

# Impact of Prevailing Wages on the Cost Along the Different Construction Trade

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**Abstract-** In 1997, the Ohio senate passed Senate Bill 102 which established the Ohio School Facilities Commission as a separate agency to oversee the rebuilding projects of the public schools in Ohio. To lower the construction cost, the bill exempted construction contractors from paying prevailing wages on these projects. The purpose of this research was to investigate this hypothesis through the statistical analysis of 8093 bids received for the schools' construction from the year 2000 to 2007. Union contractors who paid their workers union wages and non-union contractors who did not pay prevailing wages bid these projects. The hypothesis that prevailing wage laws (PWL) increased the construction cost was tested by comparing the bids/SF from both groups (union and non-union) along the different construction trades. The research indicates that there was statistical significant difference between the bids/SF for union contractors and the bids/SF for non-union contractors for only the following trades: electrical, equipment, existing conditions, exterior improvements, wood, plastics and composites, and furnishings. There was no statistical significant difference in trades' bids.

**Keywords-** Prevailing Wages; Union; Non-Union; Construction Bids

## I. INTRODUCTION

The Davis-Bacon Act of 1931 and its related acts require that all contractors and subcontractors performing on federal contracts or federally assisted contracts in excess of \$2,000 pay their laborers no less than the prevailing wage rates and fringe benefits, as determined by the Secretary of Labor, for corresponding classes of laborers and mechanics employed on similar projects in the area [1]. Generally, the Ohio labor laws mandate that the laborers working on projects funded by the State of Ohio have to be paid prevailing wages and benefits. However, in 1997, Ohio Senate Bill 102 of the 122nd General Assembly created the Ohio School Facilities Commission (OSFC) as a separate and distinct agency to oversee the rebuilding of public schools in Ohio and exempted construction undertaken by school districts from Ohio's prevailing wage laws (PWL) to lower the cost of construction to the tax payer. This exemption does not conflict with the federal PWL because this project was fully funded through the state of Ohio [2].

Considerable literature and news articles debated the merit of PWL; some estimated a cost increase of more than 30% and others stated that there would be no cost increases. While these studies agree that Davis-Bacon raises wage rates and, by implication, costs to the government, there is wide variation in the estimates. Kessler & Katz (2001) estimated that the Davis-Bacon Act increased the cost of construction to the federal government from 1.4% to 24%. There are many factors that affect the cost of a construction project which makes it difficult to isolate the impact of PWL from other factors.

The rebuilding of the public schools project in Ohio provided an excellent (but not perfect) opportunity to study the impact of PWL on prices for the owner. In this study, the authors compared the cost/square foot (SF) from 8093 bids from the year 2000 to 2007. Some of the contractors were union contractors who paid union wages; and some were non-union contractors who were exempt from paying prevailing wages after the passage of Ohio Senate Bill 102. These public schools were equitable and built to the same design guidelines and quality (personal communication with Eric Bode, OSFC). This paper adds to the studies that analyze the impact of PWL on the cost of construction by presenting a summary of literature against and for PWL followed by the analysis of 8093 bids to build these Ohio public schools.

### A. Arguments Against PWL

PWL increase labor costs, and consequently, the project construction costs. The Ohio Legislative Service Commission State House (OLSC) in its report titled "The Effects of the Exemption of School Construction Projects from Ohio's PWL" estimated the exemption saved the Ohio tax payer \$487.9 million in aggregate during the post-exemption period, an overall savings of 10.7%. Estimated savings on new construction projects were \$24.6 million (1.2%), estimated savings on school building additions to be \$408.0 million (19.9%), and estimated savings on school building alterations were \$55.2 million (2.7%). Estimated savings in urban counties totaled \$310.5 million (15.13%) while estimated savings in rural counties totaled \$177.4 million (8.65%). The report stated that these savings were at least partially attributable to the prevailing wage exemption, but their research team could not confidently confirm that this was the case [2]. The OLSC report, citing Fraundorf, Farrell, & Mason (1984) in their study of the effect of the Davis-Bacon Act on construction costs in rural areas, concluded that "a project subject to the Act would cost on average 26.1% more than the same project not subject to the Act." Fraundorf, et al, stated that the reason for the increase is based on how workers are utilized.

The OLSC report further elaborated that analyses done in conjunction with the repeal or attempted repeal of the PWL in Florida, Iowa, Kentucky, Louisiana, Maryland, Minnesota, and New Hampshire expected construction savings of 9.4%. The report cited the following reasons for the cost increase under PWL: (1) PWL reduce competition - non-union contractors may choose not to bid on a project that is subject to prevailing wage requirements, reducing competition for union contractors, (2) PWL discriminate against minority and small contractors, (3) PWL hurt rural contractors and workers, (4) PWL do not guarantee quality, and (5) PWL do not increase local tax bases.

