The Impact of Nevada's Ninety-Percent Prevailing Wage Policy on School Construction Costs, Bid Competition, and Apprenticeship Training

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Study results are based on publicly available information and are reproducible.

About the Authors

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In June of 2015, AB 172 reduced prevailing wage rates for education construction to 90% of the standard rate and increased the policy coverage threshold from $100,000 to $250,000. This study is a data-driven analysis of the consequences of these changes on school construction costs, bid competition, and apprenticeship training.

The 90% prevailing wage policy did not decrease construction costs or increase bid competition.

- Statistical analyses of construction projects in Clark and Washoe County school districts provide recent evidence that Nevada's prevailing wage requirements:
  - Do not increase costs or reduce bid competition on school construction projects.
- These results are consistent with the preponderance of peer-reviewed, academic research.
- 83% of these studies find that school construction costs are unrelated to prevailing wage laws.
- 100% of the studies indicate that prevailing wage laws do not decrease bid competition.

Why prevailing wage laws do not increase school construction costs.

- According to the U.S. Census Bureau., construction labor costs are a low percent of total costs.
- Labor costs average 23% of total costs in the U.S. and 22% of total costs in Nevada.
- When construction wages rise so does labor productivity.
- Since labor costs are a low percent of all costs, small changes in productivity are needed to offset prevailing wages.

An Unintended Attack on Apprenticeship Training as a Consequence of AB 172.

- Winning bids for union signatory contractors decreased by 41% after the 2015 policy change.
- Signatory contractors pursued projects that were not covered by the 90% rule.
- Bid competition on the examined Clark County projects decreased by 34%
- With reduced bid competition, bid costs for these projects increased by 20%.
- Jointly sponsored union-contractor training programs fund most formal construction training in Nevada.
- Reduced work for signatory contractors on schools means reduced training opportunities and funding for training.

AB 136 reverses the damage done by AB 172.

- By restoring prevailing wages on education construction to 100%.
- By restoring the coverage threshold to $100,000.

Prevailing Wage Laws are major drivers of apprenticeship training.

- Lower apprenticeship wages on prevailing wage projects create incentives to use trainees.
- Lower trainee wages increase demand for apprentices, training enrollments, and completions.
- Strong prevailing wage policies assure that wages incorporate the cost of training.

- Because 20% of construction value in Nevada is covered by prevailing wages, the policy drives training.

Funding for apprenticeship training in Nevada.

- A "cents per hour" addition to negotiated collective bargaining agreements means a large financial advantage for jointly sponsored training programs.
- As a consequence of superior funding:
    - Jointly sponsored programs represent 86% of all programs in Nevada.
    - Jointly sponsored programs train workers for the full range of trades in Nevada.
    - Unilateral programs focus on training for only electric, plumbing and pipefitting work.

Training program outcomes: Enrollments and completions.

- Jointly sponsored programs registered 91.5% of apprentices in the past 17 years, amounting to 26,479 registrations.
- Jointly sponsored programs account for 8,079 fully trained journey-workers (92.4%) compared to 562 for unilateral programs (6.4%).
- Women are under-represented in construction, but more women enroll in and finish joint apprenticeship programs.
- More veterans are enrolled and complete joint apprenticeship training programs.
- Completion rates are generally higher for jointly sponsored programs compared to nonunion programs:
    - Completions rates for electricians are 47% higher in jointly sponsored programs.
    - Completion rates are 55% higher in jointly sponsored plumbing/pipefitting programs.
    - Completion rates for Hispanic apprentices are 34% higher in jointly sponsored programs.

Training program outcomes: Training wages and completion wages.

- Apprentices in jointly sponsored programs earn higher wages during training.
- Those who complete jointly sponsored programs earn 183% more than their training wage.
- Those who complete unilateral programs earn 53% more than their training wage.

Contrasting results: The Nevada Policy Research Institute (NPRI) 2013 prevailing wage study.

- NPRI asserts that Nevada's prevailing wage law increases public building costs by about 18%.
- The NPRI study is ***not*** based on the statistical analysis of actual construction projects.
- The NPRI study was ***not*** published in a peer-reviewed academic journal.
- The NPRI study is based ***only*** on wage comparisons, not actual bid comparisons. It uses unrealistic assumptions and incomplete information about the construction industry.
- The 18% prevailing wage impact assumes labor costs are 50% of total construction costs when the actual percentage of labor costs is 22%.
- When actual labor cost data obtained from the US Census is used, the NPRI's cost impact falls to 7.2%
- When statistical methods are employed on actual construction costs, as is the case in the present study and many other peer-reviewed studies, the prevailing wage's cost impact falls to zero.

Executive Summary

The Impact of Nevada's Ninety-Percent Prevailing Wage Policy on School Construction Costs, Bid Competition, and Apprenticeship Training

Professor Jeff Waddoups, UNLV and Professor Kevin Duncan, CSU-Pueblo

Nevada's prevailing wage policy provides location and job-specific minimum wage and benefit rates for construction workers employed on public projects. The main purpose of the policy is to protect local compensation standards from competition by non-local, low-wage contractors who are attracted to areas with large government projects. Prevailing wage laws create a level playing field by allowing all contractors to compete while maintaining local compensation standards. In June of 2015, Nevada's prevailing wage law was changed with the passage of AB 172 that reduced compensation rates on publicly funded education construction to 90% of the standard rate and increased the policy coverage threshold from $100,000 to $250,000. The present study incorporates a data-driven analysis of the consequences of these changes on school construction costs and bid competition. It also examines the relationship between Nevada's prevailing wage policy, formal apprenticeship training, and the 2015 policy change.

- Results from the statistical analysis of asphalt and roofing projects for Clark County School District and roofing projects from Clark and Washoe districts indicate that projects covered by Nevada's prevailing wage policy are no more expensive, or less competitive than comparable projects that are not covered by the policy (see Appendix Tables 1 and 2).

- These findings are consistent with 83% of peer-reviewed research indicating that school construction costs are unrelated to prevailing wage laws. These results are also consistent with 100% of the studies indicating that prevailing wage laws do not decrease bid competition.

- Why aren't school construction costs affected by prevailing wage laws?
    - The most comprehensive data on construction costs is available from the U.S. Census Bureau. Average wage and benefit costs represent 23% of total costs of all construction in the U.S. The comparable figures for Nevada's industry are 22% for all construction and 27% and 28% for the types of roofing and asphalt projects examined in this study.
    - Research also shows that when construction wages increase, more skilled workers replace less skilled employees and capital equipment replaces all grades of labor.
    - Because labor costs are a low percent of total costs, only small changes in labor productivity are needed to offset the effect of prevailing wages.

- Other results for Clark County School District indicate that after the 2015 policy change the percentage of roofing and asphalt projects awarded to union signatory contractors decreased by 41%. All bidding (winning and losing submissions) by union signatory contractors decreased by 30% after 2015 (see Table 1). As the expansion of Nevada's construction industry continued after 2015, union signatory contractors moved to other projects that were not covered by the 90% prevailing wage rule.

- There are two important unanticipated consequences of these changes:

    - As union signatory contractors reduced participation in Clark County School District project bidding, the level of bid competition decreased by 34% and average bid costs increased by 20%. It is important to note that while across-the-board bid costs increased and bid competition decreased after 2015, the equality in bid costs and bid competition for prevailing wage and non-prevailing wage projects remained unchanged.

    - As is described in greater detail below, apprenticeship training programs that are jointly managed by contractors, who are signatories to collective bargaining agreements, and unions are responsible for most training resources as well as apprenticeship enrollments and successful program completions in Nevada. The reduction in union signatory contractor participation in Clark County School District projects after 2015 means that fewer training resources and fewer apprenticeship training opportunities were available for Nevada's young citizens. This finding is consistent with the preponderance of research reporting significant reductions in apprenticeship training with repeal of prevailing wage laws.

- Our evidence suggests that changes to Nevada's prevailing wage policy introduced with the passage of AB 172 in 2015 did not lower construction costs on prevailing wage projects, nor did the policy increase the level of bid competition on these projects. The unintended consequences of this policy reduced participation of union signatory contractors in bidding on school district projects. This change contributed to an across-the-board decrease in bid competition, an increase in bid costs, and a reduction in apprenticeship training resources and opportunities. The negative effect on training reduces opportunities for construction workers in Nevada to increase their skills and earnings. Because skilled workers, in construction or in any other industry, are an asset to our state, a reduction in training opportunities and resourcing is harmful to Nevada's economy.

- AB 172 harmed Nevada's construction industry without delivering on its promises of lower costs. This policy experiment should not be repeated in Nevada or in other jurisdictions. The Nevada Legislature has an opportunity to reverse the damage done by AB 172 by passing AB 136 that will restore prevailing wage rates on construction for schools to 100% of the standard rate and lower the policy coverage threshold to $100,000.

- As with all prevailing wage laws, Nevada's policy creates incentives to train workers in a volatile industry where employers otherwise would have little motivation to do so. The wage policy encourages training by allowing compensation rates for apprentices to be as low as 50% of minimum prevailing rates that are based on full journey-worker compensation. Lower wages for apprentices increase the demand for trainees on prevailing wage projects and contribute to increased training program enrollments and completions. When prevailing compensation rates include financial contributions to formal training programs, as is the case when full prevailing wages are paid, the policy increases training resources. Because 20% of all total construction value in Nevada is financed by federal, state, and local governments and is covered by federal and state prevailing wage regulations, the wage policy is an important driver of formal training in Nevada's construction industry. By assuring that the financial support for formal training is built into prices, prevailing wage laws foster the skills needed to build the structures and infrastructures for a growing, technologically sophisticated, and competitive Nevada economy.

- Formal apprenticeship training in the construction industry is provided by jointly managed union/management programs and by unilateral employer organizations, such as Associated Building Contractors (ABC). In joint programs unions and their signatory contractors determine training program content. Program financing is provided by a 'cents per hour' addition to the negotiated compensation package. Apprentices in jointly sponsored programs move between multiple employers on different projects and receive broad-based training in their trade. "Cents-per-hour" funding arrangements are rare in open shop training programs, as are opportunities to train with multiple employers on different project types. In unilateral programs only employers determine training program content. There are significant differences between these two types of programs that are summarized below.

- Using data gathered by Registered Apprenticeship Partners Information Management Data System (RAPIDS), we compare and contrast the size, scope and other indicators of performance of the various types of construction apprenticeship programs in the state, with particular focus on jointly managed programs compared to unilateral programs generally operated by the Associated Builders and Contractors.

    - The fundamental difference between the two types of programs is the superior funding provided by the cumulative effect of the "cents-per-hour training" contribution that is part of jointly sponsored programs. The comparison of training resources for the open shop program offered by the Associated Builders and Contractors (ABC) and comparable joint programs is illustrative. ABC has registered training programs for electricians, plumbers, and sheet metal workers. In 2015 the nonprofit affiliated with these ABC training programs reported to the IRS expenses of about $568,000, net assets of approximately $700,000, and 26 employees. The comparable figures for three joint programs for the same trades indicates expenses of about $6 million, net assets of $16 million, and 84 employees in 2015 (see Table 6).

- Joint programs have registered roughly 91% of Nevada's apprentices in the past decade and a half. More recently as of 2016 the figure is 85% (see Table 2).

- Joint programs train workers in a broad range of construction skills, including carpenters, ironworkers, laborers, brick and stone masons, glaziers, roofers, painters, plasterers, sheet metal workers, etc. Unilateral plans train mostly in electrical and plumbing and pipe-fitting (see Tables 3 and 4).

- Completion rates are much higher for joint programs compared to their unilateral counterparts. Compared to apprentices in unilateral programs, apprentice electricians in joint programs were *almost twice as likely* to complete their programs, and plumbing/pipefitting apprentices from joint programs were *more than twice as likely* to complete their programs (see Tables 10 and 11).

- The quality of training as indicated by wage increases upon program completion also favors joint programs. Apprentices in joint programs started at higher wages than their counterparts in unilateral programs, and those who completed their joint program earned 183% more than their starting wage compared to only 53% more for apprentices who completed their unilateral program (see Table 12).

- Joint programs contribute to diversity in construction industry by graduating 2,604 Hispanic construction workers during the period between 2000 and 2017 compared to unilateral programs that graduated 117 over the same period.

- Joint programs graduated 517 African American construction workers during the period between 2000 and 2017 compared to unilateral programs that graduated 36 over the same period.

- Construction apprentices are overwhelmingly male, but joint programs register and graduate female workers at a greater rate than unilateral plans (see Table 16 and 17). Joint programs graduated 317 women over the period compared to 12 for unilateral programs.

- Joint apprenticeship programs graduated 530 veterans during the period between 2000 and 2017 compared to only 36 graduated from unilateral programs over the same time period.

- The result of the present study and the preponderance of peer-reviewed research contrast with the findings of the study by Nevada Policy Research Institute (NPRI), which misleadingly asserted that the state's prevailing wage policy increases public construction costs by approximately 18%.

    - The NPRI study is not based on the statistical analysis of actual construction projects, nor was this study published in a peer-reviewed academic journal.
    - Rather NPRI based its results on measured differences between prevailing wage rates and alternative rates using the obviously inflated assumption that labor costs

represent 50% of total construction costs, as well as incomplete information about the construction industry.

- To illustrate the limitations of NPRI's study, consider that the estimated effect on construction costs of the prevailing wage policy decreases from 18% to 7.2% just by altering their assumption of 50% labor costs to 22%, which is consistent with data obtained from the U.S. Census of Construction.
- Moreover, the simple wage differential method used by the NPRI fails to capture the effects of changes in labor productivity and substitution of capital equipment for labor when wages change in the construction industry. Consequently, even the revised 7.2% cost estimate is unrealistically high.
- Other research has demonstrated that the wage differential method used by the NPRI yields a positive cost impact when the statistical analysis of project bids provides overwhelming evidence that no such cost effect exists. As a consequence, studies based on the wage differential approach, which are devoid of empirical content, should not be seriously considered in policy decisions.

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Section 1: Bid Costs and Competition under AB 172

Introduction

On June 9, 2015, Governor Sandoval signed Assembly Bill 172 into law lowering the applicable prevailing wage rate for publicly funded school and higher education construction in Nevada to 90% of the prevailing wage paid on other projects.[1] The new law also raised the coverage threshold for projects that are subject to Nevada's prevailing wage requirements from $100,000 to $250,000. The policy change was motivated by the belief that Nevada's prevailing wage standard increases the costs of public construction.[2]

This study is a data-driven analysis of the effects and consequences of AB 172. A statistical analysis of school construction projects from Clark County School District and from Washoe County School District provides insight into whether Nevada's prevailing wage standard affects building costs and the level of bid competition. Data from the U.S Department of Labor, Clark County School District, and other sources are used to illustrate that nature of apprenticeship training in Nevada's construction industry as well as the impact of AB 172 for formal training in Nevada.

