begin with the large sample of our cost model for the years 2004-2019, which are the limit of those available in our data sources. The dependent variable is in natural logarithm form.

We employed two methods of treating the potential endogeneity of quality measures of state road systems. The first was to include it as an implicit measure of cost, by altering the road miles by that measure. The second was to conduct a first stage estimate of cost per mile with the quality-ranking share as an exogenous variable. We then used the predicted cost per mile as a dependent variable.

The point estimate of the second approach yielded modestly higher point estimates, but these were not statistically different from the first approach. We prefer and report the more conservative estimate. Notably, our cost measure is not contract cost, but public spending per quality-adjusted mile of road. The transportation literature typically focuses on contract costs as measured by the bidding and payment process to a private sector contractor. The public finance literature treats

* These models treat prevailing wage differently. The first codes all prevailing wage states identically, the other omits the high-threshold states. Our second sample omits the high prevailing wage threshold states, leaving us more homogenous sample of state applications of prevailing wage laws.

spending as cost in these types of applications. We default to the public finance approach because individual contract data are not available.

Graphic 5: Road cost effect of prevailing wage panel estimate

Variable	Full Sample	($100,000 threshold)	($1,000,000 threshold)	PWL Policy Change Sample
Common Intercept	7.31*** (53.89)	6.73*** (52.13)	6.60*** (53.80)	6.24*** (10.73)
Prevailing Wage Law	0.113*** (2.74)	0.142*** (3.34)	0.131*** (2.95)	0.143** (2.25)
PW Suspension	-0.007 (-0.15)	0.012 (0.77)	-0.0035 (-0.07)	. . .
Vehicle Miles Traveled	3.35E-06** (2.08)	4.89E-06*** (3.33)	5.77E-6*** (3.7)	1.72E-05*** (3.49)
Federal Road Share	-1.55*** (-7.86)	-2.08*** (11.91)	-1.82* (-1.65)	5.52 (0.84)
Linear Trend	0.002 (-1.32)	0.019*** (4.92)	0.02*** (-4.60)	-0.002 (-0.34)
Recession Year	-0.07*** (-6.02)	-0.012 (-0.69)	-0.01 (-0.57)	-0.078*** (-2.69)
Total US Road Spending	-3.3E-12*** (-5.03)	-6.83E-12*** (-3.48)	-8.02E-12*** (-3.67)	-6.24E-13 (-0.37)
$\widetilde{W}Y$(first order contiguity)	8.85E-07** (2.03)	2.42E-07 (0.51)	7.71E-6 (1.41)	-5.09E-06** (-2.11)
State Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	No	No	No	No
N (i,t)†	720 (48/15)	525 (35.15)	435 (29,15)	96 (6,16)
Adjusted R-squared	0.96	0.97	0.96	0.54
S.E. of regression	0.318	0.168	0.167	0.13
F-statistic	382.6***	436.62***	337.6***	9.43***

*Note: White's (1980) corrected t-statistics are reported in a parenthesis, both models estimated using GLS. *** denotes statistically significant at the 0.01 level, ** at the 0.05 and * at the 0.10.†missing observations reduce time sample by one year (balanced sample) Dependent variable is the natural logarithm of quality adjusted road miles per state, adjusted with Pesaran, 2006. $\widetilde{W}Y$ is the first-order continuity, matrix-adjusted dependent variable (separate correction for spatial autocorrelation as described in text.*

In these four specifications estimating the cost effect of prevailing wage on road construction and maintenance costs (adjusted for quality), we report fairly consistent effects. On our prime variable of interest, we report that the presence of a prevailing wage law raises quality-adjusted construction costs by 11.3% to 14.3%.

We chose several options to treat the heterogeneity of state prevailing wage laws. Given that the high project threshold limits are in states that did not change their prevailing wage law, a separate dummy for these states yielded effectively identical results to the full sample with a prevailing wage dummy. In our second and third specifications we omitted those states with thresholds above $1,000,000 and above $100,000. The statistical variation in the coefficients of interest was trivial.

Finally, we test the model only on those states that changed their prevailing wage laws during our sample period. The point estimate was higher in this estimate, but it was not statistically different from the other estimates. The absence of different coefficients on the remaining variables boosts our confidence in the exogeneity assumption offered by Kessler and Katz.[37] We discuss the range of effects in more detail below.