While empirical evidence related to productivity differentials was mixed, the contention that unions, on average, significantly raise productivity could not be sustained [3]. Freeman and Medoff (1983) argued that unions reduced profitability in general because their productivity effects, though substantive, were nevertheless insufficient to offset increases in wage costs and greater capital intensity [4].

Returns accruing from other correlates of market power (e.g., market share, foreign competition, and government entry restrictions) and from long-lived capital appear to be more important sources of union rents. Union rent seeking at the expense of long-lived tangible and intangible capital appears to lower firms' investment in physical capital, as well as to decrease R&D and other innovative and risk-taking activities. As a consequence, productivity growth tends to be slower in unionized firms and industries [3].

The savings estimates found in other literature are presented in Table 1. Although the studies indicate savings from the removal of prevailing wage requirements, none of these estimated savings meet the standards of statistical significance. A statistically significant result is unlikely to have occurred due to chance [5]. The estimated savings are considerably lower than the 20% to 25% savings that some opponents of PWL have claimed.

TABLE 1 ESTIMATED SAVINGS [2]

Author(s)	Savings
(Thieblot, 1975) [6]	0.6%
(Gould and Bittlingmayer, 1980) [7]	4 to 7%
(Prus, 1996) [8]	5.1%
(Prus, 1999) [9]	3.8%
(Phillips, 1999) [10]	2.4%
(Phillips, 2001) [11]	0.7%

### B. Arguments for PWL

The studies that refute the argument that PWL increase project costs are based on the premise that higher wages encourage the use of more productive workers that partially offset the direct effect of higher wages on cost. The National Heavy and Highway Alliance reviewed and analyzed records for highways built from 1994 to 2002. The findings confirmed that when workers' skills and productivity justified higher wage rates, highways were built at the same or even lower cost per mile than when lower wage, lower skilled workers were employed as shown in Table 2 [12].

TABLE 2 WAGES AND THE COST PER MILE [12]

	Low Wage	High Wage
Average Hourly Wage	\$15.68	\$26.34
Hours Per Mile	10, 276	6,991
Labor Costs Per Mile	\$161,128	\$184,138
Total Costs Per Mile	\$857,965	\$826,509
Difference	\$31,456	

Philips (2001) compared the cost/SF of 201 public schools without PWL to the cost/SF of 190 public schools with PWL built in Kentucky, Ohio and Michigan from 1991 to 2000. The study concluded that there was no statistically significant difference between those two groups after adjusting for inflation. However, a review of costs one year after Ohio exempted school construction from prevailing wage requirements showed that the cost for new school construction increased from \$77/SF before the exemption to \$90/SF one year later. A more complex statistical model that estimated cost/SF for new public schools found that school boards could save 10% of construction costs by starting in the spring compared to winter [11].

Gillena, Baltz, Gassel, Kirsch, & Vaccaro (2002) evaluated injured construction workers' perceptions of workplace safety climate, psychological job demands, decision latitude, and coworker support, and the relationship of those variables to the injury severity sustained by the workers. There were statistically significant differences between union and nonunion workers' responses regarding perceived safety climate. Union workers were more likely than non-union workers to: (a) perceive their supervisors as caring about their safety; (b) be made aware of dangerous work practices; (c) have received safety instructions when hired; (d) have regular job safety meetings; and (e) perceive that taking risks was not a part of their job.

OLSC (2002) also stated the following benefits for prevailing wage laws: (1) PWL protect both the wages and jobs of local workers by preventing "wage dumping" by outside contractors, (2) PWL reduce total construction costs by encouraging the use of more qualified and productive workers, (3) PWL assure quality construction and reduce delays and overruns, (4) PWL help maintain local tax bases, and (5) PWL provide stability in the construction industry.

#### *1) Background for the Rebuilding of Ohio Public School Project:*

The OSFC provides funding, management oversight, and technical assistance to local school districts for the construction and renovation of the Ohio school facilities in order to provide an appropriate learning environment for Ohio's children. The agency builds partnerships with school districts, design firms, construction managers, and trade contractors to construct quality schools [13]. The OSFC works with the local school districts through each stage of construction and breaks the process into the following categories: financial partnership, facility planning, and project management [14].