Purpose of Prevailing Wage Laws and Nevada's Policy

Prevailing wage laws in the United States establish location and job-specific minimum wage and benefit rates for construction workers employed on publicly funded projects. The main purpose of a prevailing wage requirement is to protect local compensation standards from distortions associated with public construction.[3] Large infusions of government spending into a region may attract contractors from other areas where construction worker compensation rates are relatively low. The locally determined minimum wage enables resident contractors and their employees to compete for public projects without concern over underbidding by lower wage, out-of-area contractors. The aim of a prevailing wage law is to create a level playing field for

[1] See "Nevada Assembly Bill 172." Legiscan. Accessed at: https://legiscan.com/NV/text/AB172/2015.
[2] See "Senate passes prevailing wage exemption bill."Las Vegas Review Journal, February, 16, 2915. Accessed at: https://www.reviewjournal.com/news/politics-and-government/nevada/senate-passes-prevailing-wage-exemption-bill/.
[3] See "Wage and Hour Division, Frequently Asked Questions: Conformances, The Davis-Bacon Act, Protecting Wage Equality Since 1931," United States Department of Labor. Accessed at: http://www.dol.gov/whd/programs/dbra/Survey/conformancefaq.htm.

all, while ensuring that local wages and benefits are not undercut by government spending practices.

Nevada's prevailing wage policy was enacted on March 24, 1937.[4] As of June 9, 2015 the law applies to every contract over $250,000 involving new construction, repair or reconstruction that is funded in whole or in part by public money.[5] Public works construction financed or sponsored by the State of Nevada or any city, county, town, school district, public agency, or political subdivision is covered by the policy. The law requires that the wage rate paid to skilled and unskilled labor employed on public works construction must not be less than the wage that prevails in the county where the public project is located. This prevailing wage rate includes pension, health and welfare, vacation, holiday pay, other bona fide fringe benefits, as well as funding for apprenticeship training.[6]

To determine minimum prevailing wage rates, the Office of the Labor Commissioner annually surveys contractors who have performed work in a county. This survey extends to all of Nevada's 16 counties and Carson City.[7] The survey requests information for 43 general job classifications (carpenters, electricians, plumbers, etc.).[8] If the results of the survey find that a compensation rate is the same for more than 50% of the total hours worked for a particular job classification in a county, that rate is the prevailing wage for that type of work in that location. If no such rate can be determined, the prevailing wage for a job classification is the average wage rate (based on the number of hours worked) for the type of work in the county. Since June 9, 2015 the exception to this wage determination method is construction by a school district or the Nevada System of Higher Education. In these cases, the prevailing rate is 90% of the rate determined by the Labor Commissioner's survey.

Apprentices are paid and employed on public works projects according to the terms of the apprenticeship agreement.[9] Trainees are paid a fraction of the corresponding journey worker rate. Entry level apprentices may earn as low as 50% of the journey rate.[10] This rate increases with progress through the training program. Apprentices are employed based on the ratio of

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[4] See "Fact Sheet Prevailing Age Law." By Jered McDonald, Research Division, Legislative Counsel Bureau, June 2016. Accessed at: https://www.leg.state.nv.us/Division/Research/Publications/Factsheets/PrevailingWage.pdf.

[5] See "Public Works and Prevailing Wage Guidelines and Responsibilities of Awarding Bodies and Contractors and the Office of the Labor Commissioner." Department of Labor & Industry, State of Nevada. Accessed at: http://labor.nv.gov/uploadedFiles/labornvgov/content/PrevailingWage/PWP%20Handbook%20October%202017.pdf.

[6] See for example, "Prevailing Wage Rates for Carson City," Office of the Labor Commissioner, State of Nevada. Accessed at: http://labor.nv.gov/uploadedFiles/labornvgov/content/PrevailingWage/CARSON%202019.pdf .

[7] See "Procedure for Determination of Prevailing Wage in County," Chapter 338 Public Works, Title 28, Public Works and Planning, State of Nevada. Accessed at: https://www.leg.state.nv.us/NRS/NRS-338.html#NRS338Sec030.

[8] Some of the job classifications (for laborers and operating engineers, for example, are further divided into groups based on the specific tasks with different wage rates per group). See for example, "Prevailing Wage Rates for Carson City," Office of the Labor Commissioner, State of Nevada. Accessed at: http://labor.nv.gov/uploadedFiles/labornvgov/content/PrevailingWage/CARSON%202019.pdf .

[9] See "Public Works and Prevailing Wage Guidelines and Responsibilities of Awarding Bodies and Contractors and the Office of the Labor Commissioner." Department of Labor & Industry, State of Nevada. Accessed at: http://labor.nv.gov/uploadedFiles/labornvgov/content/PrevailingWage/PWP%20Handbook%20October%202017.pdf.

[10] Compensation varies with the program, but usually starts at 50% of the hourly rate for the corresponding journey worker and increases with progression through the training program. See Bilginsoy, Cihan (2007). "Delivering Skills: Apprenticeship Program Sponsorship and Transition from Training." *Industrial Relations*, Vol. 46, No. 4, pp. 738-763.

trainees to journeyworkers that is specified in the training program.[11] These arrangements require evidence that an apprentice is registered in a training program satisfying the requirement of the U. S. Department of Labor or the Nevada State Apprenticeship Council.

Review of Research on Prevailing Wage Laws and School Construction Costs

While research has addressed the effects of prevailing wage laws on training and safety in the construction industry and the racial composition of the construction labor force, the public policy debate is focused on the impact of this legislation on construction costs.[12] This was clearly the case during the debate in 2015 in Nevada to exempt, or otherwise limit, K-12 and higher education construction from that state's prevailing wage policy. During this debate, opponents of Nevada's policy claimed that the cost savings due to exemption would range from 5% to 30% of total construction costs.[13]

These claims are at variance with the preponderance of peer-reviewed research indicating that prevailing wage laws are unrelated to school construction costs. Specifically, 83% of peer-reviewed research conducted since the late 1990s fails to find statistically significant evidence that prevailing wage laws are associated with increased construction costs.[14]

The following review of the research examining the effect of prevailing wages on construction costs makes a distinction between studies that have and have not been reviewed by experts in the field prior to publication. Peer-Review is the gold standard for all academic research. Research that appears in academic journals has been reviewed by peer experts before publication of the study. A peer-review is not based on whether reviewers agree with the research results. Rather, the purpose of the review is to ensure quality, provide credibility, and maintain standards in the discipline. One benefit of this type of review is that peer experts are more likely to detect errors and shortcomings that may not be obvious to casual readers. It is entirely up to casual readers to evaluate the accuracy of research that has not been peer reviewed. Research methods typically vary between prevailing wage studies that have and have not been peer-reviewed. The research that has been reviewed is almost always based on the examination of hundreds or thousands of contractor bids and utilizes specialized statistical techniques and software. The advantage of the statistical analysis of bid costs is that the effect of prevailing wage regulations can be measured taking into consideration other project characteristics that are

[11] See "Nevada State Apprenticeship Council, February 5, 2016. Accessed at: http://labor.nv.gov/uploadedFiles/labornvgov/content/Meetings/Prevailing_Wage_Files/February%202016%20minutes.pdf.

[12] For a review of the research see Duncan, Kevin and Ormiston, Russell, (2018). "What Does the Research Tell us about Prevailing Wage Laws?" Labor Studies Journal, DOI: 10.1177/0160449X18766398, pp. 1-22.

[13] https://www.reviewjournal.com/news/politics-and-government/nevada/senate-passes-prevailing-wage-exemption-bill/.

[14] The research on school construction costs is consistent with other studies examining the effect of prevailing wages on the cost of building highways and other public structures. Eighty-three percent of these studies find that the wage policy is unrelated to construction costs. The exception is the construction of affordable housing where all three peer-reviewed studies find a statistically significant prevailing wage cost effect. Affordable housing construction is unlike typical public construction and other factors may be related to the exception for this segment of the industry. For a review of the research see Duncan, Kevin and Ormiston, Russell. (2018). "What Does the Research Tell us about Prevailing Wage Laws?" Labor Studies Journal, DOI: 10.1177/0160449X18766398, pp. 1-22.

also related to building costs.[15] Another advantage is that statistical analysis allows research to determine if a measured cost impact is 'statistically significant. A result that is not statistically significant is likely due to chance while an effect that is statistically significant is likely caused by something other than chance. On the other hand, research that has not been peer-reviewed and is not based on the statistical analysis of project bids, such as studies that use a wage difference approach in measuring the cost impact of prevailing wages, is often based on assumptions, hypothetical construction projects, and incomplete economic information about the construction industry.

While researchers have examined the impact of prevailing wages on a variety of different construction projects, much of the research has focused on school construction because taxpayers are particularly sensitive to policies that affect the cost of education and school construction projects are relatively uniform and numerous. Unless indicated otherwise, all of the studies reviewed below are based on the statistical analysis of project bid costs since information on change orders that determine final (total) project costs are typically unavailable.[16]

In an examination of low bids for public and private schools built between 1991 and 1999 in states with and without prevailing wage laws, Azari-Rad, Philips and Prus (2002) find that the wage policy did not have a statistically significant impact on construction costs.[17] The same conclusion is reached when these authors expand their analysis to include the strength of a state's prevailing wage law in a follow-up study (Azari-Rad, Philips and Prus 2003).[18] Using the same source employed by Azari-Rad, Philips, and Prus (Dodge Data & Analytics) and an overlapping time period (1995 to 2004), Vincent and Monkkonen (2010) report a statistically significant prevailing wage cost effect ranging between 8% and 13%.[19] Differences in statistical methods are likely responsible for the disparity in results between these studies.[20]

A number of studies have examined the introduction of prevailing wage standards in British Columbia. The Skills Development and Fair Wage Policy was introduced in this

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[15] For example, if prevailing wage projects are larger or more complex than projects that are not covered by prevailing wage laws, ignoring measures project size and complexity will result in a prevailing wage cost effect that is too high.

[16] Change orders may be related to prevailing wage legislation. Two studies have been able to obtain data on change orders and both report fewer changes with prevailing wages. Philips, Mangum, Waitzman and Yeagle report that cost overruns for road construction in Utah tripled in the decade following the 1981 repeal of prevailing wage requirements in this state. Bilginsoy's examination of school construction projects finds that average change orders, measured as a percent of the winning bid, decreased from 2.6% to 1.8% with the introduction of minimum construction wages and benefits in British Columbia. See Philips, Peter, Mangum, Garth, Waitzman, Norm, and Yeagle, Anne. 1995. "Losing Ground: Lessons from the Repeal of Nine "Little Davis-Bacon" Acts." Accessed at: http://www.faircontracting.org/PDFs/prevailing_wages/losingground.pdf and Bilginsoy, Cihan. (1999). "Labor Market Regulation and the Winner's Curse," *Economic Inquiry*, 37(3): 387-400.

[17] See Azari-Rad, Hamid, Philips, Peter, and Prus, Mark. 2002. "Making Hay When It Rains: The Effect Prevailing Wage Regulations, Scale Economies, Seasonal, Cyclical and Local Business Patterns Have On School Construction Costs." Journal of Education Finance, Vol.27, 997-1012.

[18] See Azari-Rad, Hamid, Philips, Peter, and Prus, Mark. 2003 'State Prevailing Wage Laws and School Construction Costs.' *Industrial Relations*, Vol. 42, No. 3, pp. 445-457.

[19] See Vincent, Jeffery and Monkkonen, Paavo. 2010. "The Impact of State Regulations on the Cost of Public School Construction," *Journal of Education Finance*, Vol. 35, No. 4, spring, pp. 313-330.

[20] While the models used by Azari-Rad, et al. and Vincent and Monkkonen differ with respect to measures of the number of stories, and the season of construction, etc., the latter study includes measures of population density for 2000 and construction wages in 2004 that vary by location, but do not vary over the time period of the analysis (1995 to 2004). It is unknown how the inclusion of these time-invariant measures affects the prevailing wage cost estimate.

province in1992 and established minimum wage and benefit rates for construction funded by the provincial government. Bilginsoy and Philips (2000) fail to find a statistically significant difference in winning bids for public schools that were built before and after the introduction of minimum wages and benefits.[21] In an examination of low bids and all bids, Bilginsoy (1999) also finds that the introduction of fair wages in British Columbia did not affect bid costs in terms of statistical significance.[22] Duncan, Philips, and Prus (2014) include a control group of private schools that were not covered by the wage policy in their before and after comparison. Results indicate that public schools were approximately 40% more expensive to build than comparable private schools prior to the introduction of the fair wage policy.[23] Public schools may be relatively more costly to build due to longer expected lifetimes or due to other regulations such as siting laws that limit where schools can be built.[24] Regardless of the cause of the pre-existing cost disparity, the 40% cost differential between public and private school construction did not change with the introduction of fair wage requirements.

Subsequent studies examine the effect of the British Columbian wage policy on the productivity and efficiency of construction to determine if the introduction of the wage policy was associated with any changes in construction methods that would affect costs. Duncan, Philips, and Prus (2006) find that prior to the introduction of the fair wage policy, public schools in British Columbia, were from 16% to 19% smaller than comparable private structures (holding building costs constant).[25] This size differential did not change with the introduction of the wage policy. This result indicates that the fair wage standard did not alter construction methods in a way that significantly affected construction output, i.e., the relative size of public and private schools.

Duncan, Philips, and Prus (2009) also find that efficiency of school construction changed with the introduction and subsequent expansion of the British Columbian wage policy.[26] Average construction efficiency was 86.6% for public schools built during the 18 months following the introduction of British Columbia's wage policy in 1992. Efficiency increased to 99.8% for covered projects after this time period. These data suggest that while the introduction of minimum wages for public construction may initially decrease the productivity of construction, the industry responds relatively quickly to higher wage rates by increasing overall efficiency. Duncan, Philips, and Prus (2012) report a similar pattern with respect to cost efficiency and the introduction and expansion of the fair wage policy.[27] Cumulative evidence from these studies suggests that increases in construction efficiency and productivity offset cost

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[21] See Bilginsoy, Cihan and Philips, Peter. 2000 'Prevailing Wage Regulations and School Construction Costs: Evidence from British Columbia.' *Journal of Education Finance,* Vol. 24, 415-432.

[22] See Bilginsoy, Cihan. (1999). "Labor Market Regulation and the Winner's Curse," *Economic Inquiry*, 37(3): 387-400.

[23] See Duncan, Kevin, Philips, Peter, and Prus, Mark. 2014. "Prevailing Wage Regulations and School Construction Costs: Cumulative Evidence from British Columbia." *Industrial Relations*, Vol. 53, No. 4, October, pp. 593-616.

[24] See the studies by Azari-Rad, Philips, and Prus (2003) and Vincent and Monkkenon (2010).

[25] See Duncan, Kevin, Philips, Peter, and Prus, Mark. 2006. "Prevailing Wage Legislation and Public School Construction Efficiency: A Stochastic Frontier Approach," *Construction Management and Economics*, Vol. 24, June 2006. pp. 625-634.

[26] See Duncan, Kevin, Philips, Peter, and Prus, Mark. 2009. "The Effects of Prevailing Wage Regulations on Construction Efficiency in British Columbia," *International Journal of Construction Education and Research*, Vol. 5, No.1, pp. 63-78.

[27] See Duncan, Kevin, Philips, Peter, and Prus, Mark. 2012. "Using Stochastic Frontier Regression to Estimate the Construction Cost Efficiency of Prevailing Wage Laws." *Engineering, Construction and Architectural Management*, Vo. 19, No. 3, pp 320-334.

pressure associated with the payment of fair wages and stabilized the cost of school construction in British Columbia.

