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Impact of Prevailing Wages on the Cost among the Various Construction Trades

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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. The bill also exempted the construction contractors from paying prevailing wages on these projects on the hypothesis that this exemption would lower the construction cost. The purpose of this study is to investigate this hypothesis through the statistical analysis of 8,093 bids received from the years 2000 through 2007 for the schools' construction. 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 increased the construction cost, was tested by comparing the bids/ SF (square foot) from both groups (union and nonunion) for the different construction trades. The study indicated that there was statistical significant difference between the bids/square foot for union contractors and the bids/square foot for non-union contractors for only the following trades: earthwork, existing conditions, plumbing, electrical and HVAC (heating, ventilation and air conditioning). The averages of bids/SF from the union contractors were higher than those from the non-union contractors for earthwork, existing conditions and plumbing works, and the opposite for electrical and HVAC works. There was no statistical significant difference in the bids from the communications, concrete, conveying equipment, electronic safety and security, equipment, finishes, fire suppression, furnishings, masonry, openings, structural steel, thermal and moisture protection, plastics and composites and wood works.

Key words: Prevailing wages, union, non-union, construction bids, construction trades.

1. 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 not 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, the Ohio General Assembly passed the Senate Bill 102 that created the OSFC (Ohio School Facilities Commission) as a separate and distinct agency to oversee the rebuilding of the public schools in Ohio. The Bill also exempted the contractors who undertaken the construction of these schools from the Ohio's PWL (prevailing wage laws) on the hypothesis that the exemption would lower the cost of construction to the tax payer. This exemption does not conflict with the federal PWL because these projects were 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 et al. [3] 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 make it difficult to isolate the impact of PWL from other factors.

The rebuilding of the public schools project in Ohio

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provided an excellent (but not perfect) opportunity to study the impact of PWL on prices for the owner. OSFC provided the author the bidding data for 8,325 bids from the years 2000 through 2007. Some of the contractors were union contractors who paid union wages, and some were non-union contractors who did not pay prevailing wages because of the passage of Ohio Senate Bill 102. These public schools were equitable and built to the same design guidelines and quality based on the 1997 Supreme Court ruling in the case Derolph v. the State of Ohio [4] that preceded the creation of the OSFC. This paper adds to the studies that analyze the impact of PWL on the cost of construction through the analysis of 8,093 bids to build these Ohio public schools.

2. The Research Problem

There are many factors that affect the cost of a construction project making it difficult to isolate the impact of PWL from other factors. Considerable literature and news articles have debated the merit of PWL, some claim estimated cost increases of more than 26% and others claim that there are no cost increases [5]. Labor unions, from the neoclassical view, use their monopolistic power to raise wages, thereby increasing costs. 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 [6]. 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 construction 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. Trade unions can use this research to be more competitive and turn around the decline in union membership that has been occurring since 1979 [7].

3. 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. 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 [8].

The OSFC serves as a funding partner for the school districts to finance their school construction projects and provide the children of Ohio adequate and equitable schools. 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 1997 Supreme Court case Derolph v. the State of Ohio that preceded the creation of the OSFC.

The calculation ensures that schools throughout the state are adequate and equitable [4]. 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 [9].

The goal of OSFC is to ensure statewide equity and quality for school facilities using a comprehensive standardized facilities assessment program and the OSDM (Ohio School Design Manual) 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 [10].

OSFC uses an efficient project delivery model utilizing the private sector by employing private construction management firms to oversee the 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 OSFC publicly open, read and tabulate the contractors' bids. Following the bid-opening meeting, the low bidders are evaluated against predetermined qualifications to determine whether they are responsible bidders [8].

4. Data Collection and Analysis

The OSFC provided the author with the bidding data for 8,325 bids from the years 2000 through 2007. 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, A/E (architect/engineers') estimate and the square footage for each school. The bidding data were in several standard reports that were combined into one spread sheet. 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 some contractors because they disconnected their phone lines and/or went out of business. The research team determined the union/nonunion affiliations for the contractors of 8,093 out of 8,325 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 is faulty. However, the bid amounts/SF of the school neutralize the variations in school size. Therefore, the first step was dividing the bid amount 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 OSFC mostly awarded the contracts to the lowest responsible bidder, therefore, the lowest bids represent the cost to the owner excluding the change order cost during construction. 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.