The OSFC serves as a funding partner for the school districts to finance their school construction projects. The program is designed to provide different levels of state funding assistance to the districts according to their financial abilities (the districts' assessed property valuation per pupil). In other words, the amount or share of the total project cost a district pays is based on the property valuation per pupil. This share for each district is calculated based on the *Derolph, v. the State of Ohio* (1997) case that preceded the creation of the OSFC. The calculation ensures that schools throughout the state are "adequate and equitable," in other words, the schools are similar (personal communication with Eric Bode, OSFC). The OSFC also provides funding assistance in the form of loans to the districts that need funding [15].

The goal of OSFC is to ensure statewide equity and quality for school facilities using a comprehensive standardized facilities assessment program and the Ohio School Design Manual (OSDM) to standardize the process. The OSFC Planning Group is responsible for the assessment and master planning of classroom facilities for schools participating in the OSFC program. As districts are permitted to choose their own architects, the OSDM provides districts and architects with standards of design and construction that assure a statewide standard of quality [16].

#### *C. The Bidding Process of OSFC*

OSFC uses an efficient project delivery model utilizing the private sector by employing private construction management firms to oversee projects. The bidding process for the OSFC projects is similar to that of other public projects. The process begins with public advertisement to bidders, which divides the work into trade packages and describes each package. The contractors' bids are publicly opened, read, and tabulated. Following the bid-opening meeting, the low bidders are evaluated against predetermined qualifications to determine whether they are responsible bidders [17].

## II. THE RESEARCH PROBLEM

There are many factors that affect the cost of a construction project which make it difficult to isolate the impact of PWL from other factors. As presented earlier, considerable literature and news articles debate the merit of PWL; some claim estimated cost increases of more than 26% and others claim that there are no cost increases. Labor unions, from the neoclassical view, use their monopolistic power to raise wages, thereby increasing costs [18]. From this point of view, it appears obvious that projects completed by union contractors would be more expensive than projects completed by non-union contractors. However, it is suggested that unions reduced turnover, increased quality, and improved productivity [18]. These conflicting views raise the question: can unions pay more and still submit a competitive bid due to higher productivity? The objective of this research was to test the hypothesis that bids - from contractors who did not pay prevailing wages - were significantly less than those from union contractors in the construction of the OSFC projects.

In order for a trade union to survive and bring the above cited PWL's qualities to the construction industry, union contractors must be competitive in a capitalistic market. If the compensation differential exceeds the productivity differential, then non-union firms will underbid union firms; therefore, union contractors will need to adopt corrective actions to survive. Some examples of these corrective actions include: lower union labor wages, provide more and better union training, re-evaluate the bidding strategy, utilize equipment more and worker less, etc. However, if the union workers are more productive than non-union workers, then the union workers should be able to obtain higher wages without having a negative impact on cost. Unions can use this research to be more competitive and turn around the decline in union membership that has been occurring since 1979 [19].

## III. DATA ANALYSIS

The OSFC provided the authors with several standard reports that were combined into one spreadsheet. The collected data for the research included: county name where the school is located, school district, school name, contractor's name, contractor's address, contractor's trade, contractor's union affiliation, contractor's bid amount, architect/engineers' (A/E) estimate, and the square footage for each school. Upon review of the received data, nearly half of the bids did not have a union/non-union affiliation of the contractor. Extensive efforts were made to find out the union/non-union status of every contractor. These efforts included (1) Internet search, (2) contacting the regional union offices across Ohio, and (3) contacting

the contractors directly. However, it was not possible to collect the affiliation for all the contractors because some had disconnected phone lines and/or had gone out of business. The research team determined the union/nonunion affiliations of the contractors for 8093 out of 8325 bids (97.23%). The total value of the known union/non-union affiliations bids was \$12,495,822,258 of the total \$12,667,724,130 or 98.64% of all bids based on dollar amount. The bids of unknown contractor affiliations were deleted from the data set.

Because the schools across the state of Ohio have different sizes, the comparison between union and non-union bid amounts was faulty. However, the bid amount/SF of the school neutralized the variations in school size. Therefore, the first step was dividing the bid amount and the A/E's estimates over the area of the school for every bid.

The lowest bids - for the same work in every school/project - were the most competitive, and they were based on the most economical method of construction and markup. The research team created another subset of records that contained only the lowest bid for every contract. Eliminating the inefficient and uncompetitive bids from this set of data allowed the comparison between the most competitive bids of the union and non-union contractors. OSFC mostly employed the contractors with the lowest bids; therefore, this was the cost to the owner excluding the change order cost during construction.