Keller and Hartman (2001) use a non-regression, wage comparison analysis to measure the effect of Pennsylvania's prevailing wage policy on the cost of building public schools.[28] Data for hours worked on 25 public schools completed between 1992 and 1997 are used to calculate and compare labor costs with and without the payment of prevailing wages. Data from a large nonunion contractor in Pennsylvania is used to measure labor costs if the wage policy did not apply. These labor costs are compared to costs with the payment of prevailing wages. Assuming that labor productivity and hours worked remain unchanged with the switch from open shop to prevailing rates, the average cost increase for the 25 school projects that can be attributable to prevailing wages is 2.25%. However, Blankenau and Cassou (2011) and Balistreri, McDaniel, and Wong (2003) find that when construction wage rates increase, more skilled and productive construction workers replace less skilled employees and capital equipment replaces all grades of labor.[29] These types of changes mitigate at least some of the effect of higher construction wages on total construction costs.

Because the method used by Keller and Hartman (2001) does not take these adjustments into consideration, it is likely that their prevailing wage estimate of 2.25% is too high. Furthermore, the method used by Keller and Hartman suffers from the flaw of automatically concluding that prevailing wages increase costs. If prevailing wages exceed the alternative wage rate, this comparison automatically indicates that labor cost and total construction costs are higher with prevailing wages. The only answer this method can provide is 'how large is the cost impact?' This method and conclusion differs from studies that are based on a statistical examination of bid costs that include other factors that are also related to costs (regression analysis). This type of analysis determines first, if there is a prevailing wage cost effect and second, if it is statistically significant. In this way, the statistical method is an improved scientific method.

Alan Atalah (2013a; 2013b) examines over 8,000 school construction bids submitted by union and nonunion contractors to determine if prevailing wages would affect school construction costs in Ohio.[30] His examination from 2000 to 2007 covers schools built after the 1997 exemption of Ohio schools from prevailing wage requirements. Since Ohio's prevailing wages are based on union rates, the union-nonunion bid comparison is a proxy test of the wage policy (minus any administrative costs associated with prevailing wage requirements). Atalah's (2013a) comparison of average bid costs (adjusted for the size of the school) across the state fails to reveal any statistically significant differences between union and nonunion contractor bids.

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[28] See Keller, Edward and Hartman, William. 2001 'Prevailing Wage Rates: the Effects on School Construction Costs, Levels of Taxation, and State Reimbursements,' *Journal of Education Finance*, Vol. 27, pp. 713-728.

[29] See Blankenau, William and Steven Cassou. (2011). "Industry Differences in the Elasticity of Substitution and Rate of Biased Technological Change between Skilled and Unskilled Labor," *Applied Economics*, 43: 3129-3142 and Balistreri, Edward; Christine McDaniel; and Eina Vivian Wong. (2003). "An Estimation of U.S. Industry-Level Capital-Labor Substitution Elasticities: Support for Cobb-Douglas," *The North American Journal of Economics and Finance*, 14: 343-356.

[30] See Atalah, Alan. (2013) (a). "Comparison of Union and Nonunion Bids on Ohio School Facilities Commission Construction Projects," *International Journal of Economics and Management Engineering*, 3(1): 29-35 and Atalah, Alan. (2013) (b). "Impact of Prevailing Wages on the Cost among the Various Construction Trades," *Journal of Civil Engineering and Architecture*, 7(4): 670-676.

The exception is the southern region of the state where bids by nonunion contractors are significantly larger than bids submitted by union contractors. This is the case when all bids and low bids are examined.

Atalah (2013b) also compares the same average adjusted bids submitted by union and non-union contractors across the state for 18 different trades. In 13 trades there are no statistically significant differences between union and nonunion bids. For the other five trades, union bids were significantly higher than bids submitted by nonunion contractors in three of the cases. In the other two remaining trades, bids by nonunion contractors were higher than those submitted by union contractors.

Two recent studies that are either under consideration for publication in peer-reviewed journals or will soon be submitted for publication consideration, report results that are similar to general findings. In a comparison of schools built with and without federal Davis-Bacon prevailing wage regulations between 2013 and 2016, Onsarigo, Duncan, and Atalah find that schools built with prevailing wages are no more expensive than schools built without the wage requirement.[31] In the examination of schools built within the Minneapolis/St. Paul metropolitan area between 2015 and 2017, Duncan and Manzo find that schools built under prevailing wage requirements are no more costly than metropolitan schools built without the wage policy.[32]

In a recent peer-reviewed study that is not based on school construction, but addresses an issue relevant to Nevada's 90% rule created by AB 172, Duncan's examination of highway resurfacing in Colorado finds that bid costs did not change when prevailing rates changed from union to average rates. This change represented a reduction in hourly compensation of 18% for three-quarters of the job classifications involved in highway resurfacing.

The preponderance of the research on prevailing wages and school construction costs suggested that minimum construction wage and benefit rates are not associated with increased building costs. Why aren't costs affected by prevailing wages? First, the studies by Duncan, Philips, and Prus (2006, 2009, and 2012) suggest that construction efficiency and productivity increases with the introduction of minimum wage and benefit rates in the industry. This finding is consistent with the studies by Blankenau and Cassou (2011) and Balistreri, McDaniel, and Wong (2003) who find that contractors make productivity-enhancing adjustments when confronted with higher wage rates. Additionally, labor costs are a low percentage of total costs in the construction industry– approximately 23% of all building costs in the United States (U.S. Census Bureau 2012). The corresponding figure for Nevada is 22%. Since labor costs represent a small portion of overall costs, relatively minor changes are needed to offset higher prevailing wage and benefit rates.

Review of Research on Prevailing Wage Laws and Bid Competition

Many prevailing wage opponents assert that one way the wage policy increases construction costs is by reducing the level of bid competition. This claim is often made in the

[31] See Onsarigo, Lameck, Duncan, Kevin, and Atalah, Alan. (2019). "Prevailing Wages, Building Costs, Bid Competition, and Bidder Behavior." Submitted to *Construction Management and Economics*, October 2018.
[32] Manzo, Frank and Duncan, Kevin. (2018). An Examination of Minnesota's Prevailing Wage Law: Effects on Costs, Training, and Economic Development. Accessed at: https://midwestepi.files.wordpress.com/2018/07/mepi-csu-examination-of-minnesotas-prevailing-wage-law-final.pdf.

absence of any empirical evidence (Leef 2010).[33] There have been three peer-reviewed studies and another paper that is in the review process that empirically examines the effect of the wage policy on the level of bid competition. Two of these studies are based on school construction with the other two examining highway and other public construction. All of these studies are based on the statistical analysis of contractor bids and all find that prevailing wage requirements do not reduce the number of bidders. In an examination of public works projects in five northern California cities, Kim, Kuo-Liang, and Philips (2012) do not find statistically significant differences in the number of competing contractors for projects that are, and are not covered by prevailing wages.[34] In an examination of highway construction in Colorado, Duncan (2015) finds that the level of bid competition does not differ between federally funded projects that require the payment of prevailing wage laws and adherence to the Disadvantaged Business Enterprise policy and state-funded projects that are not subject to either of these policies.[35] In an examination of school construction in British Columbia, Bilginsoy (1999) finds that introduction of fair wage requirements was associated with an increase in bid competition that diminished over time.[36] The examination of school construction costs by Onsarigo, Duncan and Atalah also finds that the level of bid competition does not differ for construction that was and was not covered by federal Davis-Bacon prevailing wages.

Examination of Clark County and Washoe County School Construction

Information on Clark County School District (CCSD) construction projects was obtained through open records requests. Specifically, we requested work that involved the removal and replacement of asphalt and roof replacements, repairs, and recoating. These types of projects were selected as they represent the most common and numerous types of recent construction activity. Requests were made for the district's "advertisements of bids" and the "bid tabulations."[37] Bid advertisements announce the projects to interested contractors and include descriptions of the tasks involved as well as the district's estimated cost of the project. Bid tabulations include the names and bids of each responsive contractor. With this information we are able to examine the effect of prevailing wage requirements on project bid costs and the level of bid competition. Since the data on asphalt and roof work covers the 2009 to 2018 period, we are able to examine the effect of prevailing wage regulations on costs and competition taking into consideration the 2015 policy change.

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[33] See Leef, George. (2010). "Prevailing Wage Laws: Public Interest or Special Interest Legislation?" *Cato Journal*, 30(1): 137-154.

[34] See Kim, Jaewhan; Chang Kuo-Liang; and Peter Philips. (2012). "The Effect of Prevailing Wage Regulations on Contractor Bid Participation and Behavior: A Comparison of Palo Alto, California with Four Nearby Prevailing Wage Municipalities," *Industrial Relations*, 51(4): 874-891.

[35] Duncan, Kevin. (2015). "The Effect of Federal Davis-Bacon and Disadvantaged Business Enterprise Regulations on Highway Maintenance Costs," *Industrial and Labor Relations Review*, 68(1): 212-237.

[36] See Bilginsoy, Cihan. (1999). "Labor Market Regulation and the Winner's Curse," *Economic Inquiry*, 37(3): 387-400.

[37] For examples of available information see "Bids in Progress," Contracts, Procurement & Compliance, Clark County School District. Accessed at: https://www.ccsd.net/departments/contracts-procurement-compliance/bids-in-progress.

Through an open record request we were also able to obtain data from Washoe County School District (WCSD) for projects involving roofing projects. These types of projects are the most numerous for WCSD over the 2009 to 2018 period. We obtained information on the district's engineer/agency cost estimate of the project as well as the bid tabulations (inclusive of the project name/address, bid date, as well as the names and bids of each participating contractor).

With this information we are able to create two data sets. The first consists of 29 asphalt and 52 roofing projects awarded by CCSD over the 2009 to 2018 period (for a total of 81 observations). The second consists of 52 CCSD roofing projects and 34 WCSD roofing projects also awarded over the 2009 to 2018 period (for a total of 86 observations). With these data sets we are able to examine the effect of Nevada's prevailing wage law and the 2015 policy change on the level of bid costs and bid competition, taking into consideration the size and complexity of the project, whether a contractor who was awarded a project was signatory to a collective bargaining agreement, the date the contract was awarded, the type of school (high, middle, elementary), and other factors that are also related to construction costs.

Selected summary statistics for CCSD asphalt and roofing projects are reported in Table 1 and can be used to illustrate the changes occurring after 2015. These data indicate that inflation-adjusted average winning bids increased from approximately $421,000 to $791,000 after the 2015 prevailing wage policy change. The data for the district's inflation-adjusted cost estimate of the project indicates that the increase in bids is due to the district pursuing more expensive projects after 2015. These average cost estimates for combined asphalt and roofing projects increased from approximately $598,000 before 2015 to about $815,000 after 2015.

Table 1 . Selected Summary Statistics for Clark County School District Asphalt and Roof Replacement Construction Projects, 2009-2018. Information from Winning Bids.

Average Project Characteristic	Before 2015	After 2015
Real Winning Bid	$420,568	$790,703
Real Cost Estimate	$598,134	$814,700
% Winners are Union Contractors	68.9%	40.6%
% Prevailing Wage Projects	100%	50%
# Bidders	4.0	3.5

Source: Clark County School District. Total number of observations is 77 (45 before 2015 and 32 after 2015). Four observations are omitted because the union status of the contractor is unknown.

Prior to the policy change, contractors who were signatories to collective bargaining agreements won about 69% of CCSD asphalt and roofing projects. After the policy change, union contractors were awarded approximately 41% of these projects. This represents an approximate 41% decrease in the projects won by, and awarded to signatory contractors. This difference is statistically significant.[38] One reason for the decline in winning union contractors may be related to the change in the percent of projects that were covered by prevailing wage requirements. Before the 2015 policy change all of the bids on these projects exceeded the $100,000 prevailing wage coverage threshold. Consequently, prevailing wage requirements applied to all of the projects awarded before the policy change. After the policy change, and the increase in the prevailing wage coverage threshold to $250,000, 50% of CCSD asphalt and

[38] This difference is significant at the 0.05 level (t-value = 2.48).

roofing projects were covered by the revised prevailing wage policy. So, part of the decrease in the winning share of union contractors could be due to the decrease in the percent of projects covered by prevailing wages (based on the assumption that union contractors are less likely to win projects that are not covered by the wage policy).

An alternative comparison examines changes in the percent of winning union contractors before and after the 2015 policy, focusing exclusively on prevailing wage projects. Based on this comparison, union contractors won approximately 69% of these CCSD projects before the policy and 31.2% of prevailing wage projects after the policy change. This represents an approximate 55% decrease in the percent of projects awarded to union contractors. This difference is statistically significant.[39]

If union contractors won 41% of all projects after the 2015 policy change, but only won 31.2% of prevailing wage projects in this period, this implies that union contractors won 50% of the projects that were not covered by the wage policy ([31.2% + 50%]/2= 41%). This is true since 50% of all projects required the payment of prevailing wages after 2015. Regardless, these data indicate that the combined decrease in awarded contracts by union contractors was approximately 41% after 2015.

Other data reported in Table 1 indicate that the number of contractors submitting bids on CCSD asphalt and roofing projects decreased from an average of 4.0 bidders per project before the policy change to 3.5 competing contractors after the policy change. This decrease is likely related to the decrease in union signatory contractors after 2015.

Why did union contractors reduce participation in bidding on CCSD school projects?[40] With the passage of AB172 and the introduction of the 90% prevailing wage rate, some signatory contractors and unions negotiated concessions approximately equal to the 10% reduction in official prevailing total compensation rates. Some trades negotiated for a 10% reduction in hourly wage rates while keeping benefits at 100%. Other trades reduced benefits while keeping hourly wages unchanged.[41] Unionized roofers in the southern region of the state pursued the latter option while operating engineers involved in CCSD asphalt work made no concessions. Either option posed difficulties for signatory contractors.

As Nevada's construction industry continued to recover from the Great Recession (2008), contractors ceased bidding on education projects and pursued other construction projects that were not affected by the 90% prevailing wage rule. These data suggest that an unintended consequence of AB 172, and the 90% prevailing wage change, was a reduction in signatory contractor participation in CCSD projects that contributed to a reduction in the number of bidders on CCSD projects. The examination of these issues is pursued further in the detailed examination of bid costs and bid competition taking project size and complexity, time of bid awards, and type of school, etc. into consideration.

The statistical (regression) analysis of each sample is reported and described in Appendix A and summarized here. Results for CCSD combined asphalt and roofing projects indicate that, taking into consideration bids that were placed before and after the 2015 policy change, project size and complexity, the type of school (high, middle, or elementary), the time of bid awards, union status of the contractor, and other factors that influence construction costs, prevailing wage requirements do not have a statistically significant effect on bid costs. This finding is consistent

[39] This difference is significant at the 0.05 level (t-value = 3.29).

[40] Data from all bids on CCSD asphalt and roofing projects indicates that union bidding decreased by 37% after 2015. This difference is statistically significant below the 0.05 level (t-value = 7.40).