We did not anticipate effects from the suspension of federal Davis-Bacon rules in the wake of Hurricane Katrina, and these empirics support our priors. Also as expected, our roadway usage data (vehicle miles traveled) affected costs. More miles traveled increases the cost per mile. Higher federal road share tended to reduce state and local spending, an effect with several possible causes. Neither of these latter two variables are surprising or of particular interest in this study.

We note that our findings appear very similar in both method and result to Kessler and Katz and Vitaliano.[38] Both of these studies introduce econometric models of the effects of prevailing wage laws, and each finds that state laws increase costs of road construction and maintenance. Our findings also are close to the magnitude of those reported by Vedder, Clark and Kersey, though our methods differ substantially.[39]

Our second estimate evaluates the effect of eliminating prevailing wage legislation on the quality-adjusted cost of roads in a two-way, fixed-effect model. The identifying variation in this model is the group of six states that changed their laws during our available sample period.

Graphic 6: Road cost effect of prevailing wage

Treatment models, two-way fixed effects with variation in timing

Variable	Model 1	Model 2	Model 3
Common Intercept	6.759*** (38.92)	6.926*** (45.11)	7.12*** (216.9)
Prevailing Wage Law	0.089* (1.89)	0.089* (1.89)	0.085* (1.78)
PW Suspension	-0.03 (-0.63)	-0.03 (-0.64)	. . .
Vehicle Miles Traveled	0.0000037* (2.36)	0.0000037 (1.59)	. . .
Federal Road Share	-1.03 (-1.59)	-1.1403* (-1.78)	. . .
$\widetilde{W}Y$ (first-order contiguity)	1.4E-6*** (2.40)	. . .	. . .
State Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
N (i,t)	720 (48/15)	720 (48/15)	720 (48/15)
Adjusted R-squared	0.84	0.83	0.84
S.E. of regression	0.325	0.326	0.325
F-statistic	53.1***	53.7***	56.24***

*Note: White's (1980) corrected t-statistics errors are reported in a parenthesis, both models estimated using GLS. *** denotes statistically significant at the 0.01 level, ** at the 0.05 and * at the 0.10. Dependent variable is the natural logarithm of quality-adjusted road miles per state, adjusted with Pesaran (2006). $\widetilde{W}Y$ is the first-order continuity, matrix-adjusted dependent variable (separate correction for spatial autocorrelation as described in text).*

The parameter of interest here is the prevailing wage, which remained nearly constant across the increasingly spare specifications. These estimates offer cost increases of having a prevailing wage legislation of 8.5% to 8.9% per quality-adjusted road mile, in the point estimates. The third model here is the sparest of difference-in-difference models with the abbreviated specification of equation (1) above:

$$\boldsymbol{R_{i,t} = a_i + a_t + \rho PW_{i,t} + e_{i,t}}$$

Here, $\boldsymbol{\rho}$ is the difference-in-difference estimator of interest. Due to the variation in timing of this legislation, the coefficient value $\boldsymbol{\rho}$ should be interpreted as the weighted average of the treatment effects, or the effect of prevailing wage law changes for each time period in which a change occurs.[40]

The challenge of the variation in timing identified by Goodman-Bacon is that individual weights of the treatment effects may result from comparison between cross sections and control (non-treatment) variables that were treated early and those treated later. One way to assess this is to conduct a Bacon Decomposition to ascertain what share of the weighted effects results from these non-control comparisons. We do this across two specifications and find that between 90% and 95.5% are nonnegative weights, or derive from control and treatment comparisons.[41]

In order to provide one more potential test, we also conducted a two-period difference in difference (2004 and 2019), defining the control group as those states which maintained a prevailing wage law across the sample, and the treatment group as those which changed their laws between these dates. This estimate provided similar results, of 5.6% cost reduction per quality-adjusted road mile for those states that changed their prevailing wage legislation. However, spending varies considerably from year to year due to lumpy investments, so this point estimate should be viewed as evidence of the overall robustness of the modeling rather than a cost estimate.