The bids were also categorized by their CSI division to identify the division where PWL increased the construction cost. The Statistical Consulting Center (SCC) at Bowling Green State University (BGSU) conducted the statistical analysis of the data. The SCC conducted ANOVA analysis using the General Linear Model (GLM) with a 95% confidence level. The SCC analyzed two data sets: the first consisted of all bids and the second consisted of the lowest bid for the same work.

#### IV. RESULTS OF THE DATA ANALYSIS

The GLM analysis tested the hypothesis  $H_0$ : significant statistical differences in the bids /SF between union and non-union contractors existed. The statistical analysis for all bids from the whole state indicated that the hypothesis  $H_0$  should be rejected (i.e. there was no significant statistical difference between union and non-union bids) for the OSFC projects. Table 3 displays the average and standard deviation (SD); the SD measures the statistical dispersion of data around the average. The determining factor for the presence of significant statistical difference was the P-value generated by the GLM analysis. Using a confidence level of 95%, if the P-value was greater than the significance level of 0.05, no significant difference exists. If the P-value was less than 5%, a significant difference between union and non-union bids for OSFC projects exists. A statistically significant result with a 95% confidence level indicates that there was a 5% probability that it occurred due to chance. If a result is not statistically significant, then the measured result is likely to have occurred due to chance. The five percent line is arbitrary, but has become standard in many fields of research; statistical significance is the golden measuring stick for evaluating data [5]. Table 3 indicates that the average bid/SF for the non-union contractors (\$20.49/SF) was greater than that for the union contractors (\$19.22/SF).

TABLE 3 RESULT OF STATE LEVEL GLM ANALYSIS USING ALL BIDS

Union/Non-Union	Number of Bids	Average \$/SF	SD	P-value	Accept/Reject $H_0$
Union	2,307	19.22	25.31	0.1936	Reject
Non-union	4,286	20.49	43.03		

The analysis of the filtered set of lowest bids indicated that the hypothesis  $H_0$  was also rejected and there was no significant difference between union and non-union bids. Table 4 indicates that the average bid/SF for non-union contractors is \$18.49/SF where the average bid/SF for union contractors is \$16.99.

TABLE 4 RESULT OF STATE LEVEL GLM ANALYSIS USING THE LOWEST BIDS

Union/Non-Union	Number of Bids	Average \$/SF	SD	P-value	Accept/Reject $H_0$
Union	547	16.99	23.54	0.4199	Reject
Non-union	949	18.49	39.57		

##### A. The CSI Divisions Analysis

To identify the division where PWL increased the construction cost, the bids were categorized according to their CSI division as discussed earlier. Table 5 presents the results of the CSI division GLM analysis using all bids, and Table 6 presents the results using the filtered set of the lowest bids. The tables indicate that there was statistical significant difference between the bids/SF for union contractors and the bids/SF for non-union contractors for only the following trades: electrical, equipment, existing conditions, exterior improvements, wood, plastics and composites, and furnishings. There was significant difference between the lowest bids of union and non-union contractors in the following divisions: earthwork, electrical, existing conditions, HVAC, and plumbing. However, the average of the bids/SF of union contractors in some divisions was sometimes less than that of the non-union contractors.

TABLE 5 RESULT OF CSI DIVISIONS GLM ANALYSIS USING ALL BIDS

CSI Division	Union/Non-Union	No of Bids	Mean\$/SF	SD	P-Value	Accept/Reject
Communications	Union	136	4.35	3.85	0.05	Reject
	Non-union	274	5.29	4.95		
Concrete	Union	11	5.12	2.18	0.07	Reject
	Non-union	18	19.21	25.21		
Conveying Equipment	Union	21	15.98	15.90	0.52	Reject
	Non-union	6	17.28	20.49		
Earthwork	Union	132	0.59	0.41	0.51	Reject
	Non-union	366	0.73	0.73		
Electrical	Union	297	16.21	11.70	0.02	Accept
	Non-union	432	19.94	26.36		
Electronic Safety and Security	Union	7	4.34	4.50	0.12	Reject
	Non-union	26	2.16	2.73		
Equipment	Union	42	1.62	1.18	0.02	Accept
	Non-union	333	2.83	3.38		
Existing Conditions	Union	100	7.73	11.31	0.00	Accept
	Non-union	384	4.77	8.44		
Exterior Improvements	Union	11	5.55	4.02	0.03	Accept
	Non-union	35	3.06	2.89		
Finishes	Union	29	11.68	14.33	0.52	Reject
	Non-union	48	13.92	15.11		
Fire Suppression	Union	274	3.04	4.22	0.92	Reject
	Non-union	375	3.01	3.11		
Furnishings	Union	56	4.40	2.68	0.04	Accept
	Non-union	186	3.52	2.83		
HVAC	Union	444	20.24	17.69	0.25	Reject
	Non-union	529	21.82	24.03		
Masonry	Union	70	40.66	43.94	0.37	Reject
	Non-union	113	34.73	43.50		
Openings	Union	13	6.85	5.15	0.23	Reject
	Non-union	22	4.92	4.18		
Plumbing	Union	290	7.96	6.64	0.29	Reject
	Non-union	373	8.65	9.48		
Pollution Control Equipment	Union	2	2.07	0.45	0.91	Reject
	Non-union	8	2.12	0.64		
Structural Steel	Union	21	9.99	2.87	0.39	Reject
	Non-union	10	10.90	2.34		
Thermal & Moisture Protection	Union	24	6.15	1.81	0.19	Reject
	Non-union	114	6.85	2.47		
Wood, Plastics and Composites	Union	327	60.60	30.14	0.00	Accept
	Non-union	602	75.91	86.03		