[41] This section of the study benefited from conversations with personnel from the Southern Nevada Building Trades.

with the preponderance of peer-reviewed research indicating that prevailing wage requirements are unrelated to school construction costs. This is not a surprising result given that labor costs are a low percentage of total construction costs for the types of contractors involved in CCSD asphalt and roofing work. For example, information from the *Economic Census of Construction* indicates that labor costs (wages and benefits) represent approximately 27% of total construction costs for specialty roofing contractors and about 28% of total costs for contractors involved in highway, street, and bridge work (this category includes CCSD asphalt projects).[42]

Other results indicate that winning bids of union contractors were no more costly (in terms of statistical significance) than the bids awarded to contractors who are not signatories to collective bargaining agreements. The effects of prevailing wages and contractor union status were measured taking into consideration whether contracts were awarded before or after the 2015 policy change. This indicates that neither the wage policy, nor the payment of union compensation rates had any impact on bid costs, regardless of the 90% rule or any concessions that unions made after 2015.

Additional results indicate that there is no statistically significant relation between the level of bid competition and prevailing wage requirements taking into consideration bids that were placed before and after the 2015 policy change as well as other factors that influence the number of competing contractors. This finding is consistent with all peer-reviewed research indicating that prevailing wages do not reduce bid competition. While the level of bid competition on these CCSD projects does not vary with the payment of prevailing wages, additional results indicate that the overall level of bid competition on CCSD projects decreased by approximately 30% after the 2015 policy change. This change is statistically significant.[43]

Results from the examination of CCSD and WCSD roofing projects are consistent with the findings from CCSD asphalt and roofing projects. The payment of prevailing compensation has no statistically significant impact of the bid costs of roof work in either county. Similarly, the level of bid competition is no different (in terms of statistical significance) for roof work that is and is not covered by the wage standard.

The results of this study indicate that Nevada's prevailing wage study is not associated with increased construction costs or reduced bid competition. There is one other study that has recently measured the effect of Nevada's policy on construction costs. The study by the Nevada Policy Research Institute is reviewed in the following section

[42] See the U.S. Census Bureau, *Economic Census of Construction*, Construction: Geographic Area Series: Detailed Statistics for Establishments, accessed at: http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_23A1&prodType=table.

[43] This difference is statistically significant at the 0.05 level. T-value = 2.09.

Review of the Prevailing Wage Study by the Nevada Policy Research Institute

A 2013 study by the Nevada Policy Research Institute (NPRI) calculated that Nevada's prevailing wage policy added over $625 million to the cost of publicly funded construction in 2009 and over $346 million in 2010. These increases in labor costs suggest that the state's prevailing wage law increases public construction costs by approximately 18.5%.[44]

Unlike research that has been peer-reviewed and is based on the statistical examination of contractor bids that are submitted under competitive market conditions, the NPRI study is based on assumptions and differences between prevailing wage rates and alternative wage levels. This "wage differential method" was common in the 1970s and 1980s prior to the development of statistical software and access to electronic project cost data.[45]

The method used by the NPRI study can be illustrated by the following:[46]

1. Assume that under Nevada's prevailing wage law, labor costs are 50% to total construction costs.

2. The comparison of prevailing wage rates in Nevada with alternative wage levels obtained from the *Occupation Employment Statistics* indicates an average prevailing wage premium of 44.2% for counties in the northern region of Nevada and 45.8% for counties in the southern region of the state. [47]

3. Using data for the northern region of the state for illustrative purposes, the next step involves determining how much prevailing wage requirements increase labor costs. If labor costs are 50% of total costs and prevailing wages exceed alternative wage rates by 44.2%, then labor costs in the absence of prevailing wages would be 34.7% of total costs. Or 50% labor costs under prevailing wages, adjusted by the 44.2% wage premium can be expressed as the following: [(0.5/1.442) x 100 = 34.7%]). The total cost factor without the state's prevailing wage law would be the labor cost component of 34.7% and 50% non-labor materials costs, or 84.7% of total costs under prevailing wages.

4. NPRI reported that in 2009 spending on state, local, and education construction in the northern region was $561.7 million. Without prevailing wages, these costs would have been approximately $475.8 ($561.7 x 84.7%). The percent change in total construction costs for the northern region is 18.1% [(561.5–475.8 / 475.8) x 100 = 18.1%].[48] Using the same method and data for the southern region reported by NPRI suggests that prevailing wage requirements add 18.6% to public construction costs. The state average, based on this method is 18.5%.

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[44] See Lawrence, Geoffrey. (2013). "Who Really Prevailing Under Prevailing Wage? Nevada governments waste billions in subsidies to union labor." Nevada Policy Research Institute. Accessed at: https://www.leg.state.nv.us/Session/77th2013/Exhibits/Assembly/GA/AGA640E.pdf.

[45] See Bilginsoy and Philips 2001 for a review of the early academic and government studies that used the wage differential method to measure the cost impact of prevailing wage regulations. The bulk of these studies find a cost impact ranging between 1.5 and 3%. See Bilginsoy, Cihan and Philips, Peter. 2000 'Prevailing Wage Regulations and School Construction Costs: Evidence from British Columbia.' *Journal of Education Finance*, Vol. 24, 415-432.

[46] The NPRI study follows the method used by Glassman, Glassman, Head, Michael, Tuerck, David, and Bachman, Paul. 2008. "The Federal Davis-Bacon Act: The Prevailing Mismeasure of Wages," Beacon Hill Institute. Accessed at: http://www.beaconhill.org/BHIStudies/PrevWage08/DavisBaconPrevWage080207Final.pdf.

[47] See Occupational Employment Statistics, U.S. Department of Labor. Accessed at: https://www.bls.gov/oes/.

[48] Another, short-cut method of calculating the percentage change in total construction costs for the northern region of the state can be expressed as the following: [(1/0.847) – 1] x100 = 18.1%.

There are numerous problems with the wage differential approach and the version of this method used in the NPRI study. These problems include:

1. If the prevailing wage is greater than the alternative wage rate, this method automatically provides a positive cost impact of the wage policy. The only questions left for this method to answer are how large is the wage gap and how large is the corresponding cost impact of the wage policy? This is a departure from the statistical analysis of bids costs that first is to estimate the magnitude of the prevailing wage cost effect. The second step is to determine if this estimated impact is statistically significant. In this sense the wage differential method is inherently unscientific as the approach is construed to automatically presume a prevailing wage cost effect. This is the fundamental reason why the wage differential method indicates a prevailing wage cost impact when the statistical analysis of bids suggests to such impact exists. This is illustrated in the present study where the statistical analysis of CCSD and WCSD school construction projects fails to find a statistically significant prevailing wage cost impact while the NPRI study suggests a substantial cost impact exists.

Other studies have also illustrated this discrepancy. Duncan (2016) reproduces the wage differential method for federally funded highway resurfacing projects in Colorado and finds that Davis-Bacon prevailing wage regulations add from 7% to 17% to construction costs.[49] Results obtained from wage differential method contrast from the results of several statistical studies of highway resurfacing projects in Colorado. These peer-reviewed studies indicate that federally funded resurfacing projects with prevailing wage are no more expensive than comparable state-funded projects that do not require the payment of prevailing wages.

These studies also find that bid costs do not change as contractors switch from projects that do to projects that do not require prevailing wages. Nor, did bid costs change when prevailing wage rates switched from union to average rates. This change was associated with an 18% decrease in hourly compensation that affected three-quarters of the job classifications involved in highway resurfacing. Additionally, there is no difference in the level of bid competition between resurfacing projects that do, and do not require the payment of prevailing wages. In sum, the wage differential method will indicate a positive prevailing wage cost impact when a variety of statistical analyses indicates no such effect exists.

2. This wage differential method ignores changes in labor productivity and the substitution of capital equipment for labor when wages change in the construction industry. As described above, Blankenau and Cassou (2011) and Balistreri, McDaniel, and Wong (2003) find that when construction wage rates increase more skilled and productive construction workers replace less skilled employees and capital equipment replaces all grades of labor[50]. These types of changes mitigate at least some of the effect of higher construction wages on total construction costs. By failing to capture the effect of changes in the productivity and utilization of construction labor, the NPRI study yields a cost impact that is too large. On the other hand, the

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[49] See Duncan, Kevin. 2016. "The Wage Differential Method: Promising Construction Costs Savings with the Repeal or Weakening of Prevailing Wage Laws that Cannot be Delivered," September. Accessed at https://www.csupueblo.edu/hasan-school-of-business/_doc/kevin-duncan/wage-differential-method-critique-duncan-2016.pdf.

[50] See Blankenau, William and Steven Cassou. (2011). "Industry Differences in the Elasticity of Substitution and Rate of Biased Technological Change between Skilled and Unskilled Labor," *Applied Economics*, 43: 3129-3142 and Balistreri, Edward; Christine McDaniel; and Eina Vivian Wong. (2003). "An Estimation of U.S. Industry-Level Capital-Labor Substitution Elasticities: Support for Cobb-Douglas," *The North American Journal of Economics and Finance*, 14: 343-356.

statistical analysis of project bid costs captures the effect of changes contractors make under different wage situations.

3. The NPRI study assumes that labor costs are 50% of total costs. This assumption is used in the Glassman study and is based on adjusted data from construction costs and building cost indexes.[51] Construction cost indexes are based on selected construction costs and do not include all costs. For example, the ENR index is based material and labor costs only while the RSmeans index adds the cost of rental equipment to material and labor costs.[52] However, contractor bids include other costs related to fuels, energy, overhead, depreciation, and profit. As discussed above, the *Economic Census of Construction* provides information on all costs.[53] These data indicate that, on average, labor costs (wages and benefits) are about 23% of contractors' total construction costs nationally and approximately 22% in Nevada. The assumption that labor costs are 50% of total costs results in a prevailing wage cost impact that is too large. If the NPRI method is reproduced based on 22% labor costs (instead of 50%), the cost impact of Nevada's prevailing wage policy is 7.2% for the northern region. This is substantially smaller than the 18.1% obtained from the method used in the NPRI study.[54]

4. In measuring the prevailing wage premium, the NPRI study compares reported prevailing wage rates for different counties with wage rates obtained from the Occupational Employment Statistics (OES). The average OES data used in the NPRI study is based on average hourly earnings for all workers within an occupation. For example, the OES data is based on the earnings of skilled and unskilled workers as well as apprentices. Residential construction is relatively low skilled work. Commercial/industrial projects involve greater skills and higher pay. Apprentices who are enrolled in approved programs earn a fraction of journey wages. As a consequence, the OES data reflect a broad average for workers within a job classification. On the other hand, the OES wage rates are compared to prevailing rate for journey workers. The lower wage rates earned by apprentices on prevailing wage projects are not included. Comparing OES average wage rates that include low residential workers and apprentices to the hourly rate of only journey workers (omitting apprentices) on prevailing wage projects results in an inflated prevailing wage premium that is too high.

Due to numerous flaws and restrictive assumptions, the wage differential method used in the NPRI study cannot be adjusted in a way that makes this approach comparable to a statistical analysis of bid cost data. As a consequence, the wage differential method should not be used in the determination of policy.

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[51] See Glassman, Glassman, Head, Michael, Tuerck, David, and Bachman, Paul. 2008. "The Federal Davis-Bacon Act: The Prevailing Mismeasure of Wages," Beacon Hill Institute. Accessed at: http://www.beaconhill.org/BHIStudies/PrevWage08/DavisBaconPrevWage080207Final.pdf.

[52] For examples of widely used construction cost indexes see "Using ENR Indexes,) Engineering News-Record accessed at: https://www.enr.com/economics/faq and see "How to Use the City Cost Indexes," RSmeans. Accessed at: https://www.rsmeans.com/info/contact/about-us.aspx.

[53] See U. S. Census. (2012). "Construction: Geographic Area Series: Detailed" *Economic Census of Construction*. U.S. Census Bureau. Accessed at: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_23A1&prodType=table.

[54] This change would affect the measurement of labor costs in the absence of prevailing wages from 34.7% [0.5/1.442] x 100 = 34.7%) described above to .153 or [0.22/1.442] x 100 = %).The total costs due to Nevada's prevailing wage requirement (based on data for the northern region) would become: [(1/0.933) – 1] x100 = 7.2%.

Section 2: AB 172's Unintended Attack on Apprenticeship Training

Relationship between Prevailing Wage Laws and Apprenticeship Training

Evidence from the previous section and other peer-reviewed academic studies clearly shows that in the case of school construction there is ***no*** pattern of higher construction costs associated with the existence of prevailing wage laws.[55] Thus it is not surprising that we find no impact on construction costs associated Assembly Bill 172, which passed in 2015 and now allows contractors to bid at 90 percent of prevailing wages for school construction projects. Recall that several reasons for the findings of no effect on total construction costs have been mentioned in the literature. First, builders respond to higher wages by using more capital intensive processes and more highly skilled labor.[56] Second, builders respond by spending less on materials, fuel, and rental equipment (less waste, fewer change orders). Third, builders facing higher wages were also found to accept slightly lower profits.[57] Coupled with the fact that labor costs are roughly 23% of total costs in the construction sector[58] (Census 2012) and 22% in Nevada, it is not difficult to imagine that a 10 percent reduction in the prevailing wage associated with minor adjustments along the dimensions listed above, would lead to no actual changes in construction costs.[59]

Our evidence shows that the goal of the Assembly Bill 172 -- to reduce costs for school construction projects -- was ***not*** achieved. However, there were ***unintended negative consequences*** associated with weakening of the PWL. In particular, the evidence suggests that lower prevailing wages associated with Assembly Bill 172 undermine apprenticeship training, which is an important source of the community's skilled construction work force. Research consistent with this assertion suggests that when PWLs are repealed or weakened, the number of apprenticeship registrations in a state declines, which has a negative effect on the level of skill in the construction workforce.[60] It is likely that Assembly Bill 172, while not directly repealing the

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[55] See for example Azari-Rad, Hamid; Peter Philips; and Mark Prus. (2003). "State Prevailing Wage Laws and School Construction Costs," *Industrial Relations*, 42(3): 445-457. Bilginsoy, Cihan and Peter Philips. (2000). "Prevailing Wage Laws and School Construction Costs: Evidence from British Columbia." *Journal of Education Finance* 25(3): 415-31.

[56] See Blankenau, William and Steven Cassou. (2011). "Industry Differences in the Elasticity of Substitution and Rate of Biased Technological Change between Skilled and Unskilled Labor," *Applied Economics*, 43: 3129-3142.Balistreri, Edward; Christine McDaniel; and Eina Vivian Wong. (2003). "An Estimation of U.S. Industry-Level Capital-Labor Substitution Elasticities: Support for Cobb-Douglas," *The North American Journal of Economics and Finance*, 14: 343-356.

[57] See Duncan, Kevin and Alex Lantsberg. (2015). *How Weakening Wisconsin's Prevailing Wage Policy Would Affect Public Construction Costs and Economic Activity*. Colorado State University-Pueblo and Smart Cities Prevail.

[58] See Economic Census of Construction: U.S. Census Bureau. (2012) "Construction: Geographic Area Series: Detailed"

[59] Consider that 90% X 0.22 = 2.0%. That is 90% of prevailing wage times the 23% construction cost attributable to labor leaves an estimated reduction in total cost of only 2.1% before all other things are accounted for. After the accounting for other factors as mentioned in the text, there is generally no statistically significant impact on construction costs according to the literature.