Our attempt at spatial modeling, designed to capture network effects of road construction and maintenance was statistically significant, but small. LeSage and Dominguez argue that this provides a spillover effect, but in this case the dollar effect is negligible, even for the state with the highest total road spending.[42] This variable appears to have captured some cost link between states not controlled for by the Pesaran procedure.[43] However, the estimated cost per mile effect is economically negligible.

The Hurricane Katrina suspension was not statistically meaningful, and vehicle miles traveled offered somewhat larger effects, but not important in scale. The point estimate of the largest variable found that an additional million vehicle miles traveled increased cost per mile by $1.83. Again, this is statistically but not economically significant.

The following estimates turn to the effect of prevailing wage on labor share. Recall that prevailing wage legislation exists to cause supra-normal wages (above market equilibrium) in states with these laws. This potentially has a range of effects on other variables, including the choice of the mix of occupations to hire within a construction firm as well as the share of capital and labor employed in construction. Our interest here is in determining the adjustment along the labor-capital margin that may be caused by changes to state-level prevailing wage legislation.

We begin with the full model, which, unlike the previous cost samples, includes Washington, D.C., because the data process associated with rating road quality is not part of this estimate. We approach this as we did with the cost models above, testing two full samples with different prevailing wage coding, then testing a homogenous sample. For the remaining models we follow the same approach as in the cost estimates above, reporting only three specifications.

This table reports results from our full model, which assumes exogeneity of the timing of prevailing wage legislation changes. The first model is of 48 conterminous states and the District of Columbia. The second and third models exclude the high-threshold prevailing wages states. The final model includes only those states that changed their prevailing wage law during the sample period.

Graphic 7: Labor share effect of prevailing wage panel estimate

Full model and homogenous sample cost models

Variable	**Full Sample**	**($100,000 threshold)**	**($1,000,000 threshold)**	**PWL Policy Change Sample**
Common Intercept	8.45*** (77.82)	8.68*** (80.71)	*8.67**** *(78.00)*	9.51*** (25.39)
Prevailing Wage Law	-0.082** (-2.11)	-0.101** (-2.52)	*-0.06** *(-1.83)*	-0.18*** (-3.31)
PW Suspension	-0.017 (-0.22)	-0.04102 (-0.50)	*-0.03* *(0.57)*	. . .
Vehicle Miles Traveled	3.31E-6** (1.96)	1.21E-06 (0.78)	*-1.65E-06* *(-1.06)*	-5.06E-06 (-1.15)
Federal Road Share	-1.38*** (-3.57)	-4.66*** (-6.30)	*-0.86* *(-0.70)*	-1.79 (-0.31)
Linear Trend	-0.034*** (-14.50)	-0.0017 (-0.39)	*-0.00092* *(0.17)*	0.00189 (0.19)
Recession Year	0.04** (2.51)	0.033* (1.70)	*0.048*** *(2.16)*	0.019 (0.39)
Total US Road Spending	1.26E-11*** (6.43)	1.24E-11*** (6.05)	*1.33E-12**** *(5.51)*	1.02E-11** (2.22)
$\widetilde{W}Y$(first order contiguity)	1.24*** (7.36)	0.93*** (5.25)	*0.85**** *(3.93)*	-0.63 (-1.35)
State Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	No	No	No	No
N (i,t)	775 (49/16)	573 (36,16)	435 (29, 15)	96 (6,16)
Adjusted R-squared	0.76	0.81	0.81	0.69
S.E. of regression	0.328	0.17	0.178	0.19
F-statistic	44.0***	58.9***	52.2***	18.97***

*Note: White's (1980) corrected t-statistics are reported in a parenthesis. *** denotes statistically significant at the 0.01 level, ** at the 0.05 and * at the 0.10. Dependent variable is the labor share of highway spending adjusted with Pesaran (2006).* $\widetilde{W}Y$ *is the first-order continuity, matrix-adjusted dependent variable (separate correction for spatial autocorrelation as described in text).*

In each of these models, the prevailing wage variable was both economically and statistically meaningful. Also, these models enjoyed the expected direction of effect, reducing the labor share by 6% to 18%. Neither the Hurricane Katrina nor vehicle-miles-traveled variables are statistically meaningful, nor do their point estimates rise to a meaningful level. The federal road share of construction is negative and meets traditional levels of statistical significance. These controls are not directly part of our research questions.

