EXHIBIT

S-6

LIUNA'S RESPONSE TO STAFF'S FIRST SET OF DATA REQUESTS

Attachment Staff 1-3(a)

The Impact of Montana's Prevailing Wage Law

Effects on Costs, Training, and Economic Development

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Kevin Duncan, PhD
Distinguished University Professor
Professor of Economics
Colorado State University-Pueblo

Matthew Hinkel, PhD
Assistant Professor of Economics
Alma College

Frank Manzo IV, MPP
Executive Director
Illinois Economic Policy Institute

Executive Summary

Montana's prevailing wage law establishes minimum wages for construction workers employed on public works projects. The main purpose of Montana's prevailing wage laws is to protect local construction standards in the competitive bidding process. The law creates a level playing field for all contractors by ensuring that public expenditures maintain local market standards for wages and benefits that attract the skilled workforce needed for quality craftsmanship. It also requires that at least 50 percent of the workers employed by contractors on public works projects be residents of Montana.

Montana's prevailing wage law keeps construction costs stable and supports local contractors.

- 90 percent of peer-reviewed studies find that prevailing wage laws have no effect on the cost of constructing traditional public works projects like schools, highways, and public buildings.
- Labor costs account for just 24 percent of total construction costs in Montana.
- Peer-reviewed studies conclude that prevailing wage laws have no effect on bid competition.
- Data from the *Economic Census of Construction* reveals that states with prevailing wage laws have 2 percent more of the total value of construction work completed by in-state contractors.

Montana's prevailing wage law ensures that the next generation of construction workers is trained for in-demand careers, which combats labor shortages and protects worksite safety.

- Construction is the economy's most volatile and dangerous major industry.
- Economic research finds that prevailing wage laws increase apprenticeship training by up to 8 percent, boost productivity by at least 14 percent, and reduce injury rates by around 13 percent.
- Montana has significantly more construction apprentices per capita and 285 percent more apprenticeship programs than Idaho, North Dakota, and South Dakota—three neighboring states that do not have prevailing wage laws.
- The completion rate of apprentices in Montana (53 percent) is 21 percentage points higher than their counterparts in the three neighboring states without prevailing wage laws (33 percent).
- Construction worksites in Montana are much safer, averaging 33 percent fewer health and safety violations (0.7 violations per inspection) than those in the three neighboring states without prevailing wage laws (1.1 violations per inspection).

Montana's prevailing wage law promotes labor market competitiveness and boosts the economy.

- Economic research finds that prevailing wage laws deliver middle-class careers that attract workers into the construction trades and ensure they can afford to live in the communities where they are building roads, bridges, schools, parks, and other public infrastructure.
- Montana's prevailing wage law increases construction worker incomes by 8 percent and expands employer-provided health insurance coverage for construction workers by 8 percent.
- Prevailing wage has no effect on hours worked or employment levels of construction workers.
- Prevailing wage has no effect on the racial composition of the construction workforce.
- By protecting work for in-state contractors, upholding local construction standards, and hiring local, Montana's prevailing wage law creates 1,800 jobs, improves the state economy by $248 million, and generates $19 million in state and local tax revenues every year.
- Weakening prevailing wage in Montana by repealing the law or raising the contract coverage threshold would hurt local contractors, shrink construction worker incomes, and lead to an increase in worker misclassification and payroll fraud—without saving taxpayers any money.

Montana's prevailing wage law has positive impacts on the economy. Prevailing wage levels the playing field, promotes job quality, boosts investment in apprenticeship training programs, improves worksite safety, and stabilizes construction costs. Prevailing wage delivers great value for taxpayers.

Table of Contents

About the Authors

Kevin Duncan, Ph.D. is a Distinguished University Professor and a Professor of Economics at Colorado State University-Pueblo. Duncan teaches business and regional economics in the Hasan School of Business and has conducted applied research for the local chamber of commerce, the economic development corporation, businesses, non-profits, various state and local policy proposals, and labor unions. Duncan's research has been used in 25 states to inform construction labor market policy. His research on prevailing wage laws has appeared in leading national and international peer-reviewed academic journals such as *Construction Management and Economics*, *Industrial and Labor Relations Review*, and *Industrial Relations*. Duncan received his Ph.D. in Economics from the University of Utah and his Bachelor of Arts in Economics from the University of California, Riverside.

Matthew Hinkel, Ph.D. is an Assistant Professor of Economics at Alma College. He has also served as a research fellow for the National Alliance for Fair Contracting (NAFC) in Washington, D.C. Hinkel currently teaches courses on microeconomics and the economics of inequality. Much of his research focuses is the impact of prevailing wage laws on construction costs, worker misclassification, and the racial composition of the construction workforce. His peer-reviewed research has been published in the *British Journal of Industrial Relations* and *Labor Studies Journal*. He received his Ph.D. in Human Resources and Labor Relations from Michigan State University and his Bachelor of Science in Economics from Michigan State University.

Frank Manzo IV, M.P.P. is the Executive Director of the Illinois Economic Policy Institute (ILEPI). Manzo has become recognized nationally as one of the foremost experts on prevailing wage laws, authoring or coauthoring more than 40 reports on the topic since 2013. His research on prevailing wage laws has also appeared in the peer-reviewed *Public Works Management & Policy* and *Labor Studies Journal* academic publications. Manzo earned a Master of Public Policy from the University of Chicago Harris School of Public Policy and a Bachelor of Arts in Economics and Political Science from the University of Illinois at Urbana-Champaign.

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ILLINOIS ECONOMIC POLICY INSTITUTE

Introduction

Prevailing wage laws establish minimum wages for different types of skilled construction workers on taxpayer-funded and taxpayer-subsidized projects, based on wages, benefits, and apprenticeship training investments that are paid for similar work in the local area where projects are to be completed. The Davis-Bacon Act of 1931 establishes prevailing wages on federally funded and federally assisted construction projects, and Montana is currently one of 28 states that have state prevailing wage laws on the books (WHD, 2022). Montana's prevailing wage law ensures the payment of minimum wage and benefit rates for public works contracts involving construction (heavy, highway, and building) or services that are funded by the state, counties, municipalities, school districts, or other political subdivisions (DLI, 2022a). Montana's policy applies to contracts with a total cost of $25,000 or more.

The intent of Montana's law is to protect local construction standards in the competitive bidding process by eliminating wage cutting as a method of competing for public contracts (DLI, 2022b). Public construction bidding is different from private-sector construction. Public bodies are usually required to select the lowest bidder. In the low-bid model, contractors aim to lower their bids however possible, including through cutthroat reductions in worker wages, benefits, and apprenticeship training. Long-term investments in worker training, health care, and retirement security are often jettisoned by contractors in order to win bids on short-term projects. Additionally, relatively large construction projects funded by the State of Montana and a process that rewards the lowest bidder may attract contractors from surrounding states with lower wages and lower skills, which could erode local labor standards. In the absence of minimum prevailing wage rates, competition between in- and out-of-state contractors may induce local contractors to reduce workers' pay, benefits, and training programs. This could erode job quality and cause shortages of workers during a historically tight labor market at a time when billions of dollars are being invested on infrastructure projects across Montana. Instead, Montana's prevailing wage law levels the playing field for contractors by taking labor costs out of the equation, incentivizing them to compete based on core competencies and efficiencies and ensuring an equal opportunity for Montana contractors to bid on—and be awarded—public works projects.

Montana's prevailing wage law also uniquely prioritizes the local workforce. Not only does the law ensure the payment of wages and benefits at levels that attract highly skilled workers needed for quality craftsmanship, but it also requires that at least 50 percent of the workers employed by contractors be residents of Montana. This local hire component increases employment of Montana residents on public works projects funded by Montana taxpayers. Additionally, Montana's law includes "zone pay" that is added to the base wage and is calculated based on miles from the nearest "dispatch city" to encourage skilled workers from Montana to travel to complete infrastructure projects in rural areas of the state (DLI, 2022a).

Recently, there have been attempts to change the state's prevailing wage law. In 2021, there were proposals to repeal the law altogether (Thornton, 2021). One bill introduced in the Montana State Legislature, Senate Bill 346, would have increased the contract threshold from $25,000 to $80,000, weakening the law by reducing the number of public works projects covered. The bill was voted down in committee in 2022 (Girten, 2022). Additional changes may be proposed in 2023.

This report—conducted by researchers at Colorado State University-Pueblo, Alma College, and the Illinois Economic Policy Institute—examines the effects of Montana's prevailing wage law on construction workers, on the state's system of apprenticeship training, on the economy, and on taxpayers. The study includes a review of the research regarding the costs and benefits of prevailing wage laws. An extensive body of peer-reviewed research focuses on the impact of prevailing wage

standards on the costs of public construction. Related research examines the effect of the wage policy on the level of bid competition, an important determinant of overall construction costs. The study also reviews the benefits of prevailing wage laws, with data and research on the effect of the policy on local work for local contractors, formal training and safety in the construction industry, the employment and compensation of construction workers, and the effect of the policy on tax revenues. Additionally, the study discusses how altering prevailing wage coverage thresholds can affect local contractors. Ultimately, this study shows that Montana's prevailing wage law keeps construction costs stable, is an effective job skills advancement policy, provides upward economic mobility for blue-collar construction workers, and has positive effects on the state's economy.

Peer-Reviewed Research on the Effect of Prevailing Wage on Construction Costs

In academic journals, the process of peer review ensures quality, credibility, and high standards—with the research being scrutinized by a group of anonymous, independent experts who are more likely to detect errors and shortcomings that may not be obvious to casual readers. Peer-reviewed academic research on the impact of prevailing wage laws on construction costs typically compares bid costs of projects covered by the wage policy to the bid costs of projects that are not, taking into consideration other factors that affect construction costs such as project size and complexity. Contract bids are used as the measure of total construction costs due to the difficulty in obtaining information on change orders and follow-up maintenance (Bilginsoy, 1999; Philips et al., 1995). Most peer-reviewed studies typically use statistical analyses called regressions that assess the impact of prevailing wage laws on costs and detail whether estimates are "statistically significant," which can imply causation.

The economic consensus is that prevailing wage laws have no impact on total construction costs (Duncan and Ormiston, 2018). There are three main reasons why prevailing wage laws do not have a discernible impact on total project costs. First, labor costs are a low share of total costs in the construction industry. The most reliable data on construction costs can be obtained from the U.S. Census Bureau's *Economic Census of Construction* (Census, 2022). These data are derived from a survey of all construction contractors that conducted every five years. Data from the most recent *Economic Census of Construction*, which occurred in 2017, indicates that labor costs for all types of construction are approximately 23 percent of total construction costs.[1] The corresponding figure for Montana is 24 percent (Figure 1). Numerous studies use data from the *Economic Census of Construction* for different years and segments of the construction industry and also find that labor costs are a low percent of overall construction costs (Philips, 2014; Duncan and Waddoups, 2014).

Second, when wages rise in construction, contractors respond by utilizing more capital equipment and by hiring skilled workers to replace their less-productive counterparts. While it is an established practice to consider the combined effects of labor costs and labor productivity when considering cost pressures for the U.S. economy, these relationships are almost always ignored in policy debates over the impact of prevailing wage laws. Balistreri, McDaniel, and Wong (2003) find that when wages increase, more capital equipment and machinery is used in construction—increasing labor productivity. Additionally, Blankenau and Cassou (2011) find that the use of skilled and unskilled construction labor is very sensitive to wage rates. When construction wage rates increase, more skilled

[1] The *Economic Census of Construction* for 2017 does not report labor costs as a percent of total costs. This ratio must be calculated by dividing total construction worker wages and proportionally allocated total fringe benefits by the net value of construction work. The net value of construction is based on the total value of work completed by a contractor minus the value of work subcontracted to other contractors (Census, 2022).

and productive construction workers are hired, replacing less skilled workers. As a result, construction workers are significantly more productive in states with prevailing wage laws (Philips, 2014).

FIGURE 1: LABOR COSTS AS A SHARE OF TOTAL CONSTRUCTION COSTS, U.S. AND MONTANA, 2017

2017 *Economic Census* Construction Metrics		Math	United States	Montana
A	Net Value of Construction Work*	--	$1,574,236,474,000	$5,669,176,000
B	Blue-Collar Construction Worker Wages	--	$276,213,296,000	$1,030,453,000
C	Wages for White-Collar Employees	--	$122,602,241,000	$367,450,000
D	Blue-Collar Worker Share of Wages	B ÷ (B + C)	69.3%	73.7%
E	Total Fringe Benefits	--	$115,233,915,000	$427,836,000
F	Blue-Collar Worker Fringe Benefits	E x D	$79,809,176,000	$315,376,000
G	**Labor Costs as Share of Total Costs**	**(B + F) ÷ A**	**22.6%**	**23.7%**

Source(s): Authors' analysis of the 2017 *Economic Census* by the U.S. Census Bureau (Census, 2022). *The "Net Value of Construction Work" is the total value of construction work less the cost of construction work subcontracted out to others.

Third, contractors have been found to respond to higher wages by reducing expenditures on materials, fuels, and rental equipment and by accepting slightly lower retained earnings. Duncan and Lantsberg (2015) find that labor costs are higher but also that material costs, fuel costs, and contractor profits are lower in states with average or strong prevailing wage laws, compared to states with weak or no wage policies. The use of higher-paid and more-productive construction workers results in more efficient use of materials and fuels.

Since labor costs are a low percent of total construction costs, relatively minor changes in labor productivity, material and fuel costs, and retained earnings are needed to offset any effect of prevailing wages. The preponderance of peer-reviewed, academic research indicates that prevailing wage laws are not associated with increased construction costs, keeping inflation low.

Prevailing Wage Laws and School Construction Costs

Researchers have examined the effect of prevailing wage laws on the construction of schools, highways, affordable housing, and various of other building types (Duncan and Ormiston, 2018). School construction is often singled out as a primary focus because these projects are relatively similar, allowing researchers to measure the effect of the wage policy with greater accuracy.

In an examination of schools built between 2009 and 2018 in the Las Vegas area, Duncan and Waddoups (2020) find that Nevada's prevailing wage law has no statistically significant effect on school construction costs. This study also finds that weakening prevailing wage standards by increasing the coverage threshold value is not associated with reduced building costs. Prevailing wage requirements played no role in the relative cost of schools built above and below the initial $100,000 threshold, and did not influence costs when the threshold was increased to $250,000.

Onsarigo, Duncan, and Atalah (2020) examine public schools built in Ohio in 2013 and 2014. Some of the construction projects received federal funding and were covered by federal Davis-Bacon prevailing wage requirements. Results indicate that the cost of these schools were no different than the school construction that was not covered by the wage policy.

Atalah's (2013a; 2013b) examination of more than 8,000 bids on nearly 1,500 school projects in Ohio over the 2000 to 2007 period compares bids of construction companies that contractually pay prevailing wage to those submitted by contractors paying lower rates and finds no statistically

significant difference in bid costs per square foot (Atalah, 2013a). The average bid cost per square foot is also not higher for 15 of the 18 trades (83 percent) that paid prevailing wage rates (Atalah, 2013b).

Azari-Rad, Philips and Prus (2002) examine winning bids for more than 4,000 public and private schools built across the United States between 1991 and 1999. Results indicate that prevailing wage laws do not have a statistically significant impact on construction costs. In a follow-up study, Azari-Rad, Philips and Prus (2003) expand their analysis to compare schools built in states with prevailing wage laws of differing strength and find that all prevailing wage laws (strong, weak, or otherwise) are not related to school construction costs.

Several studies have taken advantage of the introduction of a prevailing wage policy in British Columbia, Canada to examine the effect on school construction productivity and costs. Bilginsoy and Philips (2000) assess the impact of British Columbia's Skill Development and Fair Wage Policy on the construction of schools built before and after the law and reveal an absence of cost differences. Bilginsoy's (1999) examination of schools built before and after the wage policy finds a similar result. Duncan, Philips, and Prus (2014) analyze the effect of British Columbia's prevailing wage standard with respect to a control group of private school projects and find that the cost differential did not change after the policy was introduced. In several studies, Duncan, Philips, and Prus, (2012; 2009; 2009) find that the efficiency and productivity of school construction changed in ways that stabilized building costs. Taken together, all seven of these studies provide a consistent and comprehensive review that fails to find an effect of prevailing wage standards on school construction costs.

Only one peer-reviewed study that is based on actual project bids, by Vincent and Monkkonen (2010), finds a statistically significant prevailing wage cost effect on school construction. However, the authors' approach has been questioned because they did not account for local economic conditions (Onsarigo, Duncan, and Atalah, 2020). Nevertheless, of the 13 peer-reviewed studies on school construction costs that are based project-level bid data, 12 (92 percent) provide evidence that prevailing wage laws are not associated with increased costs.