[60] See Bilginsoy, Cihan. (2005). Wage Regulation and Training: The Impact of State Prevailing Wage Laws on Apprenticeship." *The Economics of Prevailing Wage Laws*. Editors: Hamid Azari-Rad, Peter Philips, and Mark Prus. 149-168.

PWL, exerts a similar effect by undermining the financial underpinnings of skill production in the construction industry.

Why are policies such as PWLs needed to support production of skilled workers in construction? Why not just rely on employers to provide training to workers and on workers to obtain construction skills at their own expense? For a number of reasons firms and workers in construction face economic obstacles making it more difficult for them to make profitable investments in training on their own. First, consider how the nature and organization of work in construction makes it difficult to train a highly skilled workforce. The construction industry is typically characterized by smaller firms bidding for relatively *short duration* projects where the skills needed are *general* in nature, often *vary widely* from project to project, and where the skills are often most efficiently learned with a large component of *on-the-job experience*. Such market conditions create significant barriers to firms who might consider unilaterally investing in training its workers. A construction manager may ask, "why should I train workers in the nuances of high skilled electrical work when they will probably just end up leaving to a competing firm after this relatively short project has been completed and we are waiting for the next one to come along? Perhaps it's better to hire a worker that's already been trained by someone else." Because all the manager's competitors face the same market logic and incentives, none are inclined to invest in training. Such a *market failure* means that highly skilled workers, so much in demand, will not exist, because no one has a strong enough economic incentive to train them. The end result is that the community's construction work force has fewer skills than employers want, and construction contractors face a chronic shortage of skilled labor.

To make matters worse, the construction industry faces uniquely volatile demand for labor. The construction industry is often seasonal with major projects being built during peak non-winter months, although this isn't as much of a concern in Southern Nevada as it is in the north. The industry is also highly cyclical. During recessions the demand for construction labor drops more than other major industries, which leaves a higher proportion of construction workers unemployed compared to workers in other industries such as hospitality or manufacturing. Thus, construction firms facing uncertainty in the market because of volatile demand are also less likely to find training investments in workers profitable, especially when the skills in question are potentially useful for their competitors. Not only are employers' are naturally reluctant to invest when the workers who have obtained the skills may very well end up using them for the benefit of their competitors after the current project is completed, workers contemplating a career in a volatile industry like construction may be hesitant to spend years investing in skills for an industry where there are long periods of unemployment based on seasonal and cyclical factors.[61]

[61] A construction contractor who trains a worker in general skills, or skills that are widely useful to other employers, provides a positive externality. A positive externality in this case is a benefit (a skilled worker who will be widely available because of short-duration projects, etc.), which is produced in a private employment transaction that is also useful to the wider community (other construction contractors). Because the training occurs in a private transaction, the wider community does not financially support the training, which means that the other construction contractors could plausibly get access to a fully trained worker without having to pay, and thereby are get something for nothing. One cannot expect employers to consistently provide their competitors with something for nothing for very long, which suggests that the benefit (availability of construction workers trained in general skills) will be under-provided—thus a chronic skill shortage.

Solving the Market Failure

In the unionized segment of the construction industry, trade unions and employers have banded together to address such market failures that threaten to undermine the skill base of the workforce. Competing employers (such as competing electrical contractors for example) bargain with a trade union resulting in a labor agreement that contains, among other things, a common wage scale, "cents-per-hour financing of an apprenticeship program, and a Joint Apprenticeship Training Committee (JATC) with equal representation of labor and management on a board of directors. The coordination provided by the agreement helps to create and maintain a pool of skilled construction labor upon which the signatory employers can draw when demand warrants. The overall result for the U.S. economy is that there is substantially more training in the unionized sector of the construction industry.[62]

Other attempts to address market failures are also found in the non-union sector of the industry. Unilateral apprenticeship programs are generally organized by trade associations such as the Associated Building Contractors (ABC). Instead of the union jointly coordinating the training with the cooperation of signatory contractors, the trade association provides coordination to its members through which training curriculum is developed and maintained and financing is arranged.[63]

Prevailing Wage Laws and Apprenticeship Training

Besides apprenticeship programs to solve market failures and thus promote training, public policies, such as PWLs play an important role. The original purpose of PWLs as established by the Davis Bacon Act in 1933 was to make sure that bidders on public construction projects take into account local market-based standards for wages, benefits, and importantly, the very real costs associated with training. The result is that employers are better able to economically maintain and sustain a skilled construction workforce as they compete with each other for projects.[64] The existence of a PWL makes it more difficult for contractors to win bids by setting wages and benefits significantly lower than community standards made possible in part by ignoring training costs. Evidence suggests that the existence of PWLs provides financial support for apprenticeship training. Bilginsoy (2005) found that in states where PWLs exist, apprenticeship registrations are 6% to 8% higher than in states without PWLs.[65]

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[62] Waddoups, C. Jeffrey. 2014. "Union Coverage and Work-Related Training in the Construction Industry." *Industrial & Labor Relations Review* 67 (2): 532-54. Bilginsoy, Cihan. (2003). "The Hazards of training: Attrition and retention in Construction Industry Apprenticeship Programs. *Industrial and Labor Relations Review* 57: 54-67.

[63] Bilginsoy (2003) finds that unilateral programs are much less likely to lead to a worker obtaining journey-worker status (58% for joint apprenticeship programs to 30% for non-joint programs).

[64] The Census of Construction (2012) shows that 20 percent of construction spending in Nevada originates from the public sector, making it a significant contributor to construction employment.

[65] Bilginsoy, Cihan (2005). Wage Regulation and Training: The Impact of State Prevailing Wage Laws on Apprenticeship." *The Economics of Prevailing Wage Laws*. Editors: Hamid Azari-Rad, Peter Philips, and Mark Prus. 149-168.

Another study reinforces the idea, finding that the apprenticeship share of the construction workforce is higher in states with a PWL—14.4% compared to 7.7%.[66] Yet another study found that after Utah repealed its PWL, apprenticeship training dropped significantly,[67] and after Kansas dropped it PWL apprenticeships dropped by 38 percent, which is similar to the decline in Colorado, where apprenticeships dropped by 42 percent on repeal. Indeed, there were declines in apprenticeship training in all nine states that repealed their PWLs. [68]

Importantly, the increased incidence of apprenticeship training leads to productivity per worker to be 14 to 33 percent higher in states with a PWL compared to the states with no law.[69] The situation in Nevada is somewhat different because the policy in question is a weakened PWL rather than one that is repealed altogether. Bilginsoy's (2005) speaks to such a situation however, by finding that states with weaker PWLs lead have lower supplies of apprenticeship training than states with stronger laws.[70]

Apprenticeship Training in Nevada's Construction Industry: A Comparison of Joint Labor-Management and Employer-Only Programs

In light of the important link between PWLs and training in the construction industry, we will assess the apprenticeship training systems as they have currently existed in Nevada over the past decade and a half. Officially recognized apprenticeship programs are registered with the U.S. Office of Apprenticeship (USOA), which is housed in the U.S. Department of Labor. An important function of the USOA is to set standards for apprenticeship training programs and assure their quality through enforcement standards. Besides standards and quality assurance, the USOA also provides employers and trade unions with technical assistance in establishing and operating effective programs. Although not a guarantee of high quality, registration with the USOA indicates to workers, employers, and policy makers that a training program has agreed to adhere to certain guidelines indicative of high quality.

There are two main approaches to apprenticeship programs in Nevada. The first and most common form of organization is one in which a trade union and a group of employers are signatories to a collective bargaining agreement, which includes details about how a program is organized and supported financially. The organization of *joint* multi-employer programs (JMEPs) is established in the collective bargaining agreement and generally provides for a Joint Apprenticeship Training Committee (JATC) with equal representation of labor and management on a board of directors. Such jointly sponsored multi-employer programs exist for a broad array of trades and provide skills pertinent to many construction occupations.

The second and much less common method for organizing apprenticeships also features cooperation of multiple employers, but it does not include collective bargaining agreements with trade unions. Such *unilateral* multi-employer programs (UMEPs) are fully financed by

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[66] Dickson Quesada, Alison, Frank Manzo IV, Dale Belman, and Robert Bruno. (2013). A Weakened State: The Economic and Social Impacts of Repeal of the Prevailing Wage Law in Illinois. University of Illinois at Urbana-Champaign; Illinois Economic Policy Institute; Michigan State University.

[67] Azari-Rad, Hamid; Peter Philips; and Mark Prus. (2003). "State Prevailing Wage Laws and School Construction Costs," *Industrial Relations*, 42(3): 445-457.

[68] Philips, Peter; Garth Mangum; Norm Waitzman; and Anne Yeagle. (1995). Losing Ground: Lessons from the Repeal of Nine 'Little Davis-Bacon' Acts. University of Utah.

[69] Philips, Peter. (2014). Kentucky's Prevailing Wage Law: An Economic Impact Analysis. University of Utah.

[70] Ibid. Bilginsoy 2005.

employers under the auspices of trade associations such as the Associated Building Contractors (ABC). Unilateral programs are significantly less common and cover a narrower range of trades and construction occupations. For example, In Nevada unilateral programs primarily train electricians and plumbers/pipefitters. A very small program for sheet metal workers exists, but trains very few workers. Also less common are unilateral single employer programs (USEPs), where a single company establishes a program registered with the USOA. In the construction industry such programs have been very limited in Nevada.

As part of the quality assurance process, the USOA requires federally registered programs to provide data on programs and apprentices. The resulting data base titled the Registered Apprenticeship Partners Information Management Data System (RAPIDS) contains information on apprenticeship programs in Nevada. In this section of the report, we draw heavily on RAPIDS data to compare and contrast the size, scope and other indicators of performance of the various types of construction apprenticeship programs in the state. The study period covers the years from 2000 to 2017 and emphasizes similarities and differences in JMEPs and UMEPs that are organized by the ABC.

Unilateral vs. Joint Apprenticeships: Programs and Registrations

As Table 2 demonstrates there are four types of apprenticeship program by sponsor type. By far joint programs are the most common. The 49 joint programs from 2000 and 2017 amount to roughly 74% of the total programs registered. Single employer plans are not very common, nor are unilateral multi-employer plans, such as those sponsored by the ABC.

Table 2: Active Programs by Sponsor Type for 2000-2017

Program Sponsor Type	Number of Programs	Percent	Number of Registrations	Percent
JMEP	49	74.2%	26479	91.5%
USEP	4	6.1%	118	0.4%
UMEP: ABC	6	9.1%	2258	7.8%
UMEP: Non-ABC	7	10.6%	77	0.3%
Total	66		28932	

Source: RAPIDS-Nevada data.

Focusing on the numbers and percentages of individual apprentice registration paints an even starker picture of the dominance of JMEPs as a vehicle to produce highly skilled construction labor in Nevada. The 49 joint programs registered 26,479 apprentices, amounting to 91.5 percent of the total registrations. UMEP-ABC in contrast registered 7.8 percent of building trades apprentices in Nevada. Note that the other unilateral programs are very small in comparison

with USEP registering only 0.4 percent and UMEP – Non-ABC 0.3 percent of all apprentices over the period.

Unilateral vs. Joint Apprenticeships: Scope and Time-Frame of Training Opportunities

The numbers in Table 3 indicate that occupational range of *unilateral* apprenticeship training opportunities is quite limited. In Northern Nevada, for example, the only opportunity is in electrical. In southern Nevada the opportunities are limited to electrical, plumbing and sheet metal.

Table 3: ABC-Affiliated Apprenticeship Programs in Nevada

ABC Chapter	Program Number	Year Last Registered Apprentices
Contractors of Nevada Las Vegas Plumber	NV001910003	2016
ABC NV Chapter RESIDENTIAL PLUMBER	NV002020018	2005
ABC NV Chapter Electrical Reno	NV002950001	2017
ABC Electrical Las Vegas	NV003910002	2017
American Fire Sprinkler Las Vegas	NV003920005	2000
ABC Sheet Metal Las Vegas	NV004080008	2011

Source: RAPIDS-Nevada data.

Compared to the limited range of opportunities in the unilateral sector, opportunities for skills training via federally recognized apprenticeship programs appear quite expansive. Table 4 details the programs by name and number of registrations over the entire 2000 – 2017 period. Along with electrical and plumbing/ pipefitting, are programs for carpenters, ironworkers, laborers, brick and stone masons, glaziers, roofers, painters, plasterers, and sheet metal workers. The second panel of Table 4 presents similar information, but limited to the period between 2011 and 2017.

Table 4: Joint Apprenticeship Programs with 50 of more Registrations Between 2000 – 2017.

Program Name	Number of Registrations
BRICK & TI LOCAL 3 JATC	308
CALIFORNIA NV LINE JATC	984
CARPENTER MILLWRIGHTS	69
CARPENTERS DRYWALL APPLICATOR JATC	236
CARPENTERS JATC	5,029
CARPENTERS/Cabinetmaker Local #971	1,130
CEMENT MASONS & PLASTERERS	692
CEMENT MASONS LOCAL# 241	55
ELECTRICAL LOCAL #401	520
ELECTRICAL WORKERS LOCAL 357 JATC	1,696
ELEVATORS LOCAL 18 JATC (SOUTH)	557
FLOOR COVERS LOCAL 567 JATC	103
FLOORCOVERS LOCAL 1512 JATC	359
Heat & Frost and Allied Workers Local.	185
IRON WORKERS LOCAL 416 JATC	1,040
IRON WORKERS LOCAL 433 JATC	1,345
IRONWORKERS LOCAL #118 JATC	486
LABORERS LOCAL #169	546
LABORERS LOCAL 872	728
NEVADA BRICK TILE, MARBLE & STONE JATC	2,260
NEVADA GLAZIERS JATC ARCHITECTRUAL	531
NEVADA GLAZIERS JATC MASTER GLAZIER	106
NEVADA ROOFERS LOCAL 162 JATC	1,441
NO. NV PAINTERS JATC	277
OPERATING ENGINEER LOCAL #3	249
OPERATING ENGINEERS JATC	563
PAINTERS JATC	1,255
PLASTERERS LOCAL # 241 JATC	257
PLUMBERS LOCAL # 350	512
PLUMBERS LOCAL 525 JATC	893
SHEET METAL WORKERS LOCAL # 26 JATC	291
SHEET METAL WORKERS LOCAL 88 JATC	655
SPRINKLER FITTER 268 JOINT APPRENTICE.	849
Total	26,207

Source: RAPIDS-Nevada data.

Table 4 cont.: Joint Apprenticeship Programs with 50 or more Registrations Between 2011-2017.