The bids were also categorized by their CSI (Construction Specifications Institute) Division to identify the division where PWL increased the construction cost. The SCC (Statistical Consulting Center) at BGSU (Bowling Green State University)

conducted the statistical analysis of the data. The SCC conducted ANOVA (analysis of variance) analysis using the GLM (general linear model) with a 95% confidence level. The SCC analyzed two data sets: The first set consisted of all bids and the second set consisted of the lowest bid for the same work.

5. Results of the Data Analysis

The GLM analysis tested the hypothesis H_o: significant statistical differences in the bids/SF between union and non-union contractors existed. The statistical analysis for all bids from the whole state of Ohio indicated that the hypothesis H_o should be rejected (i.e., there was no significant statistical difference between union and non-union bids) for the OSFC projects. Table 1 displays the average of all bids/SF and SD (standard deviation), 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, and the hypothesis H_o is rejected. If the *P*-value was less than 5%, a significant difference between union and non-union bids for OSFC projects exists and the hypothesis H_o is accepted. A statistically significant result with a 95% confidence level indicates that there is a 5% probability of occurrence 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 [11]. Table 1 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).

The analysis of the filtered set of lowest bids indicated that the hypothesis H_o was also rejected and there was no significant difference between union and non-union bids. Table 2 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.

About 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 3 presents the results of the CSI division GLM analysis using all bids, it indicates that there is statistical significant difference between the bids/SF for union contractors and the bids/SF for non-union contractors for only the following trades: earthwork, electrical, existing conditions, HVAC and plumbing. The averages of bids/SF from the union contractors are higher than those from the non-union contractors for earthwork, existing conditions and plumbing works. The averages of bids/SF from the union contractors are lower than those from the non-union contractors for electrical and HVAC works. The tables indicate that there was not statistical significant difference between the bids/SF for union contractors and those for non-union contractors for the following trades: communications, concrete, conveying equipment, electronic safety and security, equipment, finishes, fire suppression, furnishings, masonry, openings, structural steel, thermal and moisture protection, plastics and composites and wood works.

Table 1 Result of state level GLM analysis using all bids.

Union/non-union	Number of bids	Average $/SF	SD	*P*-value	Accept/reject H_o
Union	2,307	19.22	25.31	0.1936	Reject
Non-union	4,286	20.49	43.03		

Table 2 Result of state level GLM analysis using the lowest bids.

Union/non-union	Number of bids	Average $/SF	SD	*P*-value	Accept/reject H_o
Union	547	16.99	23.54	0.4199	Reject
Non-union	949	18.49	39.57		

Table 3 Result of CSI divisions GLM analysis using all bids.

CSI division	Union/non-union	Number of bids	Mean $/SF	SD	*P*-Value	Accept/reject
Plumbing	Union	81	10.18	10.94	0.0014	Accept
	Non-union	91	6.31	2.93		
HVAC	Union	92	15.87	8.73	0.0111	Accept
	Non-union	98	22.17	21.98		
Existing conditions	Union	5	25.19	28.37	<0.0001	Accept
	Non-union	44	3.39	4.21		
Earthwork	Union	36	22.66	26.99	<0.0001	Accept
	Non-union	86	10.49	5.1		
Electrical	Union	62	12.95	3.9	0.02	Accept
	Non-union	107	19.78	22.68		
Communications	Union	27	6.43	5.65	0.0511	Reject
	Non-union	52	4.12	4.48		
Concrete	Union	5	4.19	2.22	0.297	Reject
	Non-union	7	14.61	20.78		
Conveying equipment	Union	13	0.63	0.48	0.4443	Reject
	Non-union	4	0.43	0.22		
Electronic safety and security	Union	2	3.8	3.97	0.7048	Reject
	Non-union	4	2.48	3.68		
Equipment	Union	16	1.65	1.21	0.3548	Reject
	Non-union	97	2.47	3.51		
Finishes	Union	7	4.86	11.67	0.4527	Reject
	Non-union	10	8.48	7.78		
Fire suppression	Union	82	3.08	3.39	0.0827	Reject
	Non-union	75	2.36	1.14		
Furnishings	Union	18	3.66	2.46	0.164	Reject
	Non-union	55	3.03	1.31		
Masonry	Union	11	21.11	6.3	0.3419	Reject
	Non-union	36	33.61	42.69		
Openings	Union	2	4.79	1.43	0.4205	Reject
	Non-union	8	3.18	2.5		
Structural steel	Union	13	9.17	2.98	0.8765	Reject
	Non-union	1	9.66			
Thermal and moisture protection	Union	6	5.88	1.93	0.5994	Reject
	Non-union	29	6.47	2.57		
Wood, plastics and composites	Union	69	62.01	32.83	0.2177	Reject
	Non-union	122	74.69	81.43		

