

Comparison of Union and Non-Union Bids on Ohio School Facilities Commission Construction Projects

Alan Atalah¹

Bowling Green State University, Bowling Green, OH 43403, USA

laatalah@bgsu.edu

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 based on the hypothesis that this exemption would save the Ohio tax payer 10.7%. Many other studies concluded that these savings would range from 1.5 to 26%. The purpose of this research was to investigate this hypothesis through the statistical analysis of 8093 bids received for the schools' construction from the years 2000 through 2007. Union contractors-who paid their workers union wages-and non-union contractors-who did not pay prevailing wages bid these projects. By comparing the bids/SF from both groups (union and nonunion), the hypothesis was tested. The research indicated that there was no significant difference between the bids/SF for union contractors and the bids/SF for non-union contractors.

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 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, 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].

The capital expenditure on public schools in the US exceeded \$500 billion between 1995 and 2004, building more than 12,000 new schools and managing more than 130,000 renovation and alteration projects to existing schools. The annual capital expenditure on public schools reached \$35 billion in 2004 ^[3]. Despite this enormous investment, little tracking or analyses of costs and spending have been conducted, though many school districts continually struggle to pay for new schools ^[4].

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. 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%. Furthermore, the challenge in the literature on prevailing wage laws has been to find a suitable control group that allows for isolation of PWL from other policies that may also influence construction costs ^[5].

The rebuilding of the public schools project in Ohio provided an excellent (but not perfect) opportunity to study the impact of PWL on cost for the owner. In this study, the authors compared the cost / square foot (SF) from 8093 bids from the years 2000 through 2007. Some of the contractors were union contractors who paid union wages; some were non-union contractors who were exempt from paying prevailing wages after the passage of Ohio Senate Bill 102. Eric Bode of OSFC confirmed that these public schools were designed and constructed to be equitable across the state of Ohio. They were built according to the same design and quality guidelines outlined in the Ohio School Design Manual (OSDM) ^[6]. This paper adds to these 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

The opponents of PWL argue that since PWL are associated with higher labor wages and benefits, PWL increase the 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 were \$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]. Weisberg

(2002) refuted the \$487.9 million of savings due to the exemption in this report on the ground of weak correlation coefficient, small sample size, weak isolation of other factors, and faulty calculation model to estimate the savings^[7]. Fraundorf, Farrell, & Mason(1984) concluded that “a project in rural area subject to the Davis-Bacon Act would cost on average 26.1% more than the same project not subject to the Act”. Fraundorf, et al, cited the reason for the increase was the way workers were 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 to not 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^[8]. 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^[9].

Union higher wage and benefit rates 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^[8].

Another research team analyzed data covering 205 residential projects (subsidized by the California Low Income Housing Tax Credit from 1996 to mid-2002) demonstrated that construction costs increased under prevailing wage requirements by 9% to 37%. The analysis neutralized variations in cost by geographical location and differences in project characteristics, financing, and developer attributes^[5].

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^[10]. The estimated savings are considerably lower than the 20 to 25% savings that some opponents of PWL have claimed.

TABLE I ESTIMATED SAVINGS^[2]

Author(s)	Savings
(Thieblot, 1975) ^[11]	0.6%
(Gould and Bittlingmayer, 1980) ^[12]	4 to 7%
(Prus, 1996) ^[13]	5.1%
(Prus, 1999) ^[14]	3.8%
(Phillips, 1999) ^[15]	2.4%
(Phillips, 2001) ^[16]	0.7%

B. Arguments for PWL

Several studies refute the hypothesis that higher wages and benefits are associated with increased construction costs; the use of well trained, motivated, and productive workers offset the direct effect of higher wages and benefits. In another words, the positive labor productivity deferential offset the increased wages and benefits^{[17] [14] [18] [16] [15] [13] [19] [17]}. The National Heavy and Highway Alliance reviewed and analyzed records for highways built from 1994 through 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^[20].

TABLE II WAGES AND THE COST PER MILE^[20]

	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^[16].

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.