Program Name	Number of Registrations
CALIFORNIA NV LINE JATC	509
CARPENTER MILLWRIGHTS	69
CARPENTERS DRYWALL APPLICATOR JATC	236
CARPENTERS JATC	440
CARPENTERS/Cabinetmaker Local #971	212
ELECTRICAL LOCAL #401	182
ELECTRICAL WORKERS LOCAL 357 JATC	347
ELEVATORS LOCAL 18 JATC (SOUTH)	67
IRON WORKERS LOCAL 416 JATC	94
IRON WORKERS LOCAL 433 JATC	101
IRONWORKERS LOCAL #118 JATC	122
LABORERS LOCAL #169	199
LABORERS LOCAL 872	210
NEVADA BRICK TILE, MARBLE & STONE JATC	408
NEVADA GLAZIERS JATC ARCHITECTRUAL	61
NEVADA GLAZIERS JATC MASTER GLAZIER	86
NEVADA ROOFERS LOCAL 162 JATC	257
NO. NV PAINTERS JATC	60
OPERATING ENGINEER LOCAL #3	94
OPERATING ENGINEERS JATC	121
PAINTERS JATC	141
PLASTERERS LOCAL # 241 JATC	58
PLUMBERS LOCAL # 350	155
PLUMBERS LOCAL 525 JATC	150
SHEET METAL WORKERS LOCAL # 26 JATC	83
SHEET METAL WORKERS LOCAL 88 JATC	111
Total	4573

Source: RAPIDS-Nevada data.

Trends in Apprenticeship Registrations of the Period between 2000 and 2017

The economy in Nevada featured a huge building boom during the middle of the first decade of the 2000s, followed by a severe bust brought on by the Great Recession. For example, in 2008, 9.2 percent of employment in Nevada was in the construction industry, which employed over 116 thousand workers. At the trough of the building bust in 2012, construction employment had fallen to just under 52 thousand, which is approximately 4.2 percent of the workforce.

Compare that to national numbers for 2006 where construction accounted for 5.2 percent of employment and in 2016 where it accounted for 4.3 percent of total employment (Bureau of Labor Statistics 2018). As expected, the number of apprenticeship registrations follows the business cycle quite closely for both unilateral and joint programs. The figures in Table 5 show that a large number of apprentices were registered in the joint sector, especially between 2004 and 2008. Similarly among ABC programs the registration numbers peaked in 2006. In neither the UMEP-ABC nor the JMEP segment have the numbers returned back to their peak levels; however, in percentage terms the UMEP - ABCs have come closer to matching their pre-recession numbers.

Table 5: Registrations in Various Types of Apprenticeship Programs by Year.

	Type of Apprenticeship Program				
Year	UMEP (non ABC)	USEP	JMEP	UMEP (ABC)	Total
2000	12	5	1,129	143	1,289
2001	3	2	1,060	175	1,240
2002	0	6	1,577	181	1,764
2003	12	20	1,604	144	1,780
2004	6	7	2,713	140	2,866
2005	6	7	2,396	192	2,601
2006	16	14	3,387	248	3,665
2007	4	2	2,703	150	2,859
2008	12	17	3,314	209	3,552
2009	0	3	1,347	23	1,373
2010	0	1	444	93	538
2011	0	0	467	41	508
2012	2	12	616	46	676
2013	3	4	772	51	830
2014	1	4	794	116	915
2015	0	12	947	86	1,045
2016	0	2	979	172	1,153
2017 partial	0	0	230	48	278
Total	77	118	26,479	2,258	28,932

Source:RAPIDS-Nevada data.

Another way to compare the resources invested in training through the JMEP and UMEP-ABC tracks is to examine IRS Form 990s from the various training trusts. Table 6 shows that according to IRS Form 990 data the nonprofits affiliated with the northern and southern Nevada ABC training programs these open shop organizations possessed revenue of approximately $568,000, net assets of approximately $711,000, and 26 employees for the 2015 tax filing. These training resources are compared to three *joint* programs that offer training in electrical, plumbing and sheet metal trades. Collectively, these programs had approximately $6 million in revenue, $16 million in net assets, and employed 84 workers in 2015. This represents over 10 times the revenue of the ABC programs, over 20 times ABC net assets, and 3 times the number of employees.

Table 6: Apprentice Program Revenue, Expenses, and Net Assets for Selected Open Shop and Joint Union-Contractor Training Programs

Training Program Name (s)	Apprenticeship Trades	Training Fund Expenses and Net Assets*	Training Program Employment*
Associated Builders and Contractors Nevada Chapter / Combined Northern and Southern Chapters	Electrical, Plumbing and Sheet Metal	Expenses =$567,591 Assets=$710,503	26 Employees
Electrical JATC, Southern Nevada	Electricians	Expen.=$2.5 million Assets=$2.2 million	36 Employees
Las Vegas Plumbers and Pipefitters Local 525 Apprenticeship and Training Trust	Plumbers and Pipefitters	Expen.=$2.3 million Assets=$9.5 million	33 Employees
Sheet Metal Workers Local 88 Joint Apprenticeship & Training Trust	Sheet Metal Workers	Expen.=$1.1 million Assets=$4.3 million	15 Employees
Total for Selected Joint Union-Management JATC Apprentice Training Programs	Electricians, Plumbers, Pipefitters, and Sheet Metal Workers	Expen.=$5.9 million Assets=$16.0 million	84 Employees

Sources: Propublica, Nonprofit Explorer (https://projects.propublica.org/nonprofits/). Assets (net) are equal to total assets minus liabilities. * Based on 2015 IRS Form 990. JATC = joint apprenticeship training committee

The Great Recession and Training

The Great Recession was truly a disaster for Nevada's construction industry especially from 2009 to 2012. One question addressed by Table 7 is whether it was the recession that killed the UMEP-ABC programs. For the years 2009 through 2012, it is obvious that the number of new registrations dropped precipitously. However, only in the case of the ABC Sheet Metal program, does the demise seem to coincide with the Great Recession. The others were either not operational well before the recession or were severely weakened during the recession but staged a comeback as the economy improved.

Table 7: New Apprentice Registrations in ABC-Affiliated Programs in Nevada 2000 – 2017.

	Program/Location						
Year	Plumbing Heating (Las Vegas)	ABC Nevada Chapter Residential Plumber (Reno)	ABC Nevada Chapter (Electrical) (Reno)	ABC Electrical (Las Vegas)	American Fire and Sprinkler (Las Vegas)	ABC Sheet Metal (Las Vegas)	Total
2000	17	0	40	78	8	0	143
2001	16	0	63	96	0	0	175
2002	18	0	49	114	0	0	181
2003	23	8	33	80	0	0	144
2004	14	4	42	80	0	0	140
2005	28	6	59	99	0	0	192
2006	31	0	56	161	0	0	248
2007	38	0	19	93	0	0	150
2008	21	0	100	70	0	18	209
2009	9	0	1	13	0	0	23
2010	15	0	4	58	0	16	93
2011	1	0	20	17	0	3	41
2012	5	0	15	26	0	0	46
2013	13	0	20	18	0	0	51
2014	16	0	36	64	0	0	116
2015	20	0	32	34	0	0	86
2016	32	0	69	71	0	0	172
2017 partial	0	0	25	23	0	0	48
Total from 2000	317	18	683	1195	8	37	2258
Total from 2009	111	0	222	324	0	19	676
Total from 2011	87	0	217	253	0	3	560

Source: RAPIDS-Nevada data.

Occupational Distribution of New Registrations

The results in Tables 8 demonstrate that there are apprenticeship registrations in programs associated with 32 separate occupations. The largest number of apprenticeship registrations are found in the occupations of Carpenter (21 percent), Electrician (13.9 percent), and Plumbers/Pipefitters (9.7 percent). As has been previously noted, the UMEP-ABC has focused its resources into training electricians and plumbers, which are obviously among the most common skilled occupations in construction.

Table 8: Registrations by Occupation and Program Sponsor Type (2000 - 2017).

	UMEP (non ABC)	USEP	Joint	UMEP (ABC)	Total
Bricklayer	0	0	315	0	315
Cabinet Maker	10	0	9	0	19
Carpenter	0	0	6,025	38	6063
Cement Mason	0	0	525	0	525
Dry Wall	0	0	318	0	318
Electrician	23	67	2,216	1,716	4022
Elevator	0	0	598	0	598
Erector/Line	0	0	984	0	984
Fitter	0	24	0	0	24
Floor Covering/Layer	0	0	484	0	484
Glazier	0	0	637	0	637
Insulation	0	0	225	0	225
Iron Worker/Reinforcing	0	0	1,147	0	1147
Laborer/Construction Craft	0	0	1,274	0	1274
Marble	0	0	172	0	172
Mill Wright	0	0	147	0	147
Operating Engineer	0	0	805	0	805
Painter	0	0	1,043	12	1055
Pipe Fitter	29	23	1,245	8	1305
Plasterer	0	0	479	0	479
Plumber	10	0	1,040	440	1490
Protective Signal	3	0	0	0	3
Residential	1	0	9	7	17
Roofer	0	0	1,445	0	1445
Sheet Metal	0	0	946	37	983
Stone Mason	0	0	29	0	29
Structural Steel	0	0	1,724	0	1724
Taper	0	0	541	0	541
Terazzo	0	0	13	0	13
Tile	0	0	2022	0	2022
Truck Driver	0	0	7	0	7
Tuck Pointer	0	0	55	0	55
Welder	1	4	0	0	5
Total	77	118	26,479	2,258	28,932

Source: RAPIDS-Nevada data.

Performance of Apprenticeship Programs by Sponsor Type: Completion Rates

One method of comparing the effectiveness of apprenticeship programs is by assessing rates of cancellation and completion, keeping in mind that there are currently active apprentices who do not fit in either category (suspensions for example). Table 9 presents information on cancellation and completion rates for all programs by sponsor type. Focusing on experiences of apprentices in JMEPs and UMEP-ABCs, apprentices in the UMEP-ABCs experience a slightly higher rate of cancellation than JMEPs – 71 percent compared to 66 percent.

Such a comparison may, however, be misleading because the many of the JMEPs are more narrowly defined, and not represented in the UMEP-ABC system. The data in Tables 10 and 11 compares the cancellation and completion rates of only electricians and only plumbers/pipefitters, respectively. This 'apples-to-apples' comparison better indicates the comparative experiences of apprentices in the two systems. The completion rate for electricians in JMEPs is 59 percent compared to 31 percent in UMEP-ABC, while the completion rate for plumbers/pipefitters in JMEP is 55 percent compared to 25 percent for UMEP-ABCs programs. Obviously the completion rates are substantially more favorable among JMEPs. Evidently, the lower completion rates in Table 9 was driven by the smaller JMEP apprenticeships in trades other than electrical and plumbing/pipefitting.

Table 9: Apprentice Status through 2017: All Apprentices

	UMEP (non ABC)	USEP	Joint	UMEP (ABC)	Total
Cancelled	60	19	15,895	1,371	17,345
Complete	16	85	8,079	563	8,743
Active	1	14	2,341	316	2,672
Other	0	0	164	8	172
Total	77	118	26,479	2,258	28,932
Cancellation Rate	0.78	0.16	0.66	0.71	0.66
Completion Rate	0.21	0.72	0.34	0.29	0.34

Source: RAPIDS-Nevada data.

Table 10: Apprentice Status through 2017: Electricians

	UMEP (non ABC)	USEP	Joint	UMEP (ABC)	Total
Cancelled	19	4	757	998	1,778
Complete	4	15	1,068	454	1,541
Active	0	0	384	260	644
Other	0	0	7	4	172
Total	23	19	2,216	1,716	3,974
Cancellation Rate	0.83	0.21	0.41	0.69	0.54
Completion Rate	0.17	0.79	0.59	0.31	0.46

Source:RAPIDS-Nevada data.

Table 11: Apprentice Status through 2017: Plumber/Pipefitter

	UMEP (non ABC)	USEP	Joint	UMEP (ABC)	Total
Cancelled	10	0	432	285	727
Complete	0	0	520	95	615
Active	0	0	76	56	132
Other	0	0	12	4	16
Total	10	0	1040	440	1490
Cancellation Rate	1.00	---	0.45	0.75	0.54

Source:RAPIDS-Nevada data.

Performance of Apprenticeship Programs by Sponsor Type: Wage Rates

Another way to assess the performance of the various types of apprenticeship programs is by comparing wages of apprentices before and after the training. To compare wages we jump right to the 'apples-to-apples' comparison of 8000-hour electricians in JMEPs compared to UMEP-ABCs. The data presented in the first panel of Table 12 show mean and median starting and exiting wages of apprentices who cancelled their programs. In the narrative, we will focus on median rather than mean wages. It is often preferable to report median wages in the context of wages, because the median is less affected by outlying values. The typical starting wage for an electrician trained in UMEP-ABC was $11.75 per hour compared to $13.77 per hour for apprentices in a JMEP, which represents a 17 percent premium for JMEP apprentices. These wages were not adjusted for inflation, thus do not reflect current wage rates.

Upon cancellation, the median wages of both groups jump, suggesting that the investment in skills did improve productivity, which was reflected in higher wages. For apprentices in UMEP-ABC the median exit wage was $13.00 per hour and for apprentices in JMEP the median exit wage was 17.95 per hour. The wage premium grew from start to cancellation for the UMEP-ABC the wage increase amounted to 11 percent, while wages increased by 20 percent for JMEP apprentices. To the extent that higher wages reflect a return to skills obtained, the joint program was obviously superior. What we do not know is the how many hours of work apprentices from each group had accumulated at the time of cancellation.

The second panel of Table 12 focuses on wages of electrician apprentices who complete the 8000-hour programs. The starting wages of completers was the same as that of cancellers. The median exit wage, however, grew substantially for apprentices completing the JMEP, increasing from $13.77 to $38.99 per hour, a 183% increase. Wages for apprentices in the UMEP-ABC grew from $11.75 to $18.00 per hour, a 53 percent increase. Again, to the extent that higher wages reflect a return to skills obtained, joint programs substantially out-perform USEP-ABC programs.

Table 12: Starting and Exit Wages of Apprentices, Electricians in 8,000 Hour Programs

	Starting Wage ($)			Exit Wage ($)			Percent Change	
	Mean	Median	N	Mean	Median	N	Mean	Median
Cancellations								
All Programs	12.62	13.00	1,081	15.92	13.77	994	26%	6%
UMEP	10.80	10.80	7	11.70	11.70	7	8%	8%
USEP	---	---	---	---	---	---	---	---
JMEP (Joint)	14.29	13.77	412	19.28	17.95	414	35%	30%
UMEP (ABC)	11.60	11.75	662	13.54	13.00	573	17%	11%
Completions								
All Programs	12.94	13.21	842	28.06	32.40	798	117%	145%
UMEP	10.80	10.80	4	11.70	11.70	4	8%	8%
USEP	---	---	---	---	---	---	---	---
JMEP (Joint)	13.82	13.77	529	35.09	38.99	487	154%	183%
UMEP (ABC)	11.45	11.75	309	17.13	18.00	307	50%	53%

Source: RAPIDS-Nevada data.

Performance of Apprenticeship Programs by Sponsor Type: Racial and Ethnic Diversity of Registrants

Another aspect of apprenticeship programs that has drawn attention of analysts and policy makers is the racial and ethnic diversity of their registrants and graduates. Table 13 shows the distribution of registrants in federally recognized apprenticeship programs by racial and ethnic category over the period between 2000 and 2017. The results indicate that a majority

of registrants identified as 'White/Non-Hispanic in all four types of apprenticeship programs. The registrants in JMEPs were 51 percent White/Non-Hispanic compared to 58 percent for the UMEPs-ABC. African Americans made up 8 percent of registrations in the JMEPs, which is similar to the percentage in UMEPs-ABC at 10 percent. JMEPs were substantially more likely to register apprentices of Hispanic ethnicity than the UMEPs-ABC -- 34 percent compared to 22 percent – but were less likely to register Asian apprentices – 2 percent compared to 5 percent.