Prevailing Wage Laws and Highway Construction Costs

Five peer-reviewed studies examine the effect of federal and state-level prevailing wage laws on highway construction costs. Four (80 percent) conclude that prevailing wage laws have no impact on total construction costs. Two studies by Duncan (2015a; 2015b) compare the cost of highway resurfacing projects built in Colorado between 2000 and 2011 that were funded by the State of Colorado—which were not covered by prevailing wages at the time—with federally funded projects—which were covered by Davis-Bacon prevailing wages. Results indicate that there is no statistically significant difference in construction costs between state and federally funded projects and in construction costs for contractors who switch between federal and state projects. Furthermore, when prevailing wage determinations decreased from union-scale rates to "average rates," the cost of highway resurfacing projects in Colorado did not change.

Duncan, Gigstad, and Manzo (2022) examine more than 2,000 highway pavement projects constructed between 2014 and 2020 to analyze the effect of Kentucky's prevailing wage repeal in 2017. Prior to 2017, all federal and state highway projects were subject to prevailing wage standards. After repeal, only federal projects were covered by Davis-Bacon prevailing wages. However, difference-in-differences and fixed effects analyses fail to find statistically significant differences in bid costs between federal and state projects before and after repeal.

Manzo (2022) uses more than 1,200 highway projects in Iowa to compare the cost of federal projects that are covered by Davis-Bacon prevailing wages to state projects that are not subject to prevailing wage standards. These prevailing wage projects are also compared to similar projects that have been stripped of federal regulations through a "federal-aid swap" policy. The state's "federal-aid swap" program bypasses Davis-Bacon prevailing wage standards, Disadvantaged Business Enterprise goals, and Buy America provisions on certain highway projects. The policy allows local jurisdictions to reallocate, or "swap," federal funds for state funds on some projects and then concentrate federal monies on specific, larger projects. The result is that fewer highway projects are built with federal prevailing wage standards, contractor diversity goals, and American-made iron and steel. The Iowa Department of Transportation approved the "federal-aid swap" program in 2018. The comparison of projects built between 2016 and 2020 reveals that swapped projects were no less expensive than federal projects built in Iowa that retained prevailing wage standards. Manzo also finds that Davis-Bacon prevailing wages have no effect on total construction costs, after accounting for project size and complexity, project type, and project location.

On the other hand, in a paper on the 50 state Departments of Transportation, Vitaliano (2002) claims that state-level prevailing wage laws add 8 percent to the cost of maintaining the nation's highway system, but his analysis is simply a review of total highway expenditures. This includes administrative and engineering costs that are not directly related to the payment of prevailing wages to blue-collar construction workers. Vitaliano also does not account for the amount of new highway construction ordered, which is an important determinant of total expenditures.

Prevailing Wage Laws and Costs of Other Building Construction

Three peer-reviewed studies examine the effect of prevailing wages on other types of construction projects, and all three (100 percent) show no effect on costs. An examination of public works projects in five northern California cities—Palo Alto, Mountain View, San Carlos, San Jose, and Sunnyvale—built between 2006 and 2007 by Kim, Chang, and Philips (2012) does not find that prevailing wage standards prevent nonunion contractors from winning bids or increase construction costs. Another analysis of British Columbia's prevailing wage law by Duncan and Prus (2005) has the advantage of including a control group of projects that were not affected by the wage policy and did not find that the law altered the construction cost differential between a wide array of public and private building. Finally, Kaboub and Kelsay (2014) investigate the construction of more than 3,100 projects in 12 Midwest states between 1993 and 2002. Results for 13 different project types—including hospitals, schools, manufacturing, and office buildings—show that, while public projects are more expensive than comparable private structures, prevailing wage laws do not alter this cost differential.

Prevailing Wage Laws and the Cost of Affordable Housing Construction

While the research addressing prevailing wages and the cost of constructing schools, highways, and buildings generally finds no statistically significant cost effect, the results regarding the construction of affordable housing units differ. There are four peer-reviewed studies that examine the effect of prevailing wage requirements on the cost of building housing units was subsidized by state and federal Low-Income Housing Tax Credit policies in California over the 1997 to 2016 period. Three of these studies find that project costs are higher when prevailing wages apply and only one (25 percent) finds no effect. Cost impacts range between 5 percent and 37 percent (Dunn, Quigley, and Rosenthal, 2005; Palm and Niemeier, 2017; Littlehale, 2017). Littlehale's model yields a lower 5 percent cost estimate because his analysis takes project size and complexity into consideration. Littlehale (2020) also shows that the *absence* of prevailing wage standards on affordable housing projects has led to substantial

construction workforce shortages and an undersupply of housing units, contributing to the affordability crisis in California. Hinkel and Belman (2022) employ the most sophisticated approach, a "two-stage least squares model," and find no causal effect of prevailing wages on affordable housing construction costs. It is also worth noting that illegal cost-saving practices such as employee misclassification as independent contractors, wage theft, and the hiring of undocumented workers are especially prevalent in the residential segment of the construction industry (Juravich, Ablavsky, and Williams, 2015).

Summary of Research on the Impact of Prevailing Wage Laws on Construction Costs

In sum, there have been 25 peer-reviewed studies examining the cost implications of prevailing wage laws since 1999. Among the peer-reviewed studies that examine all building types (i.e., schools, highways, buildings, and affordable housing), 20 of 25 (80 percent) fail to find a statistically significant prevailing wage cost effect. Few states apply prevailing wage standards to affordable housing construction. Including only traditional public works projects, 19 of 21 (90 percent) studies indicate that prevailing wage laws are not associated with increased construction costs.

Research on the Effect of Prevailing Wage on Bid Competition and Local Contractors

Critics of prevailing wage laws often claim, without any empirical evidence, that the policy increases construction costs by reducing the level of bid competition (e.g., Leef, 2010). There have been six peer-reviewed studies that empirically examine the effect of prevailing wage laws on overall bid competition—an important determinant of construction costs. All of these studies are based on the statistical analysis of contractor bids, and all six (100 percent) find that prevailing wage standards do not reduce the number of bidders on public projects. In an examination of nearly 600 bids on public works projects in five northern California cities, Kim, Kuo-Liang, and Philips (2012) find no evidence that prevailing wage policies affect the number of bidders. A study of nearly 500 bids on highway construction in Colorado, Duncan (2015a) finds that the level of bid competition does not differ between federally funded projects that paid Davis-Bacon prevailing wages and state-funded projects that did not. Bilginsoy (1999) finds that introduction of prevailing wage standards in British Columbia was associated with an increase—not a decrease—in the number of bidders, but that the higher bid competition diminished over time. Onsarigo, Duncan, and Atalah's (2020) study of nearly 700 bids on school construction projects in Ohio finds no statistical difference in the number of bidders on projects built with and without prevailing wages but that "the cost-reducing effect of increased bid competition is stronger on projects covered by the prevailing wage policy." Duncan and Waddoups (2020) also find that Nevada's prevailing wage law does not influence the level of bid competition for school construction in Clark County. However, bid competition decreased by 25 percent after Nevada weakened its prevailing wage law, driven by union contractors exiting the market for other opportunities. Finally, Duncan, Gigstad, and Manzo (2022) investigate nearly 3,500 bids on about 2,100 state and federal highway projects in Kentucky and find no statistically significant impact of the 2017 repeal of prevailing wage on bid competition.

Prevailing wage laws create a level playing field for construction contractors by ensuring that public expenditures reflect local market standards of compensation and craftsmanship. Competing on a level playing field, local contractors are awarded more taxpayer-funded projects in states with prevailing wage laws. Data from the *Economic Census of Construction* reveals that states with prevailing wage laws have 2 percent more of the total value of construction work completed by in-state contractors (Census, 2022). Impacts are even larger in certain areas. Manzo (2022) finds that in-state contractors

are 8 percent more likely to be awarded federal highway projects that pay Davis-Bacon prevailing wages compared to similar projects that do not pay prevailing wages in Iowa. Manzo and Duncan (2018a) examine school construction projects in the Minneapolis-St. Paul area and find that metro-based contractors are awarded 74 percent of total bid values on projects that include prevailing wage standards and 64 percent that do not. As a result, local contractors account for a 10 percent higher market share when prevailing wages are paid on public school projects. Another examination of library construction in Santa Clara County, California reveals that 39 percent of subcontractors employed on prevailing wage projects are county-resident businesses but the corresponding figure when prevailing wages do not apply is 23 percent, a 16 percent difference in the market share of local contractors (Duncan, 2011). By keeping tax dollars in the local economy, more labor income and consumer spending remain in communities with prevailing wage standards.

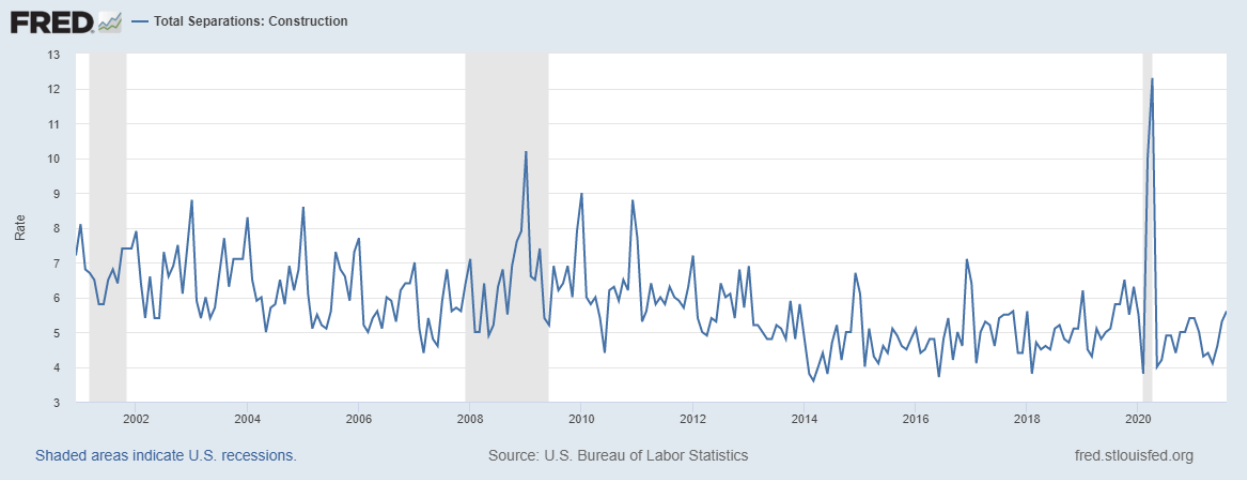
Research on the Effect of Prevailing Wage on Apprenticeship Training and Safety

Construction is distinct from other industries. It is the most volatile major industry in the United States. The construction industry is cyclical, with more activity during the upswing of the business cycle when market conditions are favorable. It is also seasonal, with construction most likely to occur outside of the winter months. Finally, when workers complete projects, there are often periods of unemployment while they look for new jobs. For context, Figures 2 and 3 compare monthly fluctuations in employment separation rates for the construction industry against the broader U.S. economy. In construction, separations rates range from a low of 3.6 percent in March 2014 to a high of 10.2 in January 2009 when the COVID-19 recession is excluded, and 12.3 percent in April 2020 during the pandemic. By contrast, there is a significantly reduced range in employment separation rates for the overall economy—from a low of 2.5 percent in February 2011 to a high of 5.3 percent in January 2001 prior to the COVID-19 recession, and 10.4 percent in March 2020 during the pandemic.

This inherent instability of construction activity creates strong disincentives for employers and employees to invest in a highly skilled, efficient, and safe workforce. When work is available, contractors take on additional workers, but typically shed employees when a project is completed, the season comes to an end, or the economy slows. There is no guarantee that the trained worker will be retained. Moreover, from the worker's perspective, there is little incentive to incur the costs of training out-of-pocket due to the possibility of prolonged spells of unemployment and the potential need to change industries altogether. The result is a "market failure" in which long-term investments in worker training are not made at adequate levels.

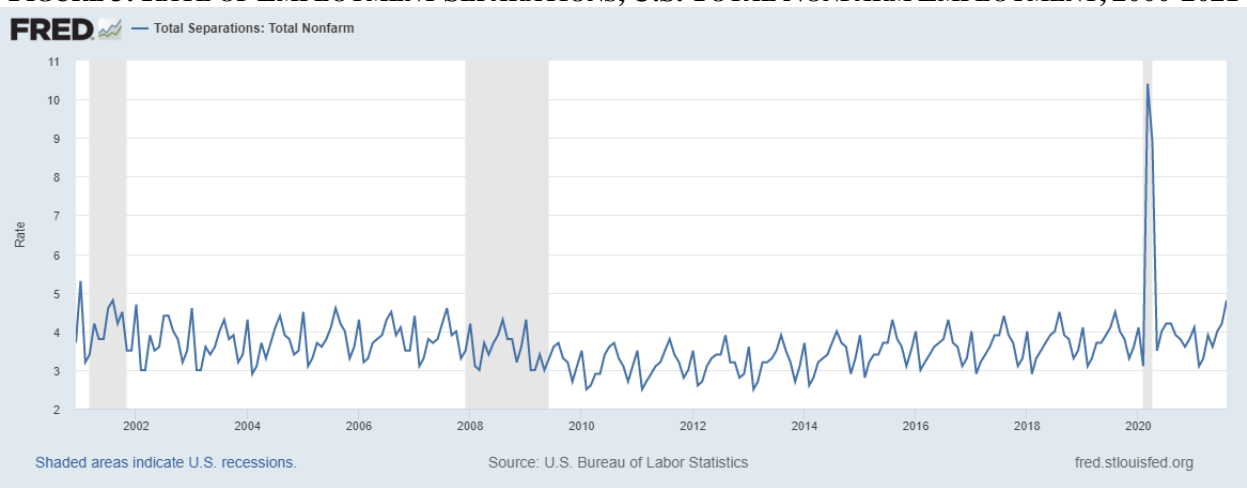
A state prevailing wage law helps to correct this market failure by reflecting local market-based standards for wages, benefits, and workforce training investments in the communities where projects are being built, ensuring that the next generation of workers is trained and the industry can access a stable supply of skilled workers. Contractors who have greater access to registered apprenticeship programs are less likely to report that their local pipeline for supplying trained craft workers is "poor," less likely to lose workers to other industries, and less likely to experience delays in project completion times due to shortage of workers (Manzo, Petrucci, and Bruno, 2022). As a result, a state prevailing wage law institutionalizes competitive labor market practices in the construction industry and combats skilled labor shortages.

FIGURE 2: RATE OF EMPLOYMENT SEPARATIONS, U.S. CONSTRUCTION, 2000-2021



Source(s): Screenshot of construction separations data from the Federal Reserve Bank of St. Louis (FRED, 2022a).

FIGURE 3: RATE OF EMPLOYMENT SEPARATIONS, U.S. TOTAL NONFARM EMPLOYMENT, 2000-2021



Source(s): Screenshot of total nonfarm separations data from the Federal Reserve Bank of St. Louis (FRED, 2022b).

Apprenticeships typically involve a mix of on-the-job training and in-class instruction that covers basic and specialized skills of particular crafts (Bilginsoy, 2003). During the on-the-job component of training, the apprentice earns while they learn, but at a rate that is less than the fully trained journeyworker. Typically, apprentice wage rates are based on a fraction of the corresponding journeyworker rate, starting as low as 50 percent and increasing with program progress. With this arrangement, the cost of training workers is shared between the apprentice and the employers who are sponsoring the training. This wage savings creates an incentive for contractors to hire a combination of journeyworkers and apprentices. Upon completion of apprenticeship programs, trainees become certified journeyworkers.

Economic research shows that state prevailing wage laws increase apprenticeship training in the construction industry. Bilginsoy (2005) finds that apprenticeship enrollments are 6 percent to 8 percent higher in states with prevailing wage laws compared to states without these laws. Bilginsoy also finds that apprentices in states with prevailing wage laws complete their on-the-job and classroom training at a faster rate than apprentices in states without prevailing wage laws. This effect is most robust in

states with stronger prevailing wage laws.[2] Another study finds that the apprenticeship share of the construction workforce is 14 percent in states with prevailing wage laws compared to 8 percent in states without prevailing wage laws (Dickson Quesada et al., 2013). The result is that workers are more productive due to prevailing wage laws. Productivity per construction worker has been found to be between 14 percent and 33 percent higher in states with the wage policy (Philips, 2014).