This specification requires exogeneity in the timing of the prevailing wage legislative change, the Kessler and Katz assumption.[44] While we view this as highly plausible, we also relax that assumption in our two-way, fixed-effects model illustrated below.

Graphic 8: Road construction labor share effect of prevailing wage

Treatment models, two-way fixed effects with variation in timing

Variable	Model 1	Model 2	Model 3
Common Intercept	8.4490*** (77.82)	9.6197*** (50.22)	9.9151*** (70.31)
Prevailing Wage Law	-0.054 (-1.46)	-0.114 (-1.27)	-0.113 (-1.24)
PW Suspension	-0.017 (-0.19)	0.007 (-0.07)	-0.40 (-0.43)
Vehicle Miles Traveled	1.7E-6 (1.01)	-1.04E-7 (0.04)	-1.03E-6 (0.70)
Federal Road Share	-1.28*** (-3.72)	-2.02** (-2.09)	-1.77*** (-2.50)
Linear Trend	-0.034*** (-14.50)	. . .	. . .
Recession Year	0.13*** (8.91)	. . .	. . .
Total US Highway Spending	1.03*** (5.48)	. . .	. . .
$\widetilde{W}Y$(first order contiguity)	5.03E-12*** (6.13)	1.4185** (0.03)	. . .
State Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	No	Yes	Yes
N (i,t)	775 (49/15)	775 (49/15)	775 (49/15)
Adjusted R-squared	0.76	0.47	0.46
S.E. of regression	0.328	0.334	0.336
F-statistic	44.0***	11.2***	11.1***

*Note: White's (1980) standard errors are reported in a parenthesis, and Model 1 is estimated using GLS to *** denotes statistically significant at the 0.01 level, ** at the 0.05 and * at the 0.10. Dependent variable is the labor share of highway spending adjusted with Pesaran (2006).* $\widetilde{W}Y$ *is the first-order continuity, matrix-adjusted dependent variable (separate correction for spatial autocorrelation as described in text).*

For both sets of dependent variables we conduct one further robustness check, the exclusion of Louisiana due to the enormous inflow of road construction dollars in the wake of Hurricane Katrina. In these set of models (not shown), the prevailing wage coefficient point estimates remain similar to those reported above, but the level of statistical significance changes. For the cost model, the results were nearly identical. In our labor share estimate, in model 1, the value falls slightly inside the traditional level of statistical significance, while both models 2 and 3 fall outside that level.

As previously mentioned, the dependent variable of labor share in this estimate has a weakness which we cannot fully overcome. There is no apparent reason why this variable would be correlated with prevailing wage, but we cannot fully exclude this consideration. This is an endogeneity bias risk that we must consider when evaluating these findings.

Our robustness tests provide some evidence that project cost thresholds affect the labor share, but the impact is very modest. Excluding Louisiana, due to its extreme labor share post-Hurricane Katrina, casts doubt on the statistical certainty of the labor share estimates, but not on the point estimate.

Taken together, these concerns motivate us to reject the inference that changes to prevailing wage laws alter the labor share of construction. This may be due to measurement error, or due to a longer time path for such adjustments to occur. Also, it may simply be true that prevailing wage legislation does not change the market wage enough to alter the input mix on road construction. It may also simply be a matter of too few observations. Firms may not adjust quickly to labor cost changes, so detecting the effect may require more observations than we currently have.

We have considerably more confidence in our cost models. In these models the data quality is higher, and we have nearly identical results across models for each of the four different samples of states. Using the high and low point estimates, we provide the cost savings of ending state prevailing wage legislation in the six states that did so during our sample period. As yet another robustness check, we estimate the cost models 1-3, using only these six states in a sample. This is a small sample panel, but the only meaningful difference was a much higher coefficient (roughly 26% higher costs with prevailing wage).

Using the coefficients from the larger samples, we estimate the cost savings per mile due to the elimination of a prevailing wage law in the six states. Since these estimates use a common coefficient for all states, the savings differentials come from the differences in state-level costs per mile and the differences in assessed road quality. However, these estimates hold these two values constant. It is possible that the termination of prevailing wage legislation through legislative action has road quality effects, a question we leave to further research. These results appear in appear in Graphic 9.