Table 13: Racial/Ethnic Composition of Apprentices 2000 – 2017: Registrations

	Type of Apprenticeship Program				
Race/Ethnicity	UMEP (non ABC)	USEP	Joint	UMEP (ABC)	Total
No Information Provided	5	0	309	38	352
White/Non-Hispanic	49	96	13507	1319	14971
African American	4	6	2211	236	2457
Native American	4	2	604	42	652
Asian	2	2	590	110	704
Hawaiian/ Pac. Islander	2	1	259	14	276
Hispanic of any Race	11	11	8999	499	9520
Total	77	118	26479	2258	28932
Percent in Various Programs	UMEP (non ABC)	USEP	Joint	UMEP (ABC)	Total
No Information Provided	6%	0%	1%	2%	1%
White/Non-Hispanic	64%	81%	51%	58%	52%
African American	5%	5%	8%	10%	8%
Native American	5%	2%	2%	2%	2%
Asian	3%	2%	2%	5%	2%
Hawaiian/ Pac. Islander	3%	1%	1%	1%	1%
Hispanic of any Race	14%	9%	34%	22%	33%

Source: RAPIDS-Nevada data.

Performance of Apprenticeship Programs by Sponsor Type: Racial and Ethnic Diversity of Completions

Another important question is whether the distribution in race and ethnic diversity in registrations persists to completions. If opportunities for work and training are not distributed equitably for working apprentices, one would see a significant difference in the racial and ethnic distributions of registrations compared to completions. Similar to the results on registrations, the

results in Table 14 on completions show that a majority identified as 'White/Non-Hispanic' in the four types of apprenticeship programs. The results also show that the percent of completions in the 'White/Non-Hispanic' category exceeded registrations for all program types. For white non-Hispanics, 51 percent of registrations were white non-Hispanic compared to completions at 55 percent. For UMEPs-ABC, registrations were 58 percent for White/Non-Hispanic and jumped to 64 percent for completions. These results suggest that in both types of programs, attrition was lower for white non-Hispanics than it was for other groups.

Table 14: Racial/Ethnic Composition of Apprentices Who Completed the Program

	Type of Apprenticeship Program				
Race/Ethnicity	UMEP (non ABC)	USEP	Joint	UMEP (ABC)	Total
No Information Provided	1	0	85	12	98
White/Non-Hispanic	12	73	4459	361	4905
African American	1	3	517	36	557
Native American	1	1	153	6	161
Asian	0	1	194	27	222
Hawaiian/ Pac. Islander	1	0	67	4	72
Hispanic of any Race	0	7	2604	117	2728
Total	16	85	8079	563	8743
Percent in Various Programs	UMEP (non ABC)	USEP	Joint	UMEP (ABC)	Total
No Information Provided	6%	0%	1%	2%	1%
White/Non-Hispanic	75%	86%	55%	64%	56%
African American	6%	4%	6%	6%	6%
Native American	6%	1%	2%	1%	2%
Asian	0%	1%	2%	5%	3%
Hawaiian/ Pac. Islander	6%	0%	1%	1%	1%
Hispanic of any Race	0%	8%	32%	21%	31%

Source: RAPIDS-Nevada data.

In both JMEPs and UMEP-ABC groups, 6 percent of completions identified as African American, which is slightly lower than the percent of registrations so identifying. The percent of completions identifying as Hispanic stayed roughly the same for completions in the JMEP and UMEP-ABCs, where 32 percent of completions in the JMEP groups identified as Hispanic compared to 21 percent identifying as Hispanic in the UMEPs-ABC group.

Table 15 focuses the results on race and ethnicity for completions of electrical apprenticeship programs. Notice African American apprentices are more highly represented in among apprentices who completed JMEPs, while Hispanic apprentices are more highly represented in the UMEP-ABC category.

Table 15: Racial/Ethnic Composition of Apprentices Who Completed An Electrical Program

	Type of Apprenticeship Program				
Race/Ethnicity	UMEP (non ABC)	USEP	Joint	UMEP (ABC)	Total
No Information Provided	0	0	10	7	17
White/Non-Hispanic	4	15	709	287	1015
African American	0	0	121	32	153
Native American	0	0	13	6	19
Asian	0	0	29	24	53
Hawaiian/ Pac. Islander	0	0	16	4	20
Hispanic of any Race	0	0	170	94	264
Total	4	15	1068	454	1541
Percent in Various Programs	UMEP (non ABC)	USEP	Joint	UMEP (ABC)	Total
No Information Provided	0%	0%	1%	2%	1%
White/Non-Hispanic	100%	100%	66%	63%	66%
African American	0%	0%	11%	7%	10%
Native American	0%	0%	1%	1%	1%
Asian	0%	0%	3%	5%	3%
Hawaiian/ Pac. Islander	0%	0%	1%	1%	1%
Hispanic of any Race	0%	0%	16%	21%	17%

Source: RAPIDS-NEVADA data

Performance of Apprenticeship Programs by Sponsor Type: Registrations and Completions by Gender

The construction industry is one of the most male-dominated of all major industries. Nationwide, female workers comprised only 3 percent of new apprentice registrations, which is consistent with the pattern distribution of apprentice registrations in Nevada. Figures in Table 16 indicate that 4 percent of new registrations in JMEPs were female. The figure is slightly lower

for UMEP – ABC, where 3 percent of new registrations were female. The percent of completions identifying as female remained at 4 percent for JMEPs and dropped to 2 percent for UMEP-ABC.

Table 16: Gender Composition of Apprentices: All Registrations and Completions

	Type of Apprenticeship Program				
All Registrations	UMEP (non ABC)	USEP	Joint	UMEP (ABC)	Total
Male	75	110	25297	2179	27661
Female	2	8	1182	79	1271
Total	77	118	26479	2258	28932
Completions					
Male	16	81	7762	551	8410
Female	0	4	317	12	333
Total	16	85	8079	563	8743
Percent All Registrations	UMEP (non ABC)	USEP	Joint	UMEP (ABC)	Total
Male	97%	93%	96%	97%	96%
Female	3%	7%	4%	3%	4%
Percent Completions					
Male	100%	95%	96%	98%	96%
Female	0%	5%	4%	2%	4%

Source: RAPIDS-Nevada data.

Performance of Apprenticeship Programs by Sponsor Type: Registrations and Completions in Electrician Apprenticeships by Gender

As stated previously, most of the apprenticeships in question in the UMEP-ABC are in electrical, so in order to make an apples-to-apples comparisons of the gender distribution of registrations and completions, we compiled data focusing only on electrical apprentices. The statistics in Table 17 demonstrate that, although, the occupation is still highly male-dominated, 8 percent of registered electrical apprentices in JMEP were female compared to 4 percent female in UMEPs-ABC. Similarly, 8 percent of JMEP's completions were female, while completions in UMEP-ABC fell to 2 percent. Although the training programs producing highly skilled electricians remain highly male-dominated, the JMEP sector appears to be making more headway than the UMEP-ABC sector in providing opportunities for female workers.

Table 17: Gender Composition of Electrician Apprentices: All Registrations and Completions

	Type of Apprenticeship Program				
All Registrations	UMEP (non ABC)	USEP	Joint	UMEP (ABC)	Total
Male	22	16	2029	1651	3718
Female	1	3	187	65	256
Total	23	19	2216	1716	3974
Completions					
Male	4	12	979	443	1438
Female	0	3	89	11	103
Total	4	15	1068	454	1541
Percent All Registrations	UMEP (non ABC)	USEP	Joint	UMEP (ABC)	Total
Male	96%	84%	92%	96%	94%
Female	4%	16%	8%	4%	6%
Percent Completions					
Male	100%	80%	92%	98%	93%
Female	0%	20%	8%	2%	7%

Source: RAPIDS-Nevada data.

Performance of Apprenticeship Programs by Sponsor Type: Registrations and Completions by Veteran Status

The results in Table 18 suggest that 7 percent of trainees in UMEP-ABC and JMEPs are veterans. Jumping to Table 19 where data on just electrical apprenticeships are compiled, the veteran status of apprentices climbs to 12 percent compared to 7 percent for UMEP – ABC programs.

Table 18: Veterans: All Registrations and Completions

	Type of Apprenticeship Program				
All Registrations	UMEP (non ABC)	USEP	Joint	UMEP (ABC)	Total
NonVeteran	69	111	24659	2099	26938
Veteran	8	7	1820	159	1994
Total	77	118	26479	2258	28932
Completions					
NonVeteran	14	79	7549	527	8169
Veteran	2	6	530	36	574
Total	16	85	8079	563	8743
Percent All Registrations	UMEP (non ABC)	USEP	Joint	UMEP (ABC)	Total
NonVeteran	90%	94%	93%	93%	93%
Veteran	10%	6%	7%	7%	7%
Percent Completions					
NonVeteran	88%	93%	93%	94%	93%
Veteran	13%	7%	7%	6%	7%

Source: RAPIDS - Nevada data.

Table 19: Veterans as Electrician Apprentices: All Registrations and Completions

Type of Apprenticeship Program					
All Registrations	UMEP (non ABC)	USEP	Joint	UMEP (ABC)	Total
NonVeteran	20	17	1954	1598	3589
Veteran	3	2	262	118	385
Total	23	19	2216	1716	3974
Completions					
NonVeteran	4	13	944	423	1384
Veteran	0	2	124	31	157
Total	4	15	1068	454	1541
Percent All Registrations	UMEP (non ABC)	USEP	Joint	UMEP (ABC)	Total
NonVeteran	87%	89%	88%	93%	90%
Veteran	13%	11%	12%	7%	10%
Percent Completions					
NonVeteran	100%	87%	88%	93%	90%
Veteran	0%	13%	12%	7%	10%

Source: RAPIDS - Nevada data

Performance of Apprenticeship Programs by Sponsor Type: Registrations and Completions by Education Level

Differences in the preparation of apprentices by program sponsor type may also be of interest to policy makers. Table 20 presents data on the educational attainment of electrical apprentices in JMEPs and UMEP-ABCs in Nevada. The numbers are quite similar indicating that 98 percent and 97 percent of JMEP and UMEP-ABC apprentices start their programs with either a GED or high school diploma. The educational distribution of apprentices that complete their program mirrors that of registrations.

Table 20: Educational Attainment of Apprentices: Electricians in 8000 Hour Programs

	Type of Apprenticeship Program				
All Registrations	UMEP (non ABC)	USEP	Joint	UMEP (ABC)	Total
Less than 8th Grade	0	---	1	0	1
9th to 12th Grade	11	---	22	38	71
GED	0	---	102	171	273
High School or Greater	12	---	1204	996	2212
Post Secondary or Tech Training	0	---	5	2	7
Total	23	---	1334	1207	2564
Completions					
Less than 8th Grade	---	---	---	---	---
9th to 12th Grade	4	---	10	8	22
GED	0	---	26	34	60
High School or Greater	0	---	496	265	761
Post Secondary or Tech Training	0	---	1	0	1
Total	4	0	533	307	844
Percent All Registrations	UMEP (non ABC)	USEP	Joint	UMEP (ABC)	Total
Less than 8th Grade	0.0%	---	0.1%	0.0%	0%
9th to 12th Grade	48%	---	2%	3%	3%
GED	0%	---	8%	14%	11%
High School or Greater	52%	---	90%	83%	86%
Post Secondary or Tech Training	0.0%	---	0.4%	0.2%	0.3%
Percent Completions					
Less than 8th Grade	---	---	---	---	---
9th to 12th Grade	100%	---	2%	3%	3%
GED	0%	---	5%	11%	7%
High School or Greater	0%	---	93%	86%	90%
Post Secondary or Tech Training	0%	---	0%	0%	0%

Source: RAPIDS-Nevada data.

Summary and Conclusions from the RAPIDS Data

Over the past decade and a half in Nevada, federally recognized apprenticeship programs from the buildings trades have registered and trained almost 29,000 workers for jobs in 32 distinct occupations. The skills obtained by workers were obviously valuable to employers. For example, even after workers exited a recognized UMEP apprenticeship program before finishing graduation, wages increased by 11 percent. The analogous figure for workers exiting JMEPs before obtaining journey-worker status was 30 percent. Not surprisingly, earnings power was significantly enhanced for apprentices that finished UMEPs, where wages grew by 53 percent. For JMEPs, however, wages after successful completion of the program were 183 percent higher that entry-level apprentice wages.

Such results obviously indicate that apprenticeship programs in the building trades provide valuable opportunities for upward economic mobility. The highly skilled workers produced by such programs command high, middle-class, family supporting wages. The results also demonstrate that more than 90 percent of the apprentices during the past decade and a half have been registered in JMEPs, where a trade union and a group of employers are signatories to a collective bargaining agreement, which includes details the operation and financial support of an apprenticeship training program. Such jointly sponsored multi-employer programs provide job training opportunities for a broad array of trades and provide skills pertinent to many construction occupations. Although the non-union sector only accounts for less than 10 percent of total apprentice registrations, they are more prominent in the electrical and plumbing/pipefitting trades, especially in Northern Nevada.

As a matter of good public policy, it seems obvious that decision-makers should promote policies leading to a highly skilled, highly paid construction workforce. Such policies, by supporting institutions that provide training opportunities as outlined in this report support, lead to economic opportunity for individuals and better outcomes for employers. As the academic literature has demonstrated and as our evidence suggests, PWLs are an important public policy instrument to drive economic growth and development in the construction industry to the high road, where workers are highly skilled and productive, wages and benefits are high enough to support families, and workplaces are safe. Policies that undermine such high-road development – such as Assembly Bill 172 – ought to be avoided.

AB 172 and Apprenticeship Utilization Rates in School Construction

It is obvious that joint programs provide an out-sized share of training opportunities for apprentices to become highly skilled construction workers. Moreover, as the last section demonstrated, joint training programs exist along a wide spectrum of skills necessary to build a modern school. If Assembly Bill 172 discourages signatory contractors from bidding work on school projects, then it makes sense that apprentice utilization rates on school construction will fall (because signatories are more likely to participate in training programs).

Why would signatory contractors, who are more likely to participate in apprenticeship training programs than non-signatories, be less likely to bid school projects with AB 172 in

force? Based on the terms and conditions of their collective agreement with the union, signatory contractors are obligated to pay prevailing wages on public projects. In order to be competitive in the bidding process, signatory contractors must ask for concessions from the union either through a reduction in wages, benefits, and pensions, or they must accept lower profit margins. Rather than bearing the costs of re-bargaining the agreement or accepting lower margins, many contractors just refuse to bid the work, which means that a greater share of the work goes to non-signatories, who are less likely to participate in a formal apprenticeship training program.