In a perilous industry, better-trained workers are safer workers. Construction workers are exposed to many hazards, such as elevated worksites, excavated worksites, confined spaces, dangerous power tools and equipment, electricity, hazardous materials, and even dust and noise—which can cause breathing and hearing difficulties. The construction industry led all industries in the number of fatal injuries in 2021, representing only 5 percent of total U.S. employment but accounting for 19 percent of job-related deaths (BLS, 2022c). While prevailing wage laws do not include safety requirements, they affect construction industry injury rates indirectly through the linkage between prevailing wages and apprenticeship training, which is subsequently connected to safety. Azari-Rad (2005) examines injury data in the construction industry between 1976 and 1999 and finds that nonfatal injury rates are lower in states with prevailing wage laws by at least 7 percent and as much as 10 percent. These results are statistically significant and take into consideration other factors such as region, unemployment rate, and other trends that affect injuries. Philips (2014) finds that construction workers reported 12 percent more disabilities (such as hearing disabilities, vision disabilities, memory loss, and difficulty climbing stairs) in states without prevailing wage laws between 2009 and 2011. Additionally, Philips, Mangum, Waitzman, and Yeagle (1995) find that injuries per construction worker and serious injuries per construction worker were from 5 percent to 9 percent higher in states that do not have prevailing wage laws.

Economic studies conducted after the repeal of prevailing wage laws have also shown strong correlations with a decrease in worker training and an increase in injury rates. After Utah repealed its law, apprenticeship training declined to historical lows (Azari-Rad, Philips, and Prus, 2003). Philips (2014) shows that registered apprenticeships fell by 38 percent in Kansas following repeal. In an analysis of nine states that repealed their prevailing wage laws from 1979 to 1988, Philips, Mangum, Waitzman, and Yeagle (1995) find that repeal was associated with a 40 percent decrease in training and caused workplace injuries to rise by 14 percent, including a 15 percent increase in serious injury rates. Kelsay and Manzo (2019) find that the number of active apprentices fell by 28 percent after West Virginia repealed its prevailing wage law in May 2016, leading to a 26 percent increase in the on-the-job construction worker injury rate. Additionally, recent peer-reviewed research has found that the repeal of a state prevailing wage law leads to a 13 percent increase in construction injury rates (Li et al., 2019).

Apprenticeship Training and Safety in Montana Compared to Neighboring States

Apprenticeship programs are sponsored either jointly by labor unions and employers that are signatories to collective bargaining agreements (joint labor-management programs) or unilaterally by employers. Joint labor-management programs are cooperatively administered with standards, trainee

[2] Armand Thieblot developed a classification system for state prevailing wage laws into weak, average, and strong policies. These are based on the contract value threshold that prevailing wages apply, the level of coverage at the municipal, county, or state level, the types of work and trades excluded, the determination of prevailing wage rates, and other items (Thieblot, 1995). Distinctions by Thieblot (1995) have since been updated by Duncan and Lantsberg (2015), who conclude that there were 25 states with "strong" or "average" prevailing wage laws and 25 states with either a "weak" prevailing wage policy or no law at all in 2012.

wages, and apprentice-to-worker ratios established in collective bargaining agreements. Importantly, they include an institutional financing mechanism that is usually a cents-per-hour-worked contribution into programs. By contrast, employer-only (nonunion) programs are sponsored by a single employer, trade association, or group of employers who unilaterally determine program content, set entry requirements, and monitor trainee progress. These programs are dependent on voluntary contributions by programs sponsors and include no institutional financing mechanisms. All programs operate under the minimum standards established by the Office of Apprenticeships at the U.S. Department of Labor in conjunction with State Apprenticeship Agencies.

According to the *Economic Census of Construction*, the value of federal, state, and local construction represents 25 percent of the total value of building activity in Montana (Census, 2022). Much of this construction spending is covered by federal and state prevailing wage standards. The large percentage of building activity covered by prevailing wage standards in Montana substantially increases the investment in apprenticeship training. As a consequence, apprenticeships in construction are disproportionately high. For example, construction apprentices represented 79 percent of all apprentices in the state in 2019 (Holom, 2020). Of the Top 10 occupations by active apprenticeship employment for Montana in 2019, at least seven were construction occupations (Holom, 2020).

Figures 4 through 7 present descriptive analyses of apprenticeship training in Montana compared to three neighboring states—Idaho, North Dakota, and South Dakota—using data from the Registered Apprenticeship Partners Information Database System (RAPIDS) over eight years from 2014 through 2021. While Idaho, North Dakota, and South Dakota are covered by the Davis-Bacon Act for federal infrastructure projects, they do not have state prevailing wage laws for state-funded or locally-funded construction work. In contrast, Montana expands upon Davis-Bacon with its own prevailing wage law that applies similar requirements to state and local projects.[3] With Davis-Bacon and the state prevailing wage law working in tandem, there is a greater investment in apprenticeship programs in Montana than in the three neighboring states.

FIGURE 4: CONSTRUCTION APPRENTICES ENROLLED IN MONTANA AND NEIGHBORS, 2014-2021

Construction Apprentices with Start Years 2014-2021	Montana	Idaho	North Dakota	South Dakota	Total
Number of Apprentices	**3,452**	2,165	2,704	1,621	9,942
Share of Apprentices	**34.7%**	21.8%	27.2%	16.3%	100%

Source(s): Authors' analysis of 2014-2021 apprenticeship data from the Registered Apprenticeship Partners Information Management Data System (RAPIDS) (DOLETA, 2021).

Figure 4 presents the number of apprentices in construction over the 2014-2021 period in Montana, Idaho, North Dakota, and South Dakota. Montana had the most construction apprentices, accounting for nearly 35 percent of all apprentices across the four states. For context, according to the 2020 Census, Montana has a population of 1.1 million residents, ranking 44th in the United States. By contrast, Idaho has 1.9 million residents (ranking 38th), South Dakota has just over 900,000 residents (46th), and North Dakota has just over 800,000 residents (47th). It is notable that Montana has nearly 1,300 more construction apprentices than Idaho despite its significantly smaller population. Montana has 3.1 construction apprentices per 1,000 residents. Idaho has just 1.1 construction apprentices per 1,000 residents. Additionally, if the Dakotas were combined (population: 1.7 million), then they would have 4,325 apprentices, or about 2.5 construction apprentices per 1,000 residents. Montana thus has

[3] Neighboring Wyoming is excluded because it also has a state prevailing wage law, although it is generally considered to be a "weak" law compared to others (WHD, 2022). Note that Idaho had a prevailing wage law from 1911 until 1985, when it was repealed by the state legislature (Philips et al., 1995).

175 percent more apprentices than Idaho and 23 percent more apprentices than the Dakotas. Overall, the data suggest construction apprenticeship enrollments are particularly strong in Montana.

Figure 5 compares the number of construction apprenticeship programs in the region. Out of 713 total construction apprenticeship programs across the four states, fully 79 percent (566 programs) are based in Montana. Put differently, Montana has 285 percent more apprenticeship programs than Idaho, North Dakota, and South Dakota combined. Taken together, Figures 4 and 5 show that there are significantly more construction apprenticeship programs and apprentices in Montana, which has a prevailing wage law, than in the neighboring states, which do not. By creating a high demand for apprentices on public works projects, Montana's prevailing wage law drives skill development throughout the industry.

FIGURE 5: NUMBER OF APPRENTICESHIP PROGRAMS IN MONTANA AND NEIGHBORS, 2014-2021

Apprenticeship Programs (2014-2021)	Montana	Idaho, North Dakota, and South Dakota	Total
Total Active Programs	**566**	147	713
Share of Programs	**79.4%**	20.6%	100%

Source(s): Authors' analysis of 2014-2021 apprenticeship data from the Registered Apprenticeship Partners Information Management Data System (RAPIDS) (DOLETA, 2021).

Figure 6 presents an analysis of completion rates for construction apprentices in Montana compared to the three neighboring states without prevailing wage laws. Registered apprenticeships typically take between three and five years to complete. As a result, Figure 6 only evaluates completion rates for apprentices who were enrolled from the beginning of 2014 through the end of 2016, accounting for five-year programs. Apprentices may not finish their programs for several reasons. For example, apprentices may voluntarily quit, leave to accept another employment opportunity, or may be terminated for unsatisfactory performance.

A majority of construction apprentices in Montana (53 percent) complete their registered apprenticeship programs (Figure 6). In neighboring states without prevailing wage laws, only one-in-three apprentices (33 percent) complete their programs—a difference of 21 percentage points. The results remain consistent when broken down by program type. Joint labor-management apprenticeship programs in construction have a graduation rate of 69 percent in Montana and just 39 percent in the three neighboring states without prevailing wage laws, a difference of 30 percentage points. Among employer-only (nonunion) apprenticeship programs in construction, just 44 percent of enrollees complete their training in Montana. While this is 25 percentage points below the comparable in-state union success rate, it is 19 percentage points above the completion rate for employer-only programs in Idaho, North Dakota, and South Dakota (25 percent). This corroborates two bodies of existing economic research, which have found that joint labor-management apprenticeship programs deliver higher completion rates and that states with prevailing wage laws have higher completion rates (e.g., Manzo and Thorson, 2021; Manzo and Bruno, 2020; Bilginsoy, 2005).

FIGURE 6: COMPLETION RATES IN CONSTRUCTION APPRENTICESHIP PROGRAMS, 2014-2016 CLASSES

Completion Rate for Construction Apprentices Enrolled 2014-2016	Montana	Idaho, North Dakota, and South Dakota	Montana Difference
All Programs	53.3%	32.7%	**+20.6%**
Joint-Labor Management (Union) Programs	69.2%	38.8%	**+30.4%**
Employer-Only (Nonunion) Programs	44.2%	25.3%	**+18.9%**
Joint-Labor Management (Union) Difference	***+25.0%***	***+13.5%***	***+11.5%***

Source(s): Authors' analysis of 2014-2021 apprenticeship data from the Registered Apprenticeship Partners Information Management Data System (RAPIDS) (DOLETA, 2021).

Upon completion, hourly wages for construction workers are higher in Montana than in neighboring states without prevailing wage laws. Figure 7 compares median exit wages for all journeyworkers, union journeyworkers, and nonunion journeyworkers in Montana compared to the three comparison states. Overall, the median construction worker graduating from an apprenticeship program earns over $28 per hour in Montana, 4 percent more than the $27 per hour earned by his or her peers in Idaho, North Dakota, and South Dakota. Union construction workers who complete joint-labor management programs earn 6 percent more in Montana ($30 per hour) than their counterparts in nearby states without prevailing wages ($28 per hour). Additionally, although they are less likely to complete their programs, the nonunion construction workers who do graduate earn a median wage of more than $25 per hour in Montana, which is 18 percent more than the $22 per hour equivalent for the comparison group. In a high-inflation economy, nonunion construction workers in Montana earn significantly higher wages than their counterparts in Idaho, North Dakota, and South Dakota in part due to the state prevailing wage law, which promotes labor market competitiveness by establishing a wage floor for *all* construction workers regardless of whether they are union members or nonunion workers.

FIGURE 7: JOURNEYWORKER WAGES OF APPRENTICESHIP COMPLETERS, 2014-2016 CLASSES

Exit Wages for Construction Completers Enrolled 2014-2016	Montana	Idaho, North Dakota, and South Dakota	Montana Difference, $*	Montana Difference, %*
All Completers	$28.35	$27.27	**+$1.08**	**+4.0%**
Union Journeyworkers	$30.09	$28.47	**+$1.62**	**+5.7%**
Nonunion Completers	$25.35	$21.50	**+$3.85**	**+17.9%**

Source(s): Authors' analysis of 2014-2021 apprenticeship data from the Registered Apprenticeship Partners Information Management Data System (RAPIDS) (DOLETA, 2021). *NOTE: The median difference of 4.0% exceeds the union difference (5.7%) and the nonunion difference (17.9%). This is not an error, but rather an example of "Simpson's Paradox" when data are aggregated compared to when they are separated into subgroups (Koehrsen, 2018).

Finally, Figure 8 details all 696 inspections conducted in 2019 by the Occupational Safety and Health Administration (OSHA) at construction worksites in Montana, Idaho, North Dakota, and South Dakota. In total, 173 health and safety inspections were conducted in Montana (25 percent) while the remaining 523 OSHA inspections (75 percent) occurred in Idaho, North Dakota, and South Dakota. Construction worksites averaged 0.7 health and safety violations in Montana and 1.1 health and safety violations in the three neighboring states, a difference of 0.4 violations per inspections. Montana's construction worksites thus have 33 percent fewer health and safety violations than those in the three neighboring states without prevailing wage laws. This data, which is statistically significant, offers direct evidence that Montana's worksites are safer and healthier for construction workers.

FIGURE 8: OCCUPATIONAL SAFETY AND HEALTH INSPECTIONS AT CONSTRUCTION WORKSITES, 2019

OSHA Inspections at Construction Worksites in 2019	Total Inspections	Average Violations
Montana	173	0.74
Idaho, North Dakota, and South Dakota	523	1.10
Montana Difference, #	**--**	**-0.36**
Montana Difference, %	**--**	**-32.9%**

Source(s): Authors' analysis of Occupational Safety and Health Administration inspection data at establishments with construction industry NAICS codes (230000 to 239999) in 2019 (OSHA, 2021).

Research on the Effect of Prevailing Wage on Economic and Fiscal Outcomes

In addition to ensuring that the next generation of construction workers is trained, state prevailing wage laws foster good, middle-class careers for skilled construction workers. Philips (2014) finds a significant disparity in the wages paid to blue-collar construction workers between states with prevailing wage laws and states without prevailing wage laws. Manzo, Lantsberg, and Duncan (2016) find that prevailing wage laws can statistically increase blue-collar construction worker earnings by as much as 16 percent per year. With family-sustaining incomes, prevailing wage laws reduce the number of construction workers living below poverty by 30 percent and reduce income inequality in the construction industry by as much as 45 percent (Manzo, Lantsberg, and Duncan, 2016; Manzo and Bruno, 2014). Manzo, Gigstad, and Bruno (2020) also conclude that prevailing wage laws ensure that construction workers can afford to live in the communities where they build roads, schools, and other public infrastructure, increasing their homeownership rate by 2 percent and improving their housing wealth by 13 percent.

Economic research demonstrates that prevailing wage laws protect workers against exploitation—regardless of racial or ethnic background. Duncan and Ormiston (2018) conduct a meta-analysis of peer-reviewed studies and find no relationship between prevailing wage laws and the racial composition of the construction workforce. After accounting for individual factors such as age, gender, residence in a metropolitan area, marital status, educational attainment, and union coverage, Belman and Philips (2005) can find no evidence that prevailing wage laws deter people of color from participating in the construction industry. Furthermore, according to Bilginsoy (2005), there is no evidence that prevailing wage laws exclude people of color from training in registered apprenticeship programs. In fact, Philips, Mangum, Waitzman, and Yeagle (1995) show that, in the nine states that repealed prevailing wage laws from 1979 to 1988, people of color accounted for 19 percent of all registered apprentices pre-repeal but just 13 percent post-repeal, a 6 percentage-point drop. However, Manzo, Gigstad, and Bruno (2020) find that prevailing wage laws boost the homeownership rate of Black construction workers by 8 percent, compared with a 3 percent increase for white construction workers. Another study by Manzo, Bruno, and Manzo (2018) estimates that state prevailing wage laws reduce racial income inequality in construction by between 7 percent and 53 percent.

One demographic group that is disproportionately impacted by prevailing wage laws is military veterans, who populate the construction trades at higher rates than non-veterans. Manzo, Bruno, and Duncan (2016) use U.S. Census Bureau data for 2014 and show that veterans represent about 6 percent of the overall U.S. workforce but 7 percent of the construction workforce. This percentage is 2 percentage points higher in states with strong or average prevailing wage laws. Construction workers in those states with strong or average prevailing wage laws earn 9 percent more in wage and salary income compared to veteran construction workers in states with weak or no prevailing wage laws. Strong and average prevailing wage laws increase the number of veteran construction workers who receive employer-provided health insurance by 14 percent decrease the number of veteran construction workers with income below the official poverty level by 25 percent.

States with prevailing wage laws can also learn lessons from those that have repealed their policies within the last decade. There have been five reports released since 2016 on the effects of repealing prevailing wage laws (Figure 9). In Indiana, Manzo and Duncan (2018b) show that construction worker wages fell by 8 percent and there was no change in the average cost to build public schools post-repeal. After West Virginia's repeal in 2016, wages fell by between 1 percent and 8 percent for construction trades workers, the number of apprentices fell by 28 percent, and an analysis of over 100 winning prime contract bids found that repeal had no impact on inflation-adjusted school construction

costs—according to Kelsay and Manzo (2019). In Wisconsin, Manzo, Duncan, Gigstad, and Goodell (2020) find that repeal decreased construction worker earnings by 6 percent, increased the share of state highway construction projects being awarded to out-of-state contractors from 9 percent to 14 percent (driven by contractors from Iowa, Michigan, and Florida), and had no impact on the average cost per mile to resurface or maintain roads. As previously discussed, the 2017 repeal of prevailing wage in Kentucky had no statistical effect on bid costs and bid competition on state highway projects (Duncan, Gigstad, and Manzo, 2022). Finally, Kansas passed a state preemption law in 2013, prohibiting cities and counties from enacting local prevailing wage statutes and invalidating local ordinances. Following this state-mandated repeal of two prevailing wage ordinances in two Kansas counties, Kelsay (2016) demonstrates that repeal did not result in any cost savings and that school construction projects actually became $67 *more* expensive per square foot post-repeal.