Proponents of PWL point out that wage requirements have a less than proportionate affect on total construction costs because labor costs are a low percent of total construction costs^[21]. For example, if the labor cost increase by 15% in a project with total cost \$100,000 and labor cost of \$20,000, the total cost increase for the project is \$3,000 = 3% increase in the total cost. Apprenticeship training raise union productivity; union workers are 44 to 52% more productive than nonunion measured by value added per employee^[22]. PWL were not associated with higher-long-term construction costs. The effects of PWL on

construction efficiency in British Columbia were examined using stochastic frontier regression and British Columbian construction data. Results indicated the introduction of PWL disrupted construction efficiency for a short period of time followed by a sharp and durable increase on the long term^[17]. This examination also suggested that construction wage requirements did not significantly alter construction output. Average inefficiency for school construction in British Columbia over the period of the study was 12.1%^[23].

Union contractors have greater economies of scale, which gives them a cost advantage in large commercial office buildings, but in school and hospital construction, nonunion contractors have lower costs at all output levels. Despite the cost differences, profits for nonunion and union contractors in school and hospital construction are the same because the burden of higher union costs is shifted to buyers^[24].

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 base, and (5) PWL provide stability in the construction industry.

II. 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 schools 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 (About OSFC: Mission). 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 (About OSFC: What We Do).

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^[25]. The calculation ensures that schools throughout the state are “adequate and equitable”, in other words the schools are similar^[6].

The goal of OSFC is to ensure statewide equity and quality for school facilities using the OSDM and a comprehensive standardized assessment program to standardize the process. The OSDM assists in meeting the requirements of the Derolph, v.the state of Ohio (1997) case,

in controlling the design and construction costs and in assuring a statewide standard of quality and equality. 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 and equality^[26].

A. The Bidding Process of OSFC

OSFC uses private construction management firms to oversee projects. The bidding 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^[27].

III. 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 journal articles debated the merit of PWL; some claimed estimated cost increases of more than 26% and others claimed that there were no cost increases. Labor unions, from the neoclassical view, use their monopolistic power to raise wages, thereby increasing costs^[28]. 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 (Byrnes et al., 1988). 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. 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^[29].

IV. DATA ANALYSIS

The research objective was to test the hypothesis H_0 : there were significant statistical differences in the bids /SF between union and non-union contractors. OSFC provided

Bowling Green State University (BGSU) 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 the 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.

The overall construction industry in the US and Ohio was in a boom cycle through the late 1990s and into the mid 2007 which increased the demand for labor and materials and consequently their prices. The Producer Price Index (PPI) data reveal about a 40% increase nationally in construction materials costs alone between 2000 and 2006 [4]. The research team reasonably assumed that inflation equally increased the prices for both the union and nonunion contractors.

Some union contractors created subsidiary firms that were nonunion such as Corna Kokosing Construction Company (nonunion) was subsidiary of The Kokosing Group (union). These double breasted firms were classified as nonunion contractors because the nonunion subsidiaries were the bidders on these bids. The 8093 bids were a mix of new, additions and alterations (which were difficult to reliably and accurately separate), but the large size of bids corrected for any bias due to nonunion (or union) contractors.

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 over the area of the school for every bid.

The concentration of unions varied across the state of Ohio; for example, there was a higher concentration of union contractors in the northern region of the state than in the rest of Ohio. Investigating the existence of significant differences between the union and non-union bids /SF in the different regions identified the regions that need corrective

actions. For the purpose of this research, the state of Ohio was divided into the following three regions: northern, central, and southern regions as shown in Figure 1. The northern third was made up of 31 counties, the central was made up of 28 counties, and the southern was made up of 29 counties.



Figure 1 The three regions of the state of Ohio

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 Statistical Consulting Center (SCC) at 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.

V. RESULTS OF THE DATA ANALYSIS

Table 3 indicates that the average bid price/SF for the non-union contractors (\$20.49/SF) was greater than that for the union contractors (\$19.22/SF). The table also displays the standard deviation (SD); which is the statistical dispersion of the data around the average bid price/SF. The statistical analysis for all bids from the whole state of Ohio 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. 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 existed. If the P-value was less than 5%, a significant difference between union and non-union bids for OSFC projects existed. 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^[10].