We would, therefore expect to see that over time AB 172 would cause a reduction in the apprenticeship utilization rate in school construction. To directly test the proposition one would want apprenticeship utilization rates on school construction projects over time, so that such rates could be observed before AB 172 and after the law. Unfortunately, such data do not exist. We do however have ways to assess the rate. In particular, we compiled data on apprenticeship utilization for projects in the Clark County School district during the calendar year 2017 (see Appendix 3). The apprenticeship utilization rate is relatively high in electrical and plumbing, but excluding those two trades the utilization rates are only 5 percent. Overall for school construction the rate was 10.44 percent.[71] This is consistent with our argument, because in electrical and plumbing, there are UMEP – ABC training programs that employ apprentices, while in the other trades there are not. So ironically, we are building schools to educate and train the next generation of workers, but in part because of AB 172, we are making harder to train the next generation of construction workers through hands-on apprenticeship training associated with the building and maintenance of the education infrastructure.

Other evidence that is consistent with a fall in the apprenticeship utilization rate. In the previous section, we gathered data on roofing and asphalt. According to the results in Table 1, the signatory market share before AB 172 was 68.9 percent. After AB 172, the share fell to 40.6 percent. Obviously, if signatory contractors are more likely to train workers through their apprenticeship programs, and they have lost market share in school construction, the amount of training that is occurring while building schools must necessarily fall. Moreover, all the benefits that accrue from a more robust system of apprenticeship training associated with joint apprenticeship programs will fall along with it. Thus, the more comprehensive skills training across trades, higher completion rates, higher family-supporting wages for fully trained workers, progress toward gender equality, and the greater support for training veterans are all benefits that are diminished because of the policy in AB 172.

[71] The state of Washington currently has adopted a policy mandating an apprenticeship utilization rate of 15 percent on all public construction projects. https://apps.leg.wa.gov/RCW/default.aspx?cite=39.04.320 <accessed 02-16-19>.

Appendix A: Statistical (Regression) Analysis of CCSD and WCSD Asphalt and Roofing Projects

The data on winning bids for the samples of CCSD asphalt and roofing projects and of combined roofing projects for CCSD and WCSD are used to estimate the following models that examine the effect of prevailing wage requirements on project cost and the level of bid competition.

Model 1

$$Ln\ Real\ Bid\ Cost_{it} = \beta_0 + \beta_1\ Prevailing\ Wage\ Bid_{it} + \beta_2\ Union\ Contractor_{it} + \beta_3\ Bid\ After\ 2015_{it} + \beta_4\ Ln\ Real\ Cost\ Estimate_{it} + \beta_5\ School\ Type_{it} + \beta_6\ Quarter_{it} + \beta_7\ Project\ Type_{it} + \beta_8\ CCSD_{it} + \mu_{it}$$

Model 2

$$Ln\#\ Bidders_{it} = \beta_0 + \beta_1\ Prevailing\ Wage\ Project_{it} + \beta_2\ Bid\ After\ 2015_{it} + \beta_3\ Ln\ Real\ Cost\ Estimate_{it} + \beta_4\ School\ Type_{it} + \beta_5\ Quarter_{it} + \beta_6\ Project\ Type_{it} + \beta_7\ CCSD_{it} + \mu_{it}$$

Where *Ln Real Bid cost* is the natural log of the inflation-adjusted bid for project *i* in time period *t*. The producer price index for asphalt materials and nonresidential roofing contractors available from the Bureau of Labor Statistics are used to control for changes in prices over time.[72] *Prevailing Wage Bid* is a dummy variable equal to one for bids on school projects that exceeded the relevant threshold for prevailing wage coverage, and zero otherwise. Prevailing wage coverage applies to an awarded project if the winning bid is equal to, or greater than the relevant coverage threshold. For example, prior to the policy change that took effect on June 9, 2015 prevailing wages were required if the winning bid was equal to, or exceeded $100,000. After June 9, 2015, prevailing wages applied to projects if the winning bid equaled or exceeded $250,000. This variable measures the cost difference between projects that were, and were not covered by prevailing wage requirements. *Bid After 2015* is equal to one for bids that were submitted after the prevailing wage policy change on June 9, 2015, zero otherwise. It is important to measure the effect of prevailing wage regulations taking into account the size and complexity of a project as these factors also affect building costs. *Ln Real Cost Estimate* is the natural log of the CCSD's estimated cost of a project and is used as the measure of project size and complexity.

Previous studies that focus on new school construction use square footage as the measure of project size (Azari-Rad, Philips, and Prus 2003). Since this study includes roofing and asphalt work, the district's estimated cost is a better measure of the scope and complexity of a project regardless of its specific work type. Elsewhere, De Silva, Dunne, and Kosmopoulou (2003) and Duncan (2015) use the engineer's estimate as a measure of project size and complexity.[73]

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[72] See "Producer Price Index by Industry: Roofing Contractors, Nonresidential Building Work," Bureau of Labor Statistics, U.S. Department of Labor accessed at: https://fred.stlouisfed.org/series/PCU23816X23816X and the "Producer Price Index by Industry: Asphalt Paving Mixture and Block Manufacturing: Asphalt and Tar Mixtures (Excluding Liquid), Including Bitumen of Asphalt Concrete, Asphalt Paving Cement," Bureau of Labor Statistics, U.S. Department of Labor accessed at: https://fred.stlouisfed.org/series/PCU3241213241210131.

[73] According to CCSD personnel the cost estimate is based on several factors including information from RS Means construction cost indexes and historical CCSD project costs. While the district adjusts estimated costs for changes in materials (such as current rising steel costs), estimates are not based on the payment of prevailing wages nor were

Projects requiring the payment of prevailing wage laws will have relatively higher bids costs because these bids exceed the minimum thresholds. As a consequence, it is important to measure the effect of prevailing wage coverage relative to the estimated cost, or holding *Ln Real Estimate* constant. *School Type* is a vector of dummy variables for work on elementary, middle, high, and other education buildings built in the district (such as warehouses, etc.). *Quarter* is a vector of dummy variables measuring distinguishes bids submitted during different quarters of the year. *Roof Project* is a vector of dummy variables that distinguish between asphalt and roofing work. *Roof Project* is only included in the estimate for CCSD asphalt and roofing projects. Similarly, *CCSD* is only included for the estimate of combined CCSD and WCSD roofing projects. This variable is equal to one if the roofing project is located in CCSD and zero otherwise. The error term is μ.

While Model 1 focuses on the effect of prevailing wage requirements on project costs, Model 2 measures the effect of the wage policy on the level of bid competition. In Model 2 the natural log of the number of bidders is the dependent variable. Model 2 allows us to determine if the level of bid competition differs between projects that are and not covered by prevailing wage standards and if bid competition differed after the 2015 policy change. Both models examine the effect of prevailing wage requirements taking into consideration differences in project size, type, and other factors that may also affect building costs and bid competition.

A common issue in regression analysis concerns the statistical power of an estimate, or the sample size needed to insure a reasonable chance of rejecting the null hypothesis for a coefficient. In this application, the concern is over the sample size needed to reject the null hypothesis for the coefficient for the focus *Prevailing Wage Project* variable. Based on Green's (1991) method, a sample sizes between 48 and 51cases is needed to identify a large effect size for regressions, such as models 1 and 2 with 8 independent variables each, to achieve the conventional power norm of 0.80 with a two-tailed test and a 0.05 significance level. The effect size is based on the expected R^2 of the estimate. The larger the expected R^2, the larger the effect size and the smaller the sample size necessary for statistical power. Green's large effect size is based on an R^2 of 0.26. Goodness of fit measures for previous research examining winning bids for school construction projects range from 0.32 and 0.99 (see Vincent and Monkkonen 2010, Azari-Rad, Philips and Prus 2003, Onsarigo, Duncan, and Atalah 2018 and for examples). Onsarigo, Duncan, and Atalah (2018) report a goodness of fit measure of 0.41 for the estimate of bid competition for school construction projects. These results suggest sample sizes smaller than those recommended by Green for this application. Regardless, the estimates for models 1 and 2 reported below include 7 to 8 predictors with sample sizes ranging between 77 and 86 observations suggesting sufficiently large samples.

Results

Regression results for CCSD asphalt and roofing projects are reported in Appendix Table A.[74] Results for Model 1 indicate that, taking into consideration bids that were placed before and after the 2015 policy change, the size and complexity of a project, the signatory status of the winning contractor, and other factors that influence construction costs, prevailing wage

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adjustments made for changes in prevailing wage rates after the introduction of the 2015 policy. According to WCSD personnel the district's cost estimate is based on the wages union contractors with collectively bargained rates that exceed the 90% prevailing standard.

[74] The estimates have been corrected for heteroskedasticity.

requirements do not have a statistically significant effect of bid costs. This finding is consistent with preponderance of peer-reviewed research indicating that prevailing wage requirements are unrelated to construction costs. This finding also does not support claims by proponents of AB 172 that reducing prevailing wage compensation by 10% would reduce public construction costs.[75]

[75] See "Nevada Assembly Bill 172." Legiscan. Accessed at: https://legiscan.com/NV/text/AB172/2015 and "Senate passes prevailing wage exemption bill." Las Vegas Review Journal, February, 16, 2915. Accessed at: https://www.reviewjournal.com/news/politics-and-government/nevada/senate-passes-prevailing-wage-exemption-bill/

Appendix Table A: Regression Results for Winning Bids and the Number of Bidders for Clark County School District Asphalt and Roof Replacement Construction Projects, 2009-2018. Dependent Variable = Log of Low Bid (Model 1), Log of Number of Bidders (Model 2)

	Model 1	Model 2
Variable	Coefficient	Coefficient
Prevailing Wage Project	0.117 (0.16)	0.002 (0.15)
Union Contractor	– 0.048 (0.07)	–
Bid After 2015	0.181* (0.10)	–0.292** (0.14)
Ln Real Cost Estimate	0.764*** (0.05)	0.012 (0.06)
Elementary School	– 0.314* (0.18)	0.302** (0.12)
Middle School	–0.077 (0.20)	–0.332** (0.17)
High School	– 0.236 (0.26)	0.194 (0.30)
Quarter I Bid	–0.057 (0.09)	0.105 (0.15)
Quarter III Bid	0.276** (0.12)	–0.247 (0.18)
Quarter IV Bid	0.089 (0.07)	–0.356** (0.16)
Roof Replacement	0.399*** (0.10)	0.142 (0.11)
Constant	2.624 (0.54)	0.898 (0.73)
N=	77	83
F=	156.98	3.45
R^2 =	0.948	0.213

Source: Clark County School District. Standard errors in parentheses. * Statistically significant at the 0.1 level. ** Statistically significant at the 0.05 level. *** Statistically significant at the .01 level.

It is unlikely that the 90% change resulted in significant tax payer savings as labor costs are a low percent of total construction costs. Data from the *Economic Census of Construction* indicates that labor costs (wages and benefits) are 23% of total construction costs in the U.S. The corresponding figure for all construction in Nevada is 22%. Labor costs are approximately 27% of total construction costs for specialty roofing contractors and about 28% of total costs for contractors involved in highway, street, and bridge work (this category includes CCSD asphalt projects).[76] So, the 10% reduction in prevailing wages mandated by AB 172 affects a small portion of overall building costs in Nevada. Other results indicate the winning bids of union contractors are no more costly than those submitted by nonunion builders.

The coefficient for *Ln Real Cost Estimate* indicates that if the district's estimated project cost increases by one percent, low bids increase by approximately 0.76%. This effect is significant at the 0.01 level. With the cost estimate held constant, the coefficients for the other variables account for possible differences in how the school district and contractors price features of a project. The coefficient for the *Bid After 2015* variable indicates that low bids submitted after June 6, 2015 are approximately 20% higher than bids submitted prior to this date.[77] This effect is statistically significant at the 0.10 level and is consistent with the view that contractors overestimated the real increase in construction costs relative to the district's cost estimate as the construction industry expansion continued into 2018. Regardless of the cause, it is important to understand that this increase in contractor bids applies to all projects, not simply those requiring the payment of prevailing wages. Other results reported in Appendix Table A indicate that contractor pricing of projects at elementary schools, bids placed during the third quarter of the year, and roofing projects, relative to the respective reference categories, differed from the district's estimates in statistically significant ways. The sample size is reduced for Model 1 due to the omission of four observations missing union contractor status. The results of this model do not change significantly with the estimation of 81 observations and the omission of *Union Contractor*.

Results for Model 2 indicate that the level of bid competition is no different on projects that require the payment of prevailing wages. This finding is consistent with other research indicating the prevailing wages to not discourage contractors from bidding on projects covered by the wage policy. Other results indicate that the level of bid competition does not vary with the size or complexity of a project (*Ln Real Cost Estimate*). Competition decreased by approximately 34% after June of 2015.[78] This result is consistent with the view that union contractors pursued other bid opportunities that were not covered by the 90% prevailing wage standard as the construction industry expanded after 2015. Competition is higher on elementary school projects, but lower on middle school projects relative to other education building construction. Bid competition is lower during the fourth quarter of the year relative to the second quarter. These differences are significant at the 0.05 level. The level of bid competition between roofing and asphalt projects is not statistically significant.

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[76] See the U.S. Census Bureau, *Economic Census of Construction*, Construction: Geographic Area Series: Detailed Statistics for Establishments, accessed at: http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_23A1&prodType=table.

[77] The correct interpretation of the percentage change for the coefficient for a dummy variable in a semi-log estimate is given by $(e^{\beta_i}-1)$, or in this case, $e^{0.181}-1= 0.198$. See Peter Kennedy (1981).

[78] $e^{-0.292}-1= -0.339$.

Results for roofing projects from CCSD and WCSD are reported in Appendix Table B. Are generally consistent with the results for CCSD asphalt and roofing work. Prevailing wage laws are not associated with increased building costs or reduced bid competition. The bids of roofing contractors who are signatories to collective bargaining agreements are no more costly than the bids of nonunion contractors. Model 1 on is based on that portion of the sample with complete information on contractor signatory status. The results from Model 1 do not change when *Union Contractor* is omitted with all 86 observations included.

Appendix Table B: Regression Results for Winning Bids and the Number of Bidders for Clark County and Washoe County School District Roof Replacement & Repair Construction Projects, 2009-2018. Dependent Variable = Log of Low Bid (Model 1), Log of Number of Bidders (Model 2)

	Model 1	Model 2
Variable	Coefficient	Coefficient
Prevailing Wage Project	0.120 (0.13)	–0.087 (0.23)
Union Contractor	– 0.036 (0.06)	–
Bid After 2015	0.300*** (0.10)	–0.236 (0.18)
Ln Real Cost Estimate	0.734*** (0.04)	– 0.003 (0.06)
Elementary School	– 0.112 (0.15)	0.040 (0.20)
Middle School	0.145 (0.16)	0.153 (0.23)
High School	0.095 (0.18)	0.077 (0.26)
Quarter I Bid	–0.203** (0.09)	– 0.070 (0.13)
Quarter III Bid	0.126 (0.14)	–0.387* (0.22)
Quarter IV Bid	0.035 (0.07)	–0.399** (0.19)
Clark County School District	0.287*** (0.09)	0.613*** (0.15)
Constant	2.962 (0.49)	0.996 (0.60)
N=	83	86
F=	204.43	4.70
R^2 =	0.954	0.313

Source: Clark County and Washoe County school districts. Standard errors in parentheses. * Statistically significant at the 0.1 level. ** Statistically significant at the 0.05 level. *** Statistically significant at the .01 level.

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