Elected officials in Indiana and West Virginia—the first two states to rescind their prevailing wage laws in the wave of repeals from 2015 to 2018—have recently acknowledged that repeal failed to deliver as promised. In 2017, Indiana State Representative Ed Soliday commented that "we got rid of prevailing wage and, so far, it hasn't saved us a penny" while serving as the Assistant Republican Leader in the Indiana House of Representatives (Quinnell, 2017). Representative Soliday's observation was later confirmed in a study by the Indiana Department of Labor (2021), which found that "project costs for similar types of work have continued to increase since the repeal" and that "any effect the repeal may have had on the cost of projects was likely negligible," leading to the conclusion that repeal had "no significant impact" on project costs.[4] Furthermore, in 2021, West Virginia Governor Jim Justice, a Republican, stated that "we got rid of prevailing wage… and we've run to the windows—and they haven't come," referring to a lack of business, job, and population growth since repeal (McElhinny, 2021).

FIGURE 9: STATE ANALYSES ON THE IMPACT OF REPEAL OF PREVAILING WAGE LAWS SINCE 2016

Study	Authors	Year	Geography	Construction Worker Wages	Construction Costs	Project Focus
1	Duncan, Gigstad, Manzo	2022	Kentucky	--	*No Effect*	Highways
2	Manzo, Duncan, Gigstad, & Goodell	2020	Wisconsin	-6.4%	*No Effect*	Highways
3	Kelsay & Manzo	2019	West Virginia	-1.2% to -8.1%	*No Effect*	Schools
4	Manzo & Duncan	2018	Indiana	-8.5%	*No Effect*	Schools
5	Kelsay	2016	2 Kansas Counties*	--	*+$67.01 per square foot*	Schools

*A state preemption law repealed prevailing wage statutes in Sedgwick County, Kansas and Wyandotte County, Kansas.

Source(s): Individual studies listed in table.

These outcomes could have been avoided by understanding the effects of earlier prevailing wage repeals between 1979 and 1995. Fenn, Li, Pleites, Zorigtbaatar, and Philips (2018) find that skilled construction worker incomes decreased by between 2 percent and 4 percent and fringe benefits declined by as much as 16 percent in the states that repealed their laws during this period. Li, Zorigtbaatar, Pleites, Fenn and Philips (2019) also conclude that repeal states experienced a 13 percent increase in construction injury rates. This was driven by a 40 percent decrease in apprenticeship

[4] The Indiana Department of Labor report also said that repeal had no significant impact on wages paid and the employment of workers in Indiana's construction industry, but the Department's analysis suffered from methodological problems. Whereas other research narrowly focuses on the wages and employment outcomes of blue-collar construction workers who are directly impacted by repeal of prevailing wage laws, the Department lumped both blue-collar and white-collar workers together and did not compare Indiana's outcomes with neighboring states that maintained their prevailing wage laws (Manzo, 2021).

training (Philips et al., 1995). Repeal of a prevailing wage law has negative consequences for a state's economy, with construction worker incomes decreasing and apprenticeship training plummeting—all without providing any cost savings for taxpayers.

Even though prevailing wage laws are not associated with higher construction costs, they still impact public budgets. That is because they improve apprenticeship training and safety and promote a strong middle class. When skilled construction workers earn higher incomes, as they do in states with prevailing wage laws, they contribute more in tax revenues. Philips and Blatter (2017) show that skilled construction workers contribute about 17 percent more in income taxes and property taxes in states with prevailing wage laws. In addition, skilled construction workers are statistically less likely to rely on government assistance programs, such as Supplemental Nutrition Assistance Program (SNAP) food stamps and the Earned Income Tax Credit (EITC) assistance (Manzo, Lantsberg, and Duncan, 2016).

Finally, state prevailing wage laws have a meaningful impact on payroll tax revenue, especially reducing payroll tax fraud associated with worker misclassification. Fenn, Li, Pleites, Zorigtbaatar, and Philips' (2018) study showed that legally required benefits—including Social Security, workers' compensation insurance, and unemployment insurance contributions—decreased by between 4 percent and 10 percent in the states that repealed their laws between 1979 and 1995, greater than the 2 percent to 4 percent decrease in blue-collar construction worker incomes associated with repeal. The disproportionately larger decrease in legally required benefits is consistent with a rise in underground labor practices in the states that repealed prevailing wage laws, including employee misclassification as independent contractors, under-the-table cash payments, and wage theft (Philips and Blatter, 2017). These types of payroll fraud reduce collections of state and federal payroll taxes, including workers' compensation premiums and unemployment insurance contributions. As one example, Waddoups, Duncan, and Ormiston (2021) estimate that 11 percent of Nevada's construction labor force was either misclassified as independent contractors or working "off-the-books" in 2018, costing the state about $31 million in contributions for Nevada's workers' compensation fund and nearly $12 million to the unemployment insurance program annually.

Prevailing wage laws are effective at discouraging underground labor practices. Similar to other jurisdictions, Montana's prevailing wage law requires that contractors submit weekly certified payroll records that include each worker's name, job assignment, hours worked, total hourly compensation, and other information (SOS, 2022). This requirement discourages contractors who engage in underground labor practices from participating in projects that are covered by the state's wage standard. The additional requirement that at least 50 percent of the employees of each contractor working on the jobs be Montana residents further discourages the practice of importing vulnerable and exploited workers from other states (DLI, 2022a).

Hinkel (2022) finds that from 2010 through 2019, worker misclassification and off-the-books employment was 2 percent lower for construction workers in states with prevailing wage laws than in states without prevailing wage laws. Lower prevailing wage contract coverage thresholds were also linked with significant decreases in misclassification and off-the-books employment because more state and local projects are covered, leaving fewer workers vulnerable to exploitative practices and governments less vulnerable to payroll tax fraud. By improving transparency, accountability, and enforcement on public works projects, prevailing wage laws protect workers from illegal labor practices, promote strong public budgets that are better able to provide vital services to citizens, and deliver great value to taxpayers.

Effects of Prevailing Wage on Incomes, Health Coverage, and the Economy in Montana

This section compares labor market outcomes for construction workers in Montana to those in Idaho, North Dakota, and South Dakota. The data included in this report are from the *American Community Survey*, a random poll of approximately 1 percent of households every year conducted by the U.S. Census Bureau. This report uses 2015 through 2019 data from the *American Community Survey* (ACS) to assess the impacts of prevailing wage on the annual incomes, health insurance coverage, and hours and employment of blue-collar construction workers. Blue-collar construction workers are defined as all workers employed in "construction occupations," such as construction laborers, operating engineers, electricians, carpenters, plumbers, pipefitters, and painters, but excluding their first-line supervisors and those engaged in extraction and mining occupations.

Personal economic outcomes are better for blue-collar construction workers in Montana than for those in Idaho, North Dakota, and South Dakota (Figure 10). After adjusting for inflation to 2020 dollars, average annual incomes for blue-collar construction workers were $41,600 in Montana compared to just under $41,000 in the three neighboring states without prevailing wage laws. Construction workers in Montana also earn ($41,600) about as much as the average income of all private nonfarm workers in the state ($42,000), while their counterparts in Idaho, North Dakota, and South Dakota earn noticeably less ($41,000) than their statewide average ($42,600). A difference-in-differences calculation shows that private construction workers in Montana earn 3 percent more than their counterparts in the three states without prevailing wage law, relative to the rest of their local labor markets. Similarly, blue-collar construction workers in Montana are, relatively, 6 percent more likely to have private health insurance coverage and 9 percent more likely to have employer-provided health insurance coverage. The only metric that fares worse for blue-collar construction workers in Montana is hours worked per week, which are lower. However, this means that Montana's construction workers earn higher incomes but work less to achieve those higher earnings—so they have more disposable income and more leisure time with which to spend that money.

FIGURE 10: ECONOMIC DATA ON CONSTRUCTION WORKERS IN MONTANA VS. NEIGHBORS, 2015-2019

2014-2019 *ACS* Economic Outcomes	Blue-Collar Construction Workers			All Private Nonfarm Workers			Difference-in-Differences
	Montana	Neighbors	Difference	Montana	Neighbors	Difference	
Inflation-Adjusted Annual Incomes	$41,600	$40,996	+1.5%	$41,986	$42,621	-1.5%	**+3.0%**
Private Health Insurance Coverage	71.8%	70.8%	+1.0%	77.4%	82.1%	-4.8%	**+5.7%**
Employer-Provided Health Insurance	63.1%	59.9%	+3.2%	65.0%	70.7%	-5.7%	**+8.9%**
Usual Hours Worked Per Week	41.3	42.9	-3.7%	38.0	39.1	-2.8%	**-1.0%**
Construction Occupation Share	100.0%	100.0%	±0.0%	5.8%	5.6%	+0.2%	**+0.2%**

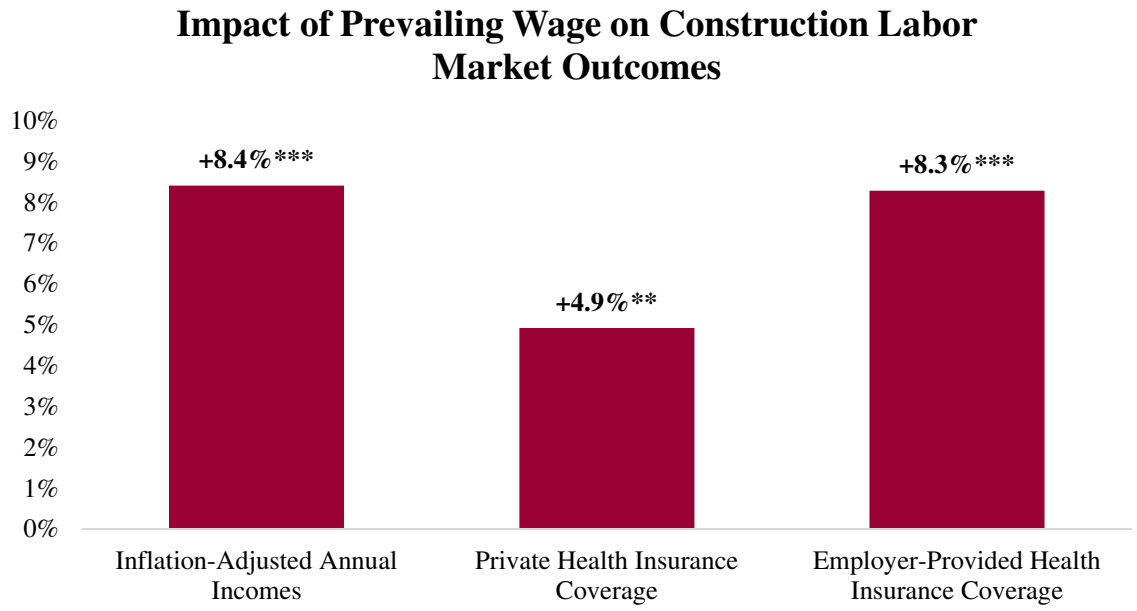
Source(s): Authors' analysis of *American Community Survey* data (one-year estimates) by the U.S. Census Bureau from 2015 through 2019 (Ruggles et al., 2022).

While the summary statistics of Figure 10 report "what is," statistical techniques can help explain "how much" Montana's prevailing wage law may or may not be responsible for these outcomes. "Regression" analyses allow researchers to account for other factors that may influence labor market outcomes by separating out the unique and independent effect of a prevailing wage law. The analyses all account for age, gender identification, racial or ethnic background, immigration status, veteran status, marital status, educational attainment, year, and (where appropriate) usual hours worked per

week, weeks worked per year, and whether the individual is employed in the construction industry. In regression analyses, a statistically significant result is an indication that the relationship may be causal.

Montana's prevailing wage law produces positive impacts on construction worker incomes and health insurance coverage (Figure 11). After accounting for other important factors, including age, gender, race, education, and the rest of the labor market, the prevailing wage law increases blue-collar construction worker annual incomes by 8 percent on average. This result is statistically significant at the 99-percent level of confidence. Montana's prevailing wage law also increases the probability that a blue-collar construction worker is covered by a private health insurance plan by 5 percentage points. This is driven entirely by an increase in employer-provided health insurance coverage: the prevailing wage law boosts their likelihood of being covered by an employer-provided plan by 8 percentage points. The former is statistically significant at the 95-percent level of confidence and the latter at the 99-percent level of confidence.

FIGURE 11: REGRESSION RESULTS ON THE IMPACT OF PREVAILING WAGE ON CONSTRUCTION WORKER EARNINGS AND HEALTH INSURANCE COVERAGE, 2015-2019



Source(s): Authors' analysis of *American Community Survey* data (one-year estimates) by the U.S. Census Bureau from 2015 through 2019 (Ruggles et al., 2022). Regression outputs for inflation-adjusted annual incomes are based on the natural logarithm and are converted to percent changes using correct adjustments to interpret natural logarithms, which is e(coefficient) – 1 or e-0. 0.08074– 1 = 8.41% (Kennedy, 1981). For full regression results, see the Appendix. Three asterisks (***) indicate significance at the 99-percent confidence level. Two asterisks (**) indicate significance at the 95-percent confidence level.

The data also show that prevailing wage laws have no impact on labor force outcomes or the racial composition of the construction workforce (Figure 12). After accounting for other important factors such as age, gender, and education, Montana's prevailing wage law has no statistical effect on both the chances that any given person in the nonfarm labor force will be a construction worker and the usual hours worked per week of employed construction workers. Furthermore, there is no evidence that Montana's prevailing wage law excludes people of color from participating in the construction trades. After accounting for other important factors, people of color initially have offsetting employment outcomes associated with prevailing wage: they are 1 percent less likely to be in construction but tend to work 2 hours more per week. However, neither finding is statistically significant at the conventional 95-percent level of confidence.

FIGURE 12: REGRESSION RESULTS ON THE IMPACT OF PREVAILING WAGE ON CONSTRUCTION WORKER EMPLOYMENT AND HOURS, 2015-2019

Regression Results	Prevailing Wage Effect	Z-Score	Significant?
Probability of Being in Construction: Total Labor Force	+0.0%	+0.02	**No**
Probability of Being in Construction: People of Color	-1.3%	-1.69	**No**
Weekly Hours Worked: All Construction Workers	-0.24	-0.52	**No**
Weekly Hours Worked: Construction Workers of Color	+1.60	+1.04	**No**

Source(s): Authors' analysis of *American Community Survey* data (one-year estimates) by the U.S. Census Bureau from 2015 through 2019 (Ruggles et al., 2022). For full regression results, see the Appendix. Three asterisks (***) indicate significance at the 99-percent confidence level. Two asterisks (**) indicate significance at the 95-percent confidence level.

The data reveal that Montana's prevailing wage law boosts construction worker incomes and expands employer-provided health insurance coverage for construction workers. If Montana were to repeal its law, the average incomes of construction workers would fall by 8 percent, or about $3,200 annually per worker (Figure 13). Repeal would have no statistical effect, however, on construction employment or hours worked. Consequently, with about 25,500 blue-collar construction workers in Montana as of May 2021, total construction worker labor income would decrease by $82 million annually (BLS, 2022b). In addition, an estimated 2,100 construction workers would lose their employer-provided health insurance coverage, an 8 percentage-point drop in coverage. Repeal of prevailing wage would result in a pay cut for construction workers and greater reliance on Medicaid and taxpayer-subsidized Affordable Care Act coverage.

FIGURE 13: IMPACT OF MONTANA'S PREVAILING WAGE LAW VS. REPEAL ALTERNATIVE, 2021

What If Montana Repealed Its Prevailing Wage Law?	Inflation-Adjusted Annual Incomes	Employer-Provided Health Coverage
Blue-Collar Construction Workers (May 2021)	25,530	25,530
Current Value Per Construction Worker (ACS 2014-2019)	$41,600	63.1%
Current Estimate for All Construction Workers	$1,062,060,000	16,100
Impact of Prevailing Wage on Workers	+8.4%	+8.3%
Estimate Per Construction Worker without Prevailing Wage	$38,374	54.8%
No-Law Estimate for All Construction Workers	$979,681,600	14,000
Impact of Repeal on All Construction Workers	**-$82,379,000**	**-2,100**

Source(s): Authors' analysis of *American Community Survey* data (one-year estimates) by the U.S. Census Bureau from 2015 through 2019 and May 2021 employment estimates from the *Occupational Employment and Wage Statistics* from the Bureau of Labor Statistics (Ruggles et al., 2022; BLS, 2022b).