## V. CONCLUSION

The overall analysis for the state of Ohio suggested the rejection of the hypothesis  $H_0$ : the average of the bids/SF for the union contractors was not significantly different than the average of the bids/SF for the non-union contractors who were exempt from paying prevailing wages. This conclusion was valid in the case of all the bids and in the case of only the lowest bids.

There was statistically significant difference between the bids/SF for union contractors and the bids/SF for non-union contractors for only the following trades: electrical, equipment, existing conditions, exterior improvements, wood, plastics and composites, and furnishings. There was significant difference between the lowest bids of union and non-union contractors in the following divisions: earthwork, electrical, existing conditions, HVAC, and plumbing.

TABLE 6 RESULT OF CSI DIVISIONS GLM ANALYSIS USING MINIMUM BIDS

CSI Division	Union/Non-Union	No of Bids	Mean \$/SF	SD	P-Value	Accept/Reject
Communications	Union	27	6.43	5.65	0.05	Reject
	Non-union	52	4.12	4.48		
Concrete	Union	5	4.19	2.22	0.30	Reject
	Non-union	7	14.61	20.78		
Conveying Equipment	Union	13	0.63	0.48	0.44	Reject
	Non-union	4	0.43	0.22		
Earthwork	Union	36	22.66	26.99	0.00	Accept
	Non-union	86	10.49	5.10		
Electrical	Union	62	12.95	3.90	0.02	Accept
	Non-union	107	19.78	22.68		
Electronic Safety and Security	Union	2	3.80	3.97	0.70	Reject
	Non-union	4	2.48	3.68		
Equipment	Union	16	1.65	1.21	0.35	Reject
	Non-union	97	2.47	3.51		
Existing Conditions	Union	5	25.19	28.37	0.00	Accept
	Non-union	44	3.39	4.21		
Finishes	Union	7	4.86	11.67	0.45	Reject
	Non-union	10	8.48	7.78		
Fire Suppression	Union	82	3.08	3.39	0.08	Reject
	Non-union	75	2.36	1.14		
Furnishings	Union	18	3.66	2.46	0.16	Reject
	Non-union	55	3.03	1.31		
HVAC	Union	92	15.87	8.73	0.01	Accept
	Non-union	98	22.17	21.98		
Masonry	Union	11	21.11	6.30	0.34	Reject
	Non-union	36	33.61	42.69		
Openings	Union	2	4.79	1.43	0.42	Reject
	Non-union	8	3.18	2.50		
Plumbing	Union	81	10.18	10.94	0.00	Accept
	Non-union	91	6.31	2.93		
Structural Steel	Union	13	9.17	2.98	0.88	Reject
	Non-union	1	9.66			
Thermal and Moisture Protection	Union	6	5.88	1.93	0.60	Reject
	Non-union	29	6.47	2.57		
Wood, Plastics and Composites	Union	69	62.01	32.83	0.22	Reject
	Non-union	122	74.69	81.43		

The definitive reasons for the lack of a statistically significant difference between the bids of the two groups need to be further researched. Production function studies indicated small overall union impacts on productivity; positive effects where they existed, appear to result from management response to decreased profit expectations and from a natural selection process. Positive union productivity effects were more evident where competitive pressures are present [3]. A potential reason for the lack of a statistically significant difference might be that the wages and benefits for non-union workers were close to those of union workers due to the boom in the construction market during the years from 2001 to 2007. The boom created a shortage in the skilled workers market, which put a competitive pressure to raise the wages of non-union workers. Why were bids of contractors in the southern counties so significantly different? Further research into the bid competitiveness of the counties in Southern Ohio is an area that deserves further research.

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