Table 4 Result of CSI divisions GLM analysis using minimum bids.

CSI division	Union/non-union	Number of bids	Mean $/SF	SD	*P*-Value	Accept/reject
Earthwork	Union	36	22.66	26.99	<0.0001	Accept
	Non-union	86	10.49	5.1		
Electrical	Union	62	12.95	3.9	0.02	Accept
	Non-union	107	19.78	22.68		
Existing conditions	Union	5	25.19	28.37	<0.0001	Accept
	Non-union	44	3.39	4.21		

Table 4 continued

CSI division	Union/non-union	Number of bids	Mean $/SF	SD	P-Value	Accept/reject
HVAC	Union	92	15.87	8.73	0.0111	Accept
	Non-union	98	22.17	21.98		
Plumbing	Union	81	10.18	10.94	0.0014	Accept
	Non-union	91	6.31	2.93		
Communications	Union	27	6.43	5.65	0.0511	Reject
	Non-union	52	4.12	4.48		
Concrete	Union	5	4.19	2.22	0.297	Reject
	Non-union	7	14.61	20.78		
Conveying equipment	Union	13	0.63	0.48	0.4443	Reject
	Non-union	4	0.43	0.22		
Electronic safety and security	Union	2	3.8	3.97	0.7048	Reject
	Non-union	4	2.48	3.68		
Equipment	Union	16	1.65	1.21	0.3548	Reject
	Non-union	97	2.47	3.51		
Finishes	Union	7	4.86	11.67	0.4527	Reject
	Non-union	10	8.48	7.78		
Fire suppression	Union	82	3.08	3.39	0.0827	Reject
	Non-union	75	2.36	1.14		
Furnishings	Union	18	3.66	2.46	0.164	Reject
	Non-union	55	3.03	1.31		
Masonry	Union	11	21.11	6.3	0.3419	Reject
	Non-union	36	33.61	42.69		
Openings	Union	2	4.79	1.43	0.4205	Reject
	Non-union	8	3.18	2.5		
Structural steel	Union	13	9.17	2.98	0.8765	Reject
	Non-union	1	9.66			
Thermal and moisture protection	Union	6	5.88	1.93	0.5994	Reject
	Non-union	29	6.47	2.57		
Wood, plastics and composites	Union	69	62.01	32.83	0.2177	Reject
	Non-union	122	74.69	81.43		

Table 4 presents the results using the filtered set of the lowest bids, and the results are almost identical to those from the all bids analysis. The averages of bids/SF from the union contractors are higher than those from the non-union contractors for earthwork, existing conditions and plumbing works. The averages of bids/SF from the union contractors are lower than those from the non-union contractors for electrical and HVAC works.

6. Conclusions

The overall analysis for the state of Ohio suggests the rejection of the hypothesis H_o: The average of bids/SF for the union contractors is not significantly different than the average of 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 is a statistical significant difference between the bids/SF for union contractors and the bids/SF for non-union contractors for only the following trades: earthwork, electrical, existing conditions, HVAC and plumbing. The results from analyzing the set of the lowest bids produced identical results. There is 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 averages of bids/SF from the union contractors are higher than those from the non-union contractors for earthwork, existing conditions and plumbing works and the opposite for the electrical and HVAC works.

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 [12]. 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 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 nonunion workers. Further research into the bid competitiveness of the union electrical and HVAC works is recommended.

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