Boosting blue-collar construction worker incomes by a total of $82 million is one way that Montana's prevailing wage law affects the state economy. The law also performs an important economic development function by protecting construction spending in the state. This additional spending circulates throughout the economy, adding value to other industries that are not related to the construction industry. Economic data from the 2017 *Economic Census of Construction* indicates that states with prevailing wage laws have nearly 91 percent of the total value of construction completed by in-state contractors (Figure 14). By contrast, states without prevailing wage laws have just 88 percent of their construction projects built by contractors based in their states. This 2 percent difference is a gain in the market share of in-state contractors for all public and private construction, and it is consistent with previous iterations of the *Economic Census of Construction* (e.g., Duncan and Manzo, 2018a). For Montana specifically, 89 percent of all construction work is completed by in-state contractors—also higher than the states without prevailing wage laws (Figure 14).

FIGURE 14: MARKET SHARE OF IN-STATE CONTRACTORS, BY PREVAILING WAGE STATUS, 2017

Economic Census of Construction Data for 2017	Total Value of Construction Work	Construction Work Completed by In-State Contractors	Market Share of In-State Contractors
States with Prevailing Wage Laws	$1,283,548,123,000	$1,164,130,474,000	90.7%
States without Prevailing Wage Laws	$692,330,697,000	$611,466,523,000	88.3%
Prevailing Wage Difference	**+$591,217,426,000**	**+$552,663,951,000**	**+2.4%**
Montana	$6,961,346,000	$6,195,972,000	89.0%

Source(s): Authors' analysis of the 2017 *Economic Census* by the U.S. Census Bureau (Census, 2022). Values are in "nominal" terms and not adjusted for inflation.

Montana's prevailing wage law supports millions of dollars of work for local contractors (Figure 15). In 2017, the total value of construction work was $7.0 billion in Montana. The prevailing wage effect of protecting more than 2 percent of this value for in-state contractors is equal to $165 million. Put differently, in the absence of a prevailing wage law, this $165 million in construction work would be completed by out-of-state or foreign contractors. However, when measuring the economic impact of the $802 million in protected construction work, it is important to net out spending that would remain in the state regardless of whether in-state or out-of-state contractors perform the work. After removing the cost of materials, supplies, power, fuel, and land, ($57 million, or 35 percent of total construction costs in Montana), the net effect of $165 million in retained construction is $108 million.

FIGURE 15: INPUT INTO ECONOMIC IMPACT ANALYSIS OF MONTANA'S PREVAILING WAGE LAW

Montana Construction Metrics		Math	Direct Effect
A	Total Value of Construction Work		$6,961,346,000
B	Supplies, Materials, Power, Fuel, and Land Percent of Total		34.6%
C	Value of Construction Work Less Supplies, Materials, Power, and Fuel	A x (1 - B)	$4,550,404,000
D	Impact of Prevailing Wage on In-State Contractor Share		+2.4%
E	Construction Work Retained In-State Due to Prevailing Wage	C x D	$108,130,000
F	Impact of Prevailing Wage on Construction Worker Incomes	Fig. 13	$82,379,000
G	**Total Impact of Prevailing Wage**	**E + F**	**$190,509,000**

Source(s): Authors' analysis of the 2017 *Economic Census* by the U.S. Census Bureau, *American Community Survey* data (one-year estimates) by the U.S. Census Bureau from 2015 through 2019, and May 2021 employment estimates from the *Occupational Employment and Wage Statistics* from the Bureau of Labor Statistics (Census, 2022; Ruggles et al., 2022; BLS, 2022b).

The economic impact of this additional in-state work is measured with the IMPLAN economic impact software (IMPLAN, 2022). IMPLAN accounts for the inter-industry relationships within an economy, measuring market transactions between businesses and households. This economic impact analysis is based on the multiplier, or ripple effect, associated with the retention of $108 million in construction spending for in-state contractors and an associated $82 million in labor income for Montana-based construction workers, or a total input of more than $190 million (Figure 16). The economic impact of over $190 million in protected construction business and construction worker spending results in an overall increase in economic activity in Montana of approximately $248 million. The corresponding employment increase is about 1,800 jobs. Specifically, the law saves or creates about 700 direct construction jobs and supports more than 1,100 additional jobs through in-state construction worker spending in sectors such as retail, service, and restaurants. The increase in economic activity is also associated with an approximate $19 million gain in tax revenues for state and local governments, particularly from income taxes. These are statewide impacts that are experienced each year.

FIGURE 16: ECONOMIC IMPACT OF MONTANA'S PREVAILING WAGE LAW, 2021 VALUES

Category	Direct Effect	Total Impact
Economic Activity	+$79.0 million	+$248.2 million
Jobs	+700 jobs	+1,800 jobs
State and Local Tax Revenues	+$8.3 million	+$19.1 million

Source(s): Authors' IMPLAN analysis using data from the 2017 *Economic Census* by the U.S. Census Bureau, *American Community Survey* data (one-year estimates) by the U.S. Census Bureau from 2015 through 2019, and May 2021 employment estimates from the *Occupational Employment and Wage Statistics* from the Bureau of Labor Statistics (IMPLAN, 2022; Census, 2022; Ruggles et al., 2022; BLS, 2022b).

The positive effects of Montana's prevailing wage law may be understated. The demand-side impacts of prevailing wage laws have been well-documented in economic research (e.g., Manzo and Duncan, 2018a; Duncan and Lantsberg, 2016; Philips, 2014). Prevailing wage laws boost earnings for blue-collar construction workers and have ripple effects across the economy and those workers spend their additional discretionary income at local businesses. However, Montana's prevailing wage law is unique in that it includes a local hire provision, requiring at least 50 percent of all workers employed on public works projects be residents of Montana. Consequently, Montana's prevailing wage law may deliver even larger economic impacts on a per-worker basis than estimated in Figure 16.

Impact of Coverage Thresholds on the Market Share of In-State Contractors

Many prevailing wage standards have minimum project value thresholds that determine when workers are paid prevailing wage rates. Publicly-funded projects with values less than the threshold are exempt from the law. Projects with values greater than the threshold are covered by the wage policy. These contract coverage thresholds vary by state (WHD, 2022). Illinois, Massachusetts, Nebraska, New York, Texas, and Washington do not have minimum thresholds, with all state projects covered by prevailing wage standards. On the other hand, Maryland and Delaware have $500,000 thresholds. The contract coverage threshold value for Montana is $25,000.

Manzo and Bruno (2016) examine the effect of changes in minimum project value thresholds and find that increases in prevailing wage thresholds are associated with reductions in the value of all construction work completed by in-state contractors. Over the five-year period from 2007 to 2012, three states raised their prevailing wage coverage thresholds. Indiana increased the threshold by $100,000 and the in-state contractor share fell 2.7 percent. Oregon's threshold increased by $25,000 with the market share of in-state contractors decreasing by 1.6 percent. Ohio had a $10,405 threshold increase and the in-state contractor share fell 0.5 percent.

By weakening prevailing wage laws, higher contract coverage thresholds also lead to higher risk of payroll fraud in the construction industry. As previously mentioned, Hinkel (2022) finds that higher thresholds are linked with significant increases in worker misclassification and off-the-books employment because fewer state and local projects are covered, leaving more workers vulnerable to exploitative practices because contractors no longer submit certified payroll records. In Montana, a higher threshold would also mean that fewer projects would require that at least 50 percent of the workers be from Montana. A higher coverage threshold would likely increase the use of out-of-state contractors, exacerbate underground labor practices, and make public bodies in Montana more vulnerable to payroll tax fraud.

Conclusion

Montana's prevailing wage law keeps construction costs stable. The preponderance of peer-reviewed studies finds that prevailing wage laws have no effect on the cost of traditional public works projects (90 percent) and on their number of bidders (100 percent). Additionally, the law levels the playing field for local contractors and ensures that Montana residents are building the state's roads, bridges, schools, parks, and other vital public infrastructure.

Montana's prevailing wage law promotes a skilled, safe construction workforce. The law increases contributions into registered apprenticeship programs in Montana and incentivizes contractors to use registered apprentices. This explains why Montana has significantly more construction apprentices than Idaho, North Dakota, and South Dakota. Construction apprentices in Montana also have a 21 percentage-point higher completion rate than their counterparts in these three neighboring states. As a result, construction worksites are much safer in Montana, suffering 33 percent fewer health and safety violations than those in the three neighboring states without prevailing wage laws.

Montana's prevailing wage law produces positive impacts on the state's economy. By upholding local construction standards, prevailing wage supports work for local contractors, increases construction worker incomes by 8 percent, and expands employer-provided health insurance coverage by 8 percent. In total, prevailing wage increases employment in Montana by 1,800 jobs and boosts the economy by $248 million while generating $19 million in state and local tax revenues every year.

Voters and elected officials in Montana may want to ensure that the state's prevailing wage laws is not repealed or weakened. If the law is repealed, blue-collar construction worker earnings would be expected to decrease by $82 million and approximately 2,100 construction workers would be expected to lose their employer-provided health insurance coverage. Additionally, weakening the law by increasing the contract coverage threshold would have similar impacts, reducing the market share of in-state contractors and exacerbating the problem of payroll fraud through worker misclassification and under-the-table employment arrangements.

Ultimately, prevailing wage is a great value for Montana taxpayers. By leveling the playing field for local contractors and reflecting local market standards of compensation and craftmanship, prevailing wage strengthens the economy. By boosting investment in apprenticeship programs, prevailing wage improves productivity and worksite safety. Finally, by stabilizing construction costs and using skilled construction workers, prevailing wage delivers public construction projects that are built right, on time, and on budget.

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Appendix

TABLE A: IMPACT OF PREVAILING WAGE LAW ON INFLATION-ADJUSTED ANNUAL INCOMES AND HEALTH INSURANCE COVERAGE FOR BLUE-COLLAR CONSTRUCTION WORKERS, 2014-2019

OLS and Probit Regressions of All Private Sector (Nonfarm) Workers	Natural Log: Real Annual Income		Probit: Private Health Insurance Coverage		Probit: Employer-Provided Coverage	
	Effect†	Error‡	Effect†	Error‡	Effect†	Error‡
Prevailing Wage x Construction Occs	**+0.081****	**(0.027)**	**+0.049****	**(0.021)**	**+0.083*****	**(0.041)**
Prevailing Wage (Montana)	+0.006	(0.007)	-0.048***	(0.005)	-0.053***	(0.006)
Construction Occupations (Blue-Collar)	-0.072***	(0.017)	-0.073***	(0.013)	-0.071***	(0.016)
Industry: Construction	+0.126***	(0.013)	-0.011	(0.011)	-0.041***	(0.012)
Work: Usual Hours Worked Per Week	+0.036**	(0.000)	+0.003***	(0.000)	+0.005***	(0.000)
Demographics: Age	+0.062***	(0.001)	-0.007***	(0.001)	+0.004***	(0.001)
Demographics: Age^2	-0.001***	(0.000)	+0.001***	(0.000)	-0.000***	(0.000)
Racial or Ethnic Background: White	+0.113***	(0.008)	+0.122***	(0.007)	+0.114***	(0.009)
Gender Identification: Female	-0.212***	(0.006)	+0.005	(0.005)	+0.008	(0.006)
Demographics: Foreign-Born	-0.029**	(0.012)	-0.009	(0.011)	-0.014	(0.013)
Demographics: Military Veteran	-0.004	(0.012)	-0.024**	(0.009)	-0.066***	(0.010)
Education: High School Degree or Less	-0.421***	(0.007)	-0.138***	(0.006)	-0.100***	(0.007)
Education: Associate's Degree	-0.267***	(0.010)	-0.072***	(0.009)	-0.047***	(0.010)
Demographics: Married	+0.174***	(0.006)	+0.117***	(0.005)	+0.128***	(0.006)
Year: 2016	+0.025***	(0.009)	Yes	Yes	Yes	Yes
Year: 2017	+0.040***	(0.008)	Yes	Yes	Yes	Yes
Year: 2018	+0.036***	(0.008)	Yes	Yes	Yes	Yes
Year: 2019	+0.069***	(0.008)	Yes	Yes	Yes	Yes
Dummies: Weeks Worked Per Year	Yes	Yes	Yes	Yes	Yes	Yes
Constant Term	5.824***	(0.027)	0.811***	(0.002)	0.695**	(0.002)
Total Observations	55,916		55,916		55,916	
Weighted to Match Population	Yes		Yes		Yes	
R^2	0.671		0.106		0.087	

Source(s): Authors' analysis of *American Community Survey* data (one-year estimates) by the U.S. Census Bureau from 2015 through 2019 (Ruggles et al., 2022). Three asterisks (***) indicate significance at the 99-percent confidence level. Two asterisks (**) indicate significance at the 95-percent confidence level. One asterisk (*) indicates significance at the 90-percent confidence level. †"Effect" indicates the coefficient, which is average marginal effects for probit regressions. ‡"Error" is the standard error.

TABLE B: IMPACT OF PREVAILING WAGE LAW ON USUAL HOURS WORKED PER WEEK, 2014-2019

Probit Regressions of Private Sector (Nonfarm) Workers	Usual Hours Worked for All Workers (#)		Usual Hours Worked for People of Color (#)	
	Effect†	Error‡	Effect†	Error‡
Prevailing Wage x Construction Occs	**-0.241**	**(0.464)**	**+1.600**	**(1.538)**
Prevailing Wage (Montana)	-0.840***	(0.112)	-1.298***	(0.384)
Construction Occupations (Blue-Collar)	-0.364	(0.286)	-0.725	(0.836)
Industry: Construction	+2.601***	(0.224)	+3.309***	(0.749)
Demographics: Age	+1.262***	(0.019)	+1.166***	(0.640)
Demographics: Age^2	-0.014***	(0.000)	-0.013***	(0.001)
Racial or Ethnic Background: White	-0.031	(0.144)		
Gender Identification: Female	-5.724***	(0.095)	-5.354***	(0.285)
Demographics: Foreign-Born	+0.767***	(0.207)	+1.360***	(0.311)
Demographics: Military Veteran	+0.321	(0.198)	+0.256	(0.715)
Education: High School Degree or Less	-0.689***	(0.114)	-0.802**	(0.404)
Education: Associate's Degree	-0.153	(0.163)	-0.486	(0.627)
Demographics: Married	+0.573***	(0.101)	+0.273	(0.309)
Year: 2016	-0.163	(0.145)	-0.684	(0.449)
Year: 2017	-0.346**	(0.145)	-0.779	(0.436)
Year: 2018	-0.123	(0.144)	-0.509	(0.429)
Year: 2019	-0.193	(0.144)	-0.573	(0.435)
Dummies: Weeks Worked Per Year	Yes	Yes	Yes	Yes
Constant Term	8.745***	(0.458)	11.726***	(1.350)
Total Observations	55,916		6,179	
Weighted to Match Population	Yes		Yes	
R^2	0.247		0.223	

Source(s): Authors' analysis of *American Community Survey* data (one-year estimates) by the U.S. Census Bureau from 2015 through 2019 (Ruggles et al., 2022). Three asterisks (***) indicate significance at the 99-percent confidence level. Two asterisks (**) indicate significance at the 95-percent confidence level. One asterisk (*) indicates significance at the 90-percent confidence level. †"Effect" indicates the coefficient. ‡"Error" is the standard error.