Graphic 9: Estimated fiscal effects of changes to prevailing wage laws

State (year repealed)	Estimated additional cost per mile of acceptable road due to prevailing wage legislation	
	Low	**High**
Arkansas (2017)	$3,122	$4,845
Indiana (2015)	$4,424	$6,866
Kentucky (2017)	$4,625	$7,177
Michigan (2018)	$5,932	$9,205
West Virginia (2016)	$5,967	$9,260
Wisconsin (2017)	$10,106	$15,682

Summary and Conclusions

This paper reports estimates of the effect of a state prevailing wage law on road construction costs per quality-adjusted mile and on the labor share of road construction from 2004 to 2019. We rely upon the Kessler and Katz argument for assuming exogeneity, noting that repeals were often judicial or randomly timed legislative actions. Our identification strategy is to use larger panel models employing the Kessler and Katz argument, and to use a two-way, fixed-effect panel model across three specifications.

In our panel model, we explicitly attempt to model recessions, trends and variation in overall federal road spending. In the two-way, fixed-effect models, we replace the explicit time modeling with year fixed effects.

We test cost and labor share on the presence of a state prevailing wage law, controlling for vehicle miles traveled and the federal share of road funding. These models all control for state fixed effects, spatial autocorrelation and common econometric concerns. Our three specifications treat differently time and the potential for network effects in bordering states. Our network effects are a first-order contiguity value of the dependent variable, designed to capture the potential cost or spending spillovers of construction projects that occur across state borders. Such items as state improvements to roads or highways or bridges connecting two states (such as connecting Indiana and Kentucky near Louisville) are what we attempt to model. We also included a dummy variable for the suspension of federal Davis-Bacon laws in four gulf states in the two months following Hurricane Katrina.

We then test four sample sizes, one of the conterminous states (with a Washington, D.C. exclusion due to concerns about road quality data), one with a $100,000 prevailing wage threshold, one with a $1,000,000 prevailing wage threshold, and one limited to the six states whose prevailing wage law changed during the sample period. We supplemented the labor share model with an estimate excluding Louisiana, which following Hurricane Katrina had labor share estimates over 100%. We also offer a six-state robustness check in our cost model, including only those states which changed prevailing wage laws during the sample period.

Across the board, the control variables in the cost model were as expected. Higher vehicle miles traveled increased costs, while a smaller share of federal roads increased state spending. The Hurricane Katrina suspension of Davis-Bacon had no effect, and the network effects were so small as to be irrelevant, though they were statistically significant to traditional levels. In our efforts to model time, we find little to compel the use of our model over a year fixed-effects specification.

These results offer some additional research questions, such as the role higher federal spending plays on costs of state projects, the role of federal share on state costs as evidence of distributional concerns with federal infrastructure spending, and the role vehicle miles traveled play on federal support. These all offer useful and interesting questions.

The major finding of our analysis of costs is that we have point estimates across several specifications that the presence of a prevailing wage law increases the cost per quality-adjusted mile of road construction by 8.9% to 14.3%.

Our estimates for labor share were less robust. We had data-measurement concerns due to uncertainty over the actual labor share, since we do not have data matching employment to road construction. As we discuss above, we believe most workers in heavy and civil engineering construction are employed in road construction, but the empirics surrounding that belief are sparse. Also, as we discuss in detail in our results section, the effect of prevailing wage laws on labor share is large, but it lacks consistent statistical significance. We interpret this as an absence of evidence that prevailing wage legislation alters the labor share of highway construction.

Finally, we note that these results follow from no restrictive assumptions regarding labor market structure. State prevailing wage laws exist to increase construction contract wages for affected employees above the market wage, regardless of structure. While we do not examine the wage issue directly, due to the challenges outlined above, we estimate two related questions. They are whether the presence of prevailing wage legislation increases construction costs for roads or changes the labor share of road construction. The answer to question one is yes: state prevailing wage laws increase road construction costs. The answer to question two is a tentative no. We find little evidence that prevailing wage legislation alters the labor share of road construction and maintenance.

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