TABLE C: IMPACT OF PREVAILING WAGE LAW ON WORKING IN PRIVATE CONSTRUCTION JOBS, 2014-2019

Probit Regressions of All (Nonfarm) Workers	Probit: Private Construction Occupations for All Workers		Probit: Private Construction Occupations for People of Color	
	Effect†	Error‡	Effect†	Error‡
Prevailing Wage (Montana)	**-0.000**	**(0.002)**	**-0.013***	**(0.008)**
Demographics: Age	+0.002***	(0.000)	+0.004***	(0.001)
Demographics: Age^2	-0.000***	(0.000)	-0.000***	(0.000)
Racial or Ethnic Background: White	-0.001	(0.003)		
Gender Identification: Female	-0.093***	(0.004)	-0.117***	(0.012)
Demographics: Foreign-Born	+0.007*	(0.004)	+0.009	(0.007)
Demographics: Military Veteran	-0.010***	(0.003)	-0.017	(0.013)
Education: High School Degree or Less	_+0.050***	(0.003)	_+0.064***	(0.011)
Education: Associate's Degree	+0.043***	(0.004)	+0.042***	(0.015)
Demographics: Married	-0.009***	(0.002)	-0.010	(0.007)
Year: 2016	Yes	Yes	Yes	Yes
Year: 2017	Yes	Yes	Yes	Yes
Year: 2018	Yes	Yes	Yes	Yes
Year: 2019	Yes	Yes	Yes	Yes
Constant Term	0.036***	(0.001)	0.047***	(0.003)
Total Observations	93,873		10,452	
Weighted to Match Population	Yes		Yes	
R^2	0.173		0.169	

Source(s): Authors' analysis of *American Community Survey* data (one-year estimates) by the U.S. Census Bureau from 2015 through 2019 (Ruggles et al., 2022). Three asterisks (***) indicate significance at the 99-percent confidence level. Two asterisks (**) indicate significance at the 95-percent confidence level. One asterisk (*) indicates significance at the 90-percent confidence level. †"Effect" indicates the coefficient, which is average marginal effects for probit regressions. ‡"Error" is the standard error.

LIUNA'S RESPONSE TO STAFF'S FIRST SET OF DATA REQUESTS

Attachment Staff 1-3(b)

Project Evaluation System (PES®)

Quantifying the Value of Union Labor in Construction Projects

Prepared for Mechanical Industry Advancement Fund (MIAF)[1]

Independent Project Analysis (IPA)

December 2022

Revised FINAL

[1] Mechanical Industry Advancement Fund, a national joint labor management cooperative committee established and operated by trustees appointed by the United Association of Plumbers and Pipefitters and Mechanical Contractors Association of America.

Prepared by Michael McFadden, Sai Santosh, and Ronit Shetty

Edited by Loren Farrar

Reviewed Aditya Munshi

Project Account ID: MCAY201RES

This IPA report analyzes the performance of union labor versus non-union labor and subcontracted versus direct hire labor on cost and schedule performance using IPA's extensive database of capital projects.

This study references an earlier study, "The Looming Labor Shortage," that Edward Merrow presented for a panel discussion at the UA/MCAA Labor Relations Conference on October 30, 2008.

The December 2022 Revised Final now includes performance comparisons between Union, Open Shop, and mixed labor projects; the earlier version showed performance comparisons between only Union and Open Shop projects. We have also changed how we display labor productivity in the graphs to make it easier to interpret.

For questions, please contact:
Michael McFadden

mmcfadden@ipaglobal.com
(703) 729 8300

Independent Project Analysis, Inc.
44426 Atwater Drive
Ashburn, VA 20147
USA

Table of Contents

About IPA

Since its founding in 1987, IPA has rapidly evolved into the preeminent consultancy in project evaluation and in project system benchmarking and has become the industry leader in quantitative analysis of project management system effectiveness worldwide. IPA improves the competitiveness of our customers by identifying the practices that generate effective use of capital in their businesses. It is our mission and unique competence to conduct research into the functioning of capital projects and project systems. We then apply the results of that research to help our customers create and use capital assets more efficiently. Our clients depend on our research results and quantitative measurements to enhance the value generated from their capital projects.

Our approach to increasing the success rate of a capital project is both simple and effective: IPA has developed detailed, carefully normalized databases that contain data about the entire project life cycle from the business idea through to early operation. We have used these data to develop powerful statistical tools that enable us to compare project performance in numerous areas.

IPA works on behalf of project owners and views project success from the vantage point of owners rather than contractors. IPA alone is responsible for the data review, analysis, and findings contained in the report.

Executive Summary

This study expands on an earlier study[2] that found that union labor is more productive than open shop labor and projects that employed union labor cost less, despite the higher average all-in wage rate paid to union labor. Other studies have similarly found that higher craft labor costs for prevailing wage projects, which often reflect union wage rates, do not result in higher total project costs than non-prevailing wage projects.[3] The current study confirmed the findings from the earlier IPA study and examined some of the underlying differences in union labor versus open shop labor that may explain the differences in productivity as well as the overall effect on project outcomes. The study found:

- Productivity for union labor is 14 percent higher versus open shop labor
- Projects that use a mix[4] of union and open shop labor have 8 percent better productivity than projects that use all open shop labor
- The use of union labor reduces the total cost of projects by an average of 4 percent versus when open shop labor is used
- The union craft labor and foremen have demonstrated a significantly higher level of skills versus open shop labor
- Strong relationships exist between higher craft skills and lower project total costs as well as better construction schedule predictability
- Projects are 40 percent less likely to experience a shortage of skilled labor when union labor is sourced versus open shop labor
- Projects that are short on skilled labor are twice as likely to have a 10 percent or higher cost overrun and are more likely to have schedule slip of 25 percent or higher
- Turnover of labor on projects is one-third less likely when union labor is employed versus open shop labor
- Turnover of labor is linked to worse project cost and schedule outcomes
- Projects using a mix of union and open shop labor saw benefits from the presence of union labor in each of the measures of performance versus projects that employ solely open shop labor

The overall findings indicate that the combination of better skills, more reliable sourcing of sufficient skilled labor, and better labor stability (e.g., less labor turnover) all contribute to better productivity and better project outcomes.

[2] Edward W. Merrow, *The Looming Labor Shortage*, presented at the UA/MCAA Labor Relations Conference, October 30, 2008.
[3] Gerard M. Waites, Esq., Prevailing Wage Laws: Research Report – Comprehensive Review of Public Policy Benefits, 2022, O'Donoghue & O'Donoghue LLP 5301 Wisconsin Ave N.W., Suite 800 Washington, DC 20015.
[4] Projects that are referenced as using mixed labor are projects involving both open shop as well as union labor. The details of the make-up of the two labor sources are unknown, apart from the fact that both union and open shop labor were used.

Background & Objectives

The MIAF is interested in promoting the value of union labor to the American industry. Since the initial 2008 IPA study on the productivity advantages of union sector labor on capital projects relative to open shop or mixed projects and the allied advantages of subcontracted union work relative to direct hire performance, the MCAA and UA have been tracking productivity and related workforce development and performance issues in a variety of ways related to the prevailing wage policy, project labor agreements, and overall private and public sector construction project policy forums that help build, maintain, and foster the high skill construction workforce training and performance.

In June 2022, the MCAA and UA decided to commission another more detailed study from IPA that is reflected in this report. The current study confirmed and expanded on the findings from the previous study and showed that although the hourly all-in labor rates[5] are higher for union labor, this is more than offset by the value gained from the better productivity; in other words, the cost of labor cannot be viewed simply through the lens of the hourly all-in rates charged for the work as labor productivity plays a significant role not only on labor costs, but also on the overall project cost and potentially other outcomes that capital project owner's value.

Labor productivity is a function of many things. The skill of the labor is a key driver of overall productivity, but multiple factors influence labor productivity, such as management practices, weather, project size and project complexity, and others. The study Edward Merrow presented to the MCAA[6] in 2008 focused on the drivers of labor productivity, which included the source of labor. Merrow's study showed how labor productivity is highly variable from project to project driven by practices such as Front-End-Loading (FEL), which is a measure of the completeness of planning done prior to project execution; execution discipline (e.g., not deviating from the original plan); construction labor work schedules (e.g., use of long work weeks or excessive overtime, etc.); and the source of labor (e.g., union versus open shop and subcontracted versus direct hire labor). After controlling for project scope (e.g., office building versus chemical plant, etc.), project size, and project type (e.g., brownfield [work at an existing site] or greenfield [work at a brand new site], etc.), the project-to-project labor productivity variability is very large, as shown in Figure 1 below. The key findings from the 2008 study are that the labor productivity is strongly driven by the practices both the owner and contractor employed in managing the project. Another finding is that the source of labor is strongly linked to lower project costs.

The current study will focus on further understanding how the source of labor—in this case, union versus mixed and open shop labor and subcontracted versus direct hire—drives productivity and how that links more broadly to project performance.

[5] The all-in wage rate is the base rate *(total earnings before payroll deductions)*, plus indirect labor, indirect material, and other indirects (including small tools and miscellaneous consumables allowance, bonds insurance, and contractor fees) *plus* overtime premiums, incentives, and travel allowances.

[6] Edward W. Merrow, *The Looming Labor Shortage*, presented at the UA/MCAA Labor Relations Conference, October 30, 2008.

Distribution of Labor Productivity on Process Projects in the US

Wide Range in Productivity From Multiple Factors (e.g., Quality of Planning, Quality of Project Management, Workforce Skill, etc.)

Figure 1

The current study focuses on how the source of labor is linked to project performance through better productivity and what drives the better productivity of union labor. Below in Figure 2 is an illustration of the framework that the study follows. We will focus on the topic of labor source and refer the reader to the earlier study in which the other drivers of productivity were analyzed.

Drivers of Labor Productivity

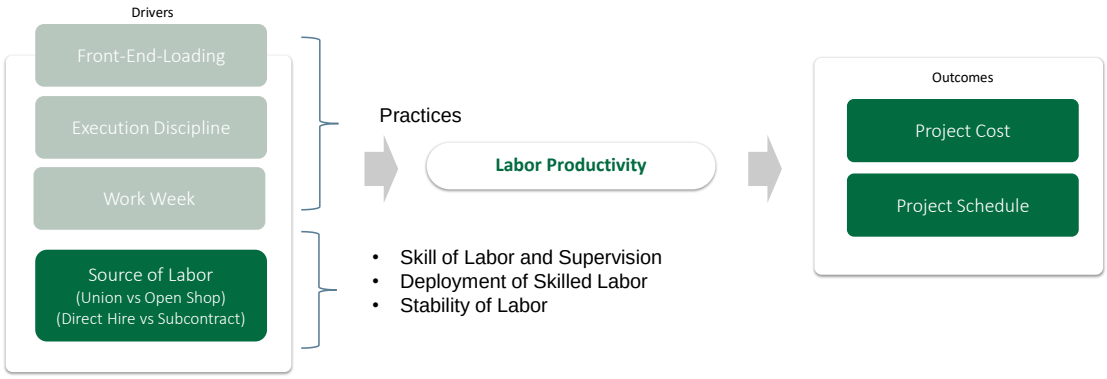


Figure 2

To determine the inherent productivity associated with the skill of the labor, it is important to be able to account for and remove these other factors. IPA has collected detailed information on thousands of capital projects, allowing us to analyze the differences in performance of union versus open shop labor on capital projects by isolating and removing the other influences of labor productivity to identify the effect of labor productivity, labor costs, and overall project performance. In this study, we seek to answer a set of questions that hopefully will shed additional light on the value of union labor to the project owner. These include the following:

- How do labor productivity and all-in wage rates compare between union and non-union labor?
- What are the benefits of using union labor on a project?
- What are the benefits of using subcontracted versus direct hire labor?
- What may explain the higher productivity performance differences?
  - Higher level of skill for both craft and foremen?
  - Lower turnover of craft during project construction?
  - More reliable deployment of sufficient labor to the projects?
  - Higher productivity leading to the need for less craft?

Study Database & Methodology

Each chapter will have a chapter-specific description of the database and methodology; however, this section describes the overall study database and methodology that will be referenced throughout.

Study Database

Since its founding in 1987, IPA has rapidly evolved into the preeminent consultancy in project evaluation and in project system benchmarking and has become the industry leader in quantitative analysis of project management system effectiveness worldwide. IPA improves the competitiveness of our customers by identifying the practices that generate effective use of capital in their businesses. It is our mission and unique competence to conduct research into the functioning of capital projects and project systems. We then apply the results of that research to help our customers create and use capital assets more efficiently. Our clients depend on our research results and quantitative measurements to enhance the value generated from their capital projects.

Our approach to increasing the success rate of a capital project is both simple and effective: IPA has developed detailed, carefully normalized databases that contain data about the entire project life cycle from the business idea through to early operation. We have used these data to develop powerful statistical tools that enable us to compare project performance in numerous areas.

IPA's capital projects database includes over 20,000 projects with more than 21 million data points regarding project drivers and project outcomes. The database includes projects executed in over 100 countries by more than 550 companies. The quality of the data is ensured by face-to-face data collections and extensive reviews of project histories. IPA's capital projects database is ever expanding as we evaluate approximately 600 projects every year. The database is supplemented with client documentation, including native cost and schedule documents, risk registers, change logs, bases of design, P&IDs, block flow diagrams, and other critical project documentation.

From this larger database of projects, we have selected a dataset of 1,550 projects that were executed in the United States over the past 20 years, which are described in the table below. These projects primarily come from the process industries, but include a good number of conventional building projects, such as offices, labs, and warehouses. From this dataset, we have coded the projects as having been executed using either union labor, non-union labor, or a mix of both. The project sizes range from $200,000 to more than $6 billion. About half of the projects employed open shop labor, one-quarter employed union labor, and one-quarter employed a mix of union and open shop labor. The projects included greenfield construction (e.g., construction at a new site, add-on, or expansion projects [new construction, but at an existing site], and revamp projects [e.g., construction projects that update existing facilities]). The projects also come from many different industrial sectors.

The dataset project characteristics are shown in Table 1 below.

Database Description

Recent Industrial Projects in the Unites States

Characteristic	United States (n = 1,550) Mean and Range
Project Size ([2002]US$ millions)	89 (median) 0.2 > 6,000
Authorization Year	2007 (2000 – 2022)
Labor Force Make up for Project	51 percent Open Shop 25 percent Union 24 percent Mixed
Project Type	21 percent Greenfield/Colocated 37 percent Add on/Expansion 39 percent Revamp 3 percent Other
Industrial Sector	29 percent Oil Refining 38 percent Chemicals 8 percent Pharmaceuticals 8 percent Consumer Products 9 percent Distribution 5 percent Mining, Metals, and Minerals 3 percent Pulp and Paper/Other

Table 1

Analysis—Source of Labor and Project Performance

In the following section, we examine the different hypotheses tested with the goal of gaining a better explanation of what is driving the project performance differences between union and open shop labor.

Methodology—Assessing Labor Productivity

Labor productivity is usually defined as a measure of the hours required to complete a certain measure of scope. For craft labor, we often look at hours per unit of installed material (e.g., feet of pipe, tons of steel, cubic yards of concrete). The analysis that follows employs two distinct approaches to measure productivity. The first is to produce labor productivity for the entire project that represents the work done collectively by all trades (e.g., civil, electrical piping, steel, etc.). The second is to look at the craft-level productivity by using a single craft (in this case, pipe fitting craft labor as the base case, given the significance of this craft on industrial projects), but the same was done with the other labor crafts (e.g., mechanical, civil and electrical, and instrumentation).

Labor Productivity at the Overall Project Level

To measure labor productivity at the overall project level, IPA employs a method we call twinning in which we compare projects that are similar to each other (e.g., office building to office building, chemical plants to chemical plants) and adjust for other differences like project size as well as normalize for wage differences from location to location and over time, as described earlier in the General Methodology Description section. We can then compare construction costs for like-to-like projects to create a productivity index for each project (e.g., actual productivity/benchmark productivity). A higher index means higher productivity (e.g., fewer labor hours per installed material). The productivity index can then be used to quantify the relationships between practices, unusual events (such as severe weather, labor source, etc.), and their effect on the relative productivity. The value of this approach is that it provides a measure of the relative labor productivity for the composite of all labor on a project. It also provides a way to determine the labor productivity when individual material quantities are not available (e.g., details on the pipe or steel are not provided).

Labor Productivity at the Craft Level

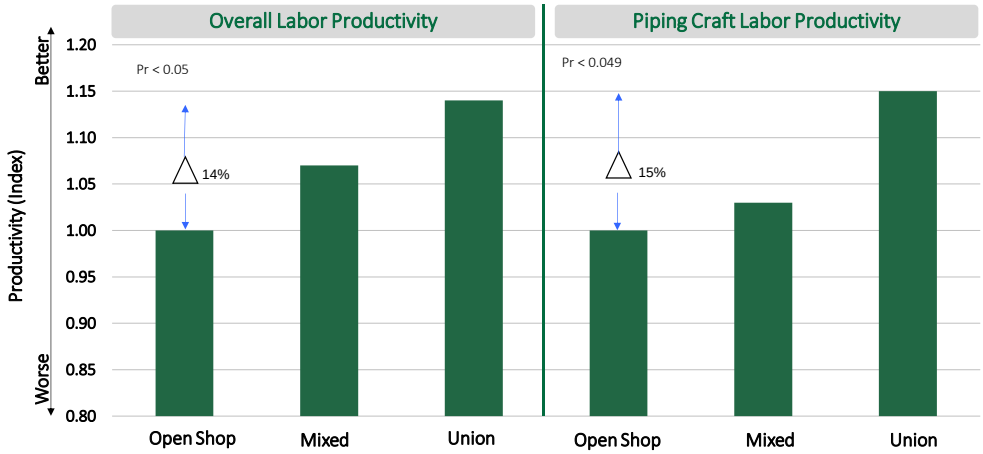
The second methodology involves the more traditional hours per unit quantity installed. We can do this for each of the major crafts (e.g., installation of pipe, steel, concrete, and electrical). For the current study, we focused on pipe fitting craft productivity, which is component of the mechanical trade. IPA has developed a methodology to normalize for feet and size of pipe as well as for other site factors that can influence a pipe installation. For every project for which IPA has collected both hours as well as quantities and characteristics of the pipe installed, we can produce a relative productivity index for the piping craft for each project. A higher index means better labor productivity (i.e., fewer labor hours required per installed quantity of pipe).

Overview Source of Labor and Project Value

The previous study linked source of labor to productivity and project costs; the current study updates and expands on that analysis to explain how the labor source is linked to other project outcomes and why. In Figure 3 below, we compare productivity for union versus mixed and open shop labor using the two methods described above. Based on the overall labor productivity method, union labor was found to be 14 percent more productive than open shop labor and 7 percent more productive than a mixed labor force. Looking specifically at the installation of pipe (part of the mechanical trade), union craft labor was found to be 15 percent more productive than open shop labor and 12 percent more productive than a mixed labor force. In other words, both methods had similar results. We looked at labor wage rates and found union labor to be 9.7 percent higher than open shop labor, on average. All of these

relationships were found to be statistically significant.[7] We also looked at the differences between subcontract and direct hire labor, but no statistically significant differences between these groups were found.

Union Labor vs. Mixed and Open Shop Labor Productivity



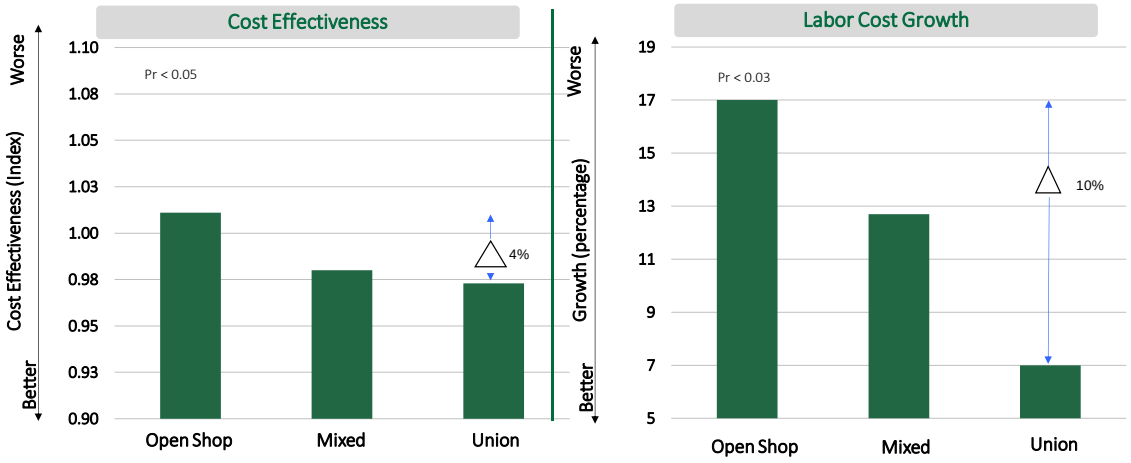
* Statistical significance shown is open shop vs. union

Figure 3

We also looked at cost and schedule performance by comparing projects that employed union labor versus projects that employed open shop labor. As shown in Figure 4 below, projects employing union labor have 4 percent lower costs (better overall cost effectiveness) and 10 percent lower labor cost growth. Although a 4 percent lower overall cost seems modest, there is very little opportunity to reduce the materials costs that make up roughly half of the costs for a typical project in the United States. Therefore, savings from higher labor productivity represent one of the primary ways that owners can reduce costs. Projects employing a mixed labor force have both cost effectiveness and cost growth performance in between open shop and union labor. In addition, we found that projects employing union labor average 8 percent less construction schedule slip than open shop.

[7] We use a measure of statistical significance that is shown as a p value in which a p value of <0.05 indicates that the findings have a less than 5 percent chance of being random; in other words, there is a 95 percent chance that the effect being tested can be considered real.

Union Labor vs. Mixed and Open Shop Project Cost Performance



* Statistical significance shown is open shop versus Union

Figure 4

Given that labor is typically 25 to 35 percent of the total project cost and the wage rate difference, combined with the better productivity, cannot account for the 4 percent overall project cost savings, we did a deeper dive to determine the source of these cost savings. The costs of materials (e.g., equipment steel, concrete, pipe, wire, etc.) are generally competitively sourced. Therefore, significant differences in the materials costs are generally not big contributors to the lower project costs. Cost savings on projects generally come from some efficiency gains in the field coming from some combination of lower labor, construction supervision, and construction indirect costs and/or efficiency gains in office costs coming from lower project management, engineering/design, and project definition costs. Looking at both field and office costs and controlling for project scope, size, and ratio of equipment and bulks (steel, pipe, concrete and electrical), as shown in Table 2 below, we found that union projects have both lower field and office costs versus the materials installed, on average, than projects that use either mixed or open shop labor. The savings come from labor as well as other construction costs (e.g., construction supervision and construction indirect costs) and lower project management costs that contribute to the lower office costs.

Project Cost Ratio Analysis

Cost Ratio	Open Shop	Mixed	Union	Statistical Significance** P > |t|
Field to Materials Cost	0.70	0.65	0.64	0.007
Office to Materials Cost	0.36	0.32	0.27	0.005

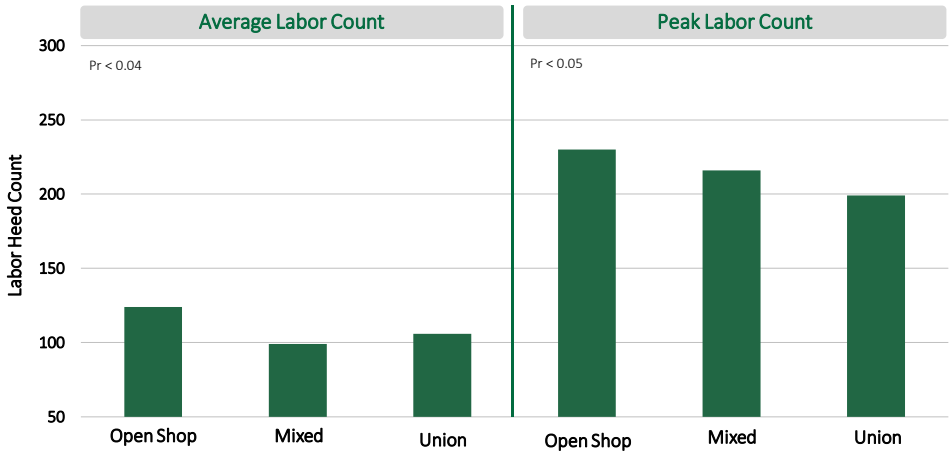
* Controlled for project size ($100 million), ratio of bulks to equipment, and project complexity

** Statistical significance shown is open shop vs. union

Table 2

To support this finding, it was found that projects that employ union labor require nearly 10 percent fewer craft workers, on average, and have a nearly 10 percent lower peak number of craft workers, on average, than projects employing open shop labor, as shown in Figure 5 below. This finding suggests that the higher productivity from union labor translates into both fewer hours overall as well as fewer individuals being required to accomplish the same work. A reduction in the peak number of craft workers is also desirable by reducing the density of workers during periods of highest construction activity. Projects with mixed labor are similar to projects employing union labor with regard to the average number of craft workers required and higher than projects employing union labor with regard to peak number of craft workers required.

Average and Peak Labor Required



* Based on a $100 million project

** Statistical significance shown is open shop vs. union

Figure 5

We also looked at the cost performance of projects by comparing those that used direct hire labor versus those that subcontracted their labor. As Figure 6 below shows, projects that use subcontracted labor have 3 percent lower

costs than the projects that use direct hire labor. However, we did not find differences in productivity or head counts between direct hire and subcontracted labor projects. We suspect the better cost effectiveness is a result of the subcontracted labor often being made up of cohorts of workers who have worked on multiple projects together, resulting in some efficiencies that our other measures could not identify.

Subcontracted vs. Direct Hire Labor and Cost Effectiveness

Figure 6

Methodology—Assessing Labor and First Line Supervisory Skills

Skill assessments for construction craft can be done using measures such as frequency of errors or defects and other means that quantify the quality of their work. As an alternative to these types of measures, IPA assess craft labor and foremen skills by asking the project owners to rate the skill level for four of the major trades (piping, mechanical, electrical, and civil) for both craft labor as well as the foremen that worked on their project. We ask them to rate the skills for each trade on a scale of 1 to 5, with 1 being unskilled, 2 being below average skill, 3 being average skill, 4 being above average skill, and 5 being highly skilled. Although this is based on judgement, it comes from owner construction and project management leads who are generally very familiar with the construction trades. IPA has gathered this information on thousands of projects and found that the rating of skills by the owners is correlated with several expected performance measures. In the following section, we show the relationships between craft and first line supervisory skills and project outcomes.

Labor Source and Skills

Overview Source of Labor and Skill

There is a strong correlation between skill and productivity. It has been reported by others that the union sector has historically funded and promoted craft training through its join labor/management apprenticeship program. In contrast, open shop labor has lacked standardized training.[8] The difference in productivity between union and open shop crafts suggests that some of that performance difference arises from better skills. Figure 7 below shows how

[8] Allison L. Huang, Robert E. Chapman, and David T. Butry, Metrics and Tools for Measuring Construction Productivity: Technical and Empirical Considerations, U.S. Department of Commerce, National Institute of Standards and Technology, Office of Applied Economics, NIST Special Publication 1101 (2009) ("Typically, training programs are funded by both owners and contractors through union and collective bargaining agreements. While open shop training programs exist, they tend to be rare."), p. 23 see citing Construction Industry Institute, Construction Industry Craft Training in the United States and Canada. RS 231-1 (Austin, TX: Construction Industry Institute, 2007).

frequently owners rated the skills of craft and foremen *(those who supervise the craft workers)* for the mechanical trades installing pipe using a scale of 1 to 5 (low to high), as described earlier. The installation of pipe on many industrial projects is the dominant craft in terms of labor hours and therefore is an important indicator of project success. When we compare the skill ratings for the craft employed on union, mixed, and open shop projects, union workers were much more likely to be rated as above average or highly skilled versus open shop and mixed workers. In other words, 75 percent of the project owners rated the craft installing piping as above average or highly skilled for union workers compared to only 63 percent of the open shop workers being rated as above average or highly skilled. Union labor was also less likely to be rated as only average or unskilled. Similar results are found for the foremen and this same pattern is also seen across the other craft disciplines (e.g., iron workers, electrical and instrumentation, and civil).

Perception of Skills for Pipe Fitter Craft and Journeymen

Union Labor More Likely to Be Rated Above Average or Highly Skilled Than Open Shop or Mixed

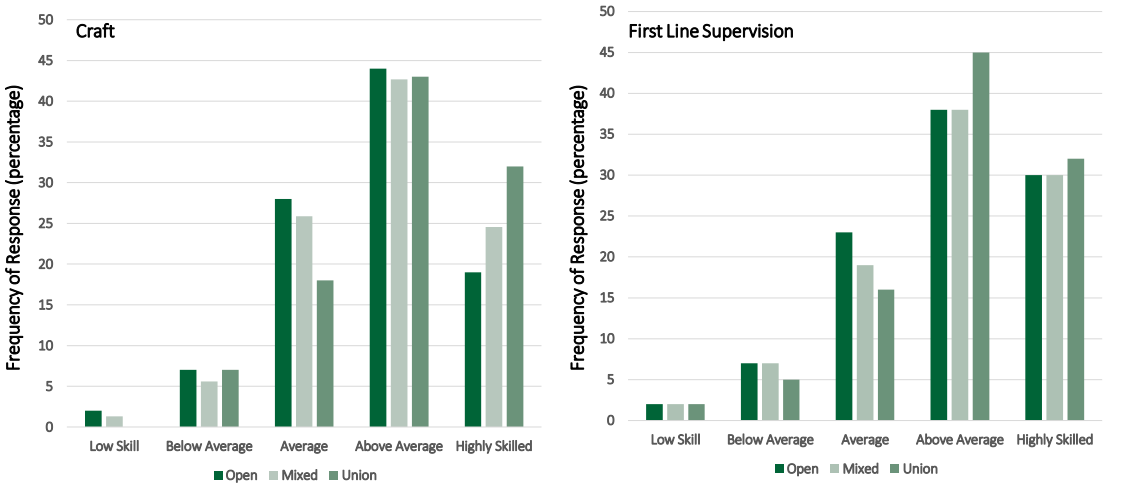


Figure 7

When we look at the relationship between craft and foremen skill and project performance, it was found that both craft and foremen skills drive cost competitiveness and cost growth. Union labor go through regular training and an apprenticeship program, both of which raise the skill levels for the craft and foremen. As Figures 8 and 9 below indicate, the projects that are able to attract the mechanical trades higher skilled craft labor and foremen to install pipe have better cost outcomes. We see the same effect for the other major crafts. In addition, we see that projects that have highly skilled labor for one craft are more likely to have highly skilled labor for the other crafts. The higher skill level that union labor brings to the project is why union labor is more productive and driving the relationship with better cost effectiveness.

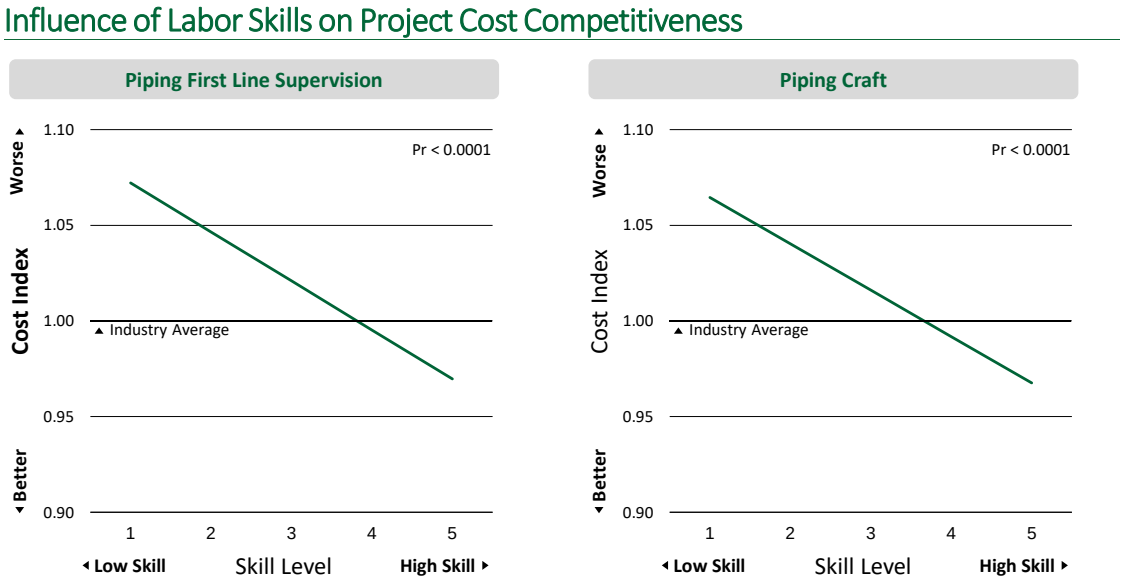


Figure 8

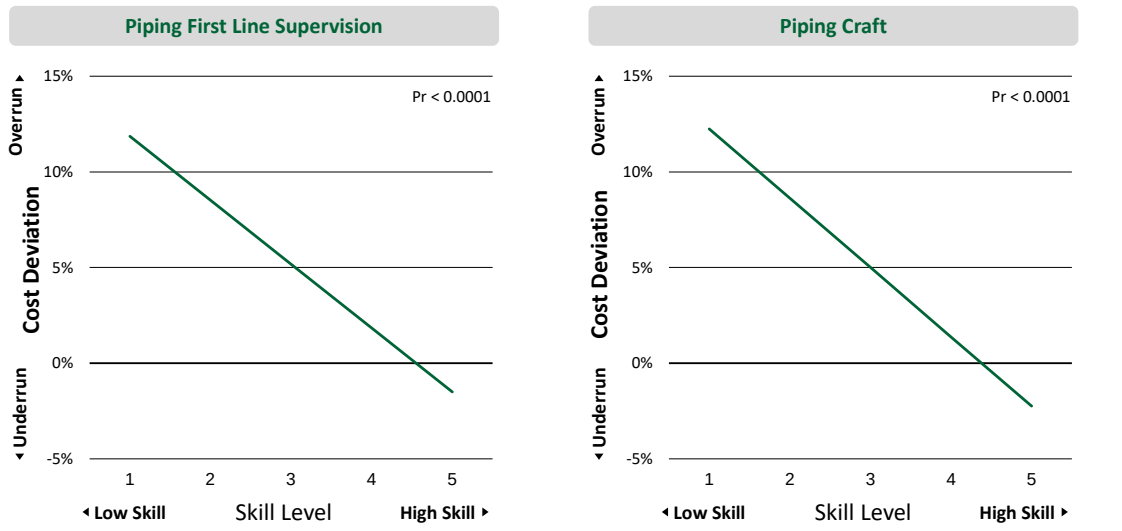


Figure 9

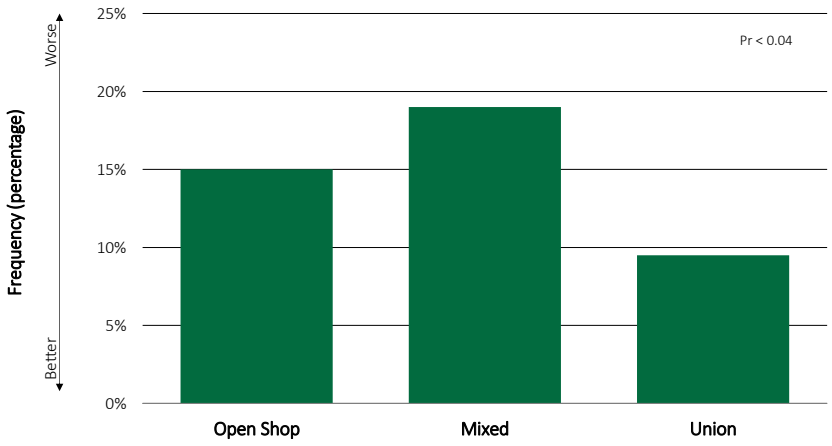
Methodology—Assessing Labor Deployment

In addition to the effects of labor skills on project outcomes, projects are sensitive to other things that force the project to deviate from the plan, which dictates the need for the number and mix of craft required for a project's execution. Any deviation from the plan often creates inefficiencies through the need for workarounds and rework and having to do work out of sequence to account for insufficient craft labor, which implies that the projects that cannot meet their labor requirements will suffer. For each project, IPA asked the owner whether sufficient skilled labor was available for the project; in other words, was there a shortage of skilled labor? We use this measure to assess whether adequate labor was deployed for each project.

Labor Source and Deployment

Over the past 20 years, about one in seven projects experienced a shortage of skilled labor, and the lack of having sufficient skilled labor has significant negative consequences on project outcomes. Other studies have asserted, that one of the greatest challenges facing the construction industry is its ability to attract and retain qualified workers. This is underscored by the fact that shortages of skilled workers continue to plague the construction industry[9]. The sourcing of labor that can meet the required number, mix, and skills of labor for the project plan is an important consideration. As figure 10 below shows, projects employing union labor are nearly 40 percent less likely to experience a shortage of skilled labor compared to the projects that employ open shop labor. Despite the value shown in the figure below for mixed labor being higher than open shop labor, there was no statistical difference between mixed and open shop projects, on average. Union contractors have access to local union referral systems and, especially on large projects, contractors can access additional support from neighboring local unions facilitating more effective deployment of labor. The findings suggest that union halls are more effective at meeting owner's requirements for sufficient skilled labor than when labor comes from open shop sources. This difference holds up in both hot as well as normal labor markets.

Frequency of a Shortage of Skilled Labor



* Statistical significance shown is open shop vs. union

Figure 10

A shortage of skilled labor creates risk for projects. Projects that experience skilled labor shortages, on average, have 10 percent higher cost growth and 6 percent greater schedule slip than projects that found enough skilled labor. They are also at greater risk of significant cost growth and schedule slip. As Figure 11 below indicates, projects that are short on skilled labor are twice as likely to have a 10 percent or higher cost overrun and are more likely to have schedule slip of 25 percent or higher.

[9] Allison L. Huang, Robert E. Chapman, and David T. Butry, Metrics and Tools for Measuring Construction Productivity: Technical and Empirical Considerations, U.S. Department of Commerce, National Institute of Standards and Technology, Office of Applied Economics, NIST Special Publication 1101 (2009)

Cost Growth and Schedule Slip From Labor Shortage

Figure 11

Methodology—Assessing Labor Turnover

For each project, IPA asks the following question to the team: what was the average monthly turnover for each craft and foremen (e.g., pipe fitting, mechanical, electrical and instrumentation, and civil)? We use this information to relate the effects of turnover on project performance.

Labor Source and Turnover

The turnover of craft and foremen can also degrade productivity as the loss of a skilled craft or supervisor leaves a gap in the workforce and bringing a new individual onto the project requires an onboarding process as well as time to become familiar with the work environment, etc. Figure 12 below shows the monthly average turnover of the mechanical trade pipe fitting craft, which compares projects that employ union, mixed, and open shop labor. On average, projects that employ union labor have monthly turnover rates that are one-third lower than open shop labor and one-quarter lower than mixed workforces for pipefitters. Similar findings were also found for the electrical, civil, and steel workers. This finding suggests that union labor is more likely to remain on the project, whereas open shop labor is more likely to leave. This finding is even more pronounced during hot labor markets during which the rate of turnover for open shop labor increases as union labor turnover remains unchanged.

Frequency of Turnover of Labor

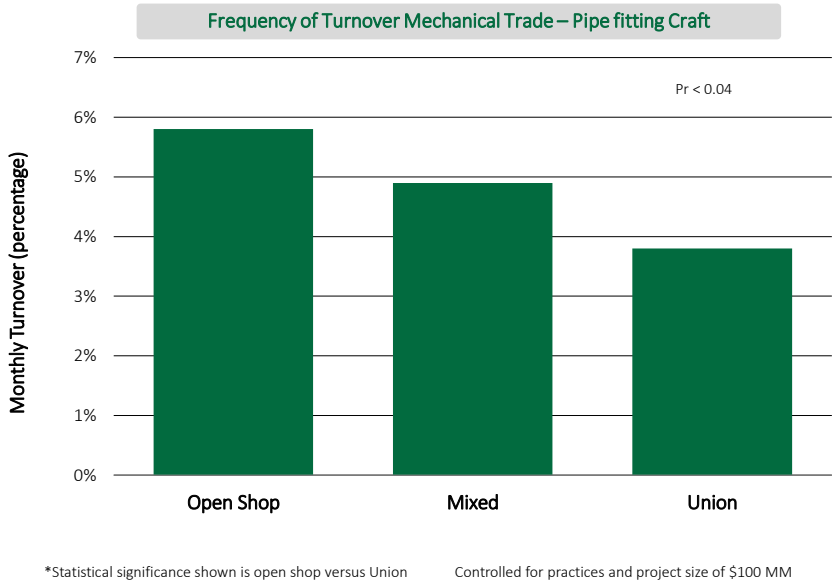


Figure 12

As with shortages of skilled labor, turnovers of skilled labor, especially unwanted turnovers, create manpower gaps that can cause projects to have to deviate from plans to work around these missing crafts until new craft and first line supervisors can be found, hired, and on boarded. The turnover of skilled labor has a negative effect on project performance. As Figure13 below indicates, the turnover of skilled craft is linked to higher cost growth as well as higher project costs.

Influence of Labor Turnover on Project Cost Performance

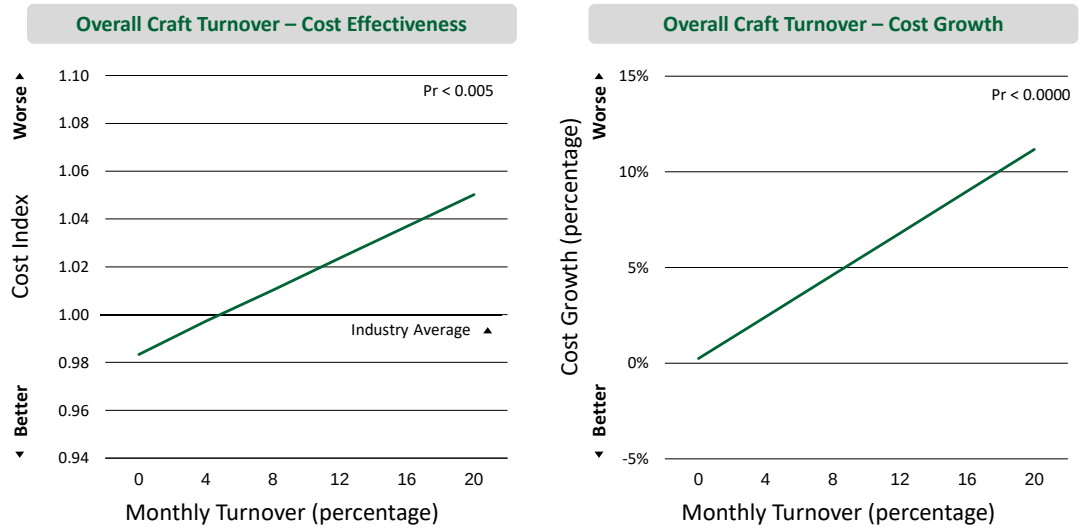


Figure 13

Conclusions

This study confirms earlier work that found that union labor delivers lower and more predictable project costs and more predictable schedules. Subcontracted labor also delivers lower overall project costs. The study confirmed union labor is significantly more productive than open shop labor and this higher productivity is linked to significant overall cost savings. Projects with mixed labor still see benefits in productivity and cost savings by having union labor on their projects as compared to open shop projects. The current study unpacked the drivers of this better productivity. As hypothesized, owner experts reported that union labor across all crafts has higher skills for both craft and foremen. One key finding is that the union labor and supervision are much more likely to be highly skilled and far less likely to be rated as average or lower skilled. The level of craft skill is directly related to overall project cost and schedule performance.

The second difference between union versus open shop and mixed labor is around the ability to reliably source the labor when needed. Projects that sourced labor from union halls are 40 percent less likely to be short on skilled labor than when projects sourced labor from open shop sources or mixed labor. Skilled labor shortages create significant challenges to projects. Our study found that skilled labor shortages are linked to worse cost and schedule performance, including increased risk of major cost growth and schedule slip. Therefore, the source of labor should be considered an important risk management practice.

Finally, we looked at the turnover of labor as another potential explanation for the higher productivity of union versus open shop labor. The study found that projects that employ union labor report significantly lower monthly turnover rates for their workers than projects employing open shop labor. Projects employing mixed labor appear to benefit from the presence of union labor with lower turnover than projects employing open shop labor. Again, labor turnover is linked to cost and schedule performance.

The combination of higher skills gained through more consistent training and better deployment of labor from union halls along with lower turnover of craft once they are on the job helps to explain the significantly higher productivity of union labor that drives lower and more predictable project costs, lower risk of major cost and schedule deviations, and a reduced labor count that may reduce the exposure hours for the project. The presence of union labor in projects employing mixed labor is evident in nearly all of the key success measures. Overall employing union labor creates significant value for owners through lower costs and more predictable schedules and acts as a risk mitigation strategy that reduces the risk of major cost and schedule deviations.

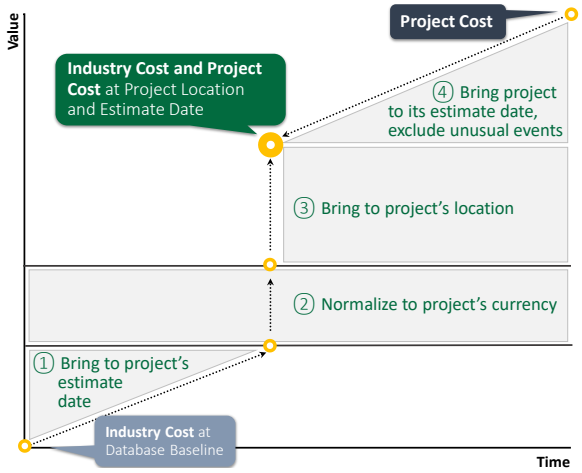
Appendix Methodology

Cost Normalization

IPA's analytic techniques include data normalization methods that allow us to make valid comparisons across different time periods and regions of the world. The goal of normalization is to neutralize any inherent advantage or disadvantage of a project's timeframe and location, which allows us to analyze and compare projects on an equal basis, thus ensuring benchmarking accuracy.

IPA's PES Database stores project cost values normalized to a constant reference location, time, and currency, and with unusual events excluded., IPA's analytic methodology accounts for:

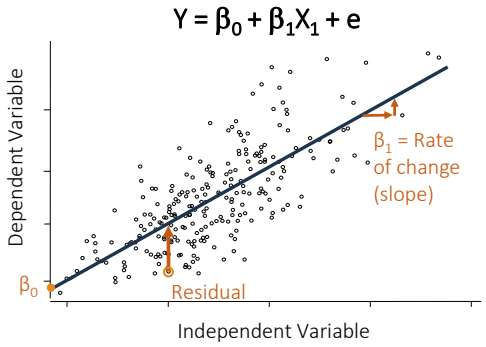
- **Time period**
  - Industry costs are escalated from the PES Database reference time period to a project's estimate date based on inflation data obtained from the projects evaluated by IPA and selected public sources
  - IPA captures inflation data for each major cost category and accounts for recent extraordinary inflation (see below for further discussion)
  - Because industry costs are presented as of the project's estimate date, escalation is removed from the project's cost estimate, while actual costs are de-escalated to the estimate date based on an expenditure profile established from the project's schedule



- **Location**
  - Industry cost data are converted from the reference currency in the PES Database *(note that in the case of this study, all projects are from the United States and all project costs were in U.S. dollars; therefore, no currency adjustment* was needed)
  - Differences in local labor rates are used to convert field labor costs from the reference location to the project's location
  - Office services and materials procurement typically follow World Open Market (WOM) pricing; for some regions, these costs are also adjusted from the reference location to the project's location
  - These location-adjustment factors can change over time, and IPA updates them as needed
- **Unusual events**
  - Costs in the PES Database exclude the effect of workers' strikes, natural disasters, global pandemics, etc.

Statistical Models

IPA uses multivariate statistical (regression) models to establish benchmarks for project outcomes (contingency used, cost, schedule, and operability) based on industry data that control for specific project characteristics. Fairly comparing targets and outcomes between a project and Industry requires the outcome models be derived from PES Database projects that have been normalized to a constant location, time, and currency, as described in the previous section. The benchmarks and distributions generated by the models account for the fact that a project outcome has multiple drivers. Controlling for these drivers simultaneously allows us to quantify the effect of each driver on that outcome. The figure below shows a simple illustration of a single-variable regression model and its associated uncertainty.



Y = Dependent Variable

X_1 = Independent Variable

β_0 = Constant

β_1 = Slope of Independent Variable

e = Residual—variance in Y that is unexplained by the variance of the independent variable(s)

IPA's models are multivariate (i.e., they account for multiple independent variables [drivers] simultaneously). Because IPA's models are based on actual project data and cannot control for every conceivable driver of a project

outcome, the models control for the most leveraging drivers, derived from empirical observations and hypotheses of what drives project performance. IPA's models are periodically updated as needed to capture recent project performance and ensure critical drivers remain relevant.

UNITED STATES
Independent Project Analysis, Inc.
44426 Atwater Drive
Ashburn, VA 20147
USA
+1 703 729 8300

BRAZIL
Independent Project Analysis Latin America
Deputado Heitor Alencar Furtado, 3415
Edificio Montelig—4° andar
Curitiba—PR, Brazil
81200-528
+55 41 3028 9028

AUSTRALIA
Independent Project Analysis, Inc.
Level 2, Suite 2
192 High Street
Northcote, VIC 3070
Australia
+61 3 9458 7300

UNITED KINGDOM
Independent Project Analysis, Ltd.
Wellington House – First Floor
Worton Drive
Reading RG2 0TG
United Kingdom
+44 118 920 7800

THE NETHERLANDS
Independent Project Analysis, Inc.
WTC The Hague Business Center, Room 03.25
Prinses Margrietplantsoen 33
2595 AM The Hague
The Netherlands
+31 70 335 0707

SINGAPORE
Independent Project Analysis, Pte Ltd.
No. 1 International Business Park
#10-02 The Synergy
Singapore 609917
Singapore
+65 6567 2201

IPA

Independent Project Analysis
www.ipaglobal.com