TABLE III 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 H₀ was also rejected (P-value = 0.41 > 0.05), and consequently, 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 IV 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 Three Regions Analysis

To identify the locations where significant differences existed between the bids of union contractors and non-union contractors, the state of Ohio was broken down into three regions as discussed earlier. Table 5 presents the results of the three region 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 no significant difference in the bids /SF between union and non-union contractors in the North and the Central regions. However, there was significant difference between the bids of union and non-union contractors in the Southern region (P-values = .0005 and 0.001 < 0.05). The average of the bid price/SF of union contractors was significantly less than that of the non-union contractors in both sets of data in the Southern region.

TABLE V RESULTS OF THE THREE REGION GLM ANALYSIS USING ALL BIDS

Region	Union / Non-Union	Number of Bids	Average \$/SF	SD	P-value	Accept / Reject H ₀
North	Union	1,804	19.34	24.68	0.2988	Reject
	Non-union	2,790	18.16	30.37		
Central	Union	168	13.44	17.59	0.9714	Reject
	Non-union	447	13.56	18.84		
South	Union	335	21.49	30.98	0.0005	Accept
	Non-union	1,049	29.64	69.63		

TABLE VI RESULTS OF THE THREE REGION GLM ANALYSIS USING MINIMUM BIDS

Region	Union / Non-Union	Number of Bids	Average \$/SF	SD	P-value	Accept / Reject H ₀
North	Union	406	17.38	24.66	0.3908	Reject
	Non-union	679	15.54	30.99		
Central	Union	39	15.27	20.04	0.6067	Reject
	Non-union	89	11.90	17.23		
South	Union	102	16.08	20.08	0.0001	Accept
	Non-union	181	32.78	65.00		

Some potential reasons for the higher bid price/SF for schools built by nonunion contractors in southern third of Ohio might be:

- This part had more nonunion density than the rest of Ohio.
- The south central and southeastern parts of Ohio were more rural and less populated, which caused the schools to be smaller in size; which the author hypothesize increased the cost/SF. However, this hypothesis contradicts the findings of Howley (2008) that smaller schools were not more expensive per student or per square foot than larger schools^[30].
- The wages and benefits for non-union workers were close to those of union workers during the years from 2001 to 2007 due the boom in the construction market. The boom created a high demand for skilled workers, which put a competitive pressure to raise the wages of nonunion workers.

VI. CONCLUSION

The overall analysis for the state of Ohio suggested the rejection of the hypothesis H₀; the average bid price/SF for the union contractors was not significantly different than the average bid price/SF for the non-union contractors. This conclusion was valid for both sets of data: all bids and the lowest bids.

The three region analysis resulted in the rejection of the hypothesis in the Northern and Central regions while the Southern region resulted in the acceptance of the hypothesis. These results led to the conclusion that there was no significant difference between bids of union and non-union contractors in the Northern and Central regions of Ohio. However, the analysis of bids in the Southern region indicated a significant difference between the two groups with an average union bid of \$21.49/SF and an average non-union bid of \$29.64.

Production function studies indicated small overall union impacts on productivity; the effects appear to result from management's response to decreased profit expectations and from a natural selection process. Positive union productivity effects were more evident where competitive pressures are present (Addison and Hirsch 1989).

The collected data reflected only the bid prices and lowest bid prices; i.e., the basic labor and material expenses

(the hard costs) for each project. The additional change orders and soft costs, such as site acquisition, architectural, engineering, and project management, were not considered in this analysis. Hard costs typically account for about 70% of a project's total cost, although this can vary by project and locale. Some proponents of PWL assert that their presence increases skilled workmanship and decreases change orders, thereby making the contract bid price and the final hard construction cost closer on PWL projects^[4].

The following issues are recommended for further research:

- The definitive reasons for the statistical significant difference between the bids of the two groups in the southern regions of Ohio;
- The impact of regional union density or strength on the cost/ SF;
- Development of better tracking and reporting system of soft and hard construction cost and making the data available for researchers because the absence of detailed school construction cost data and measurement poses a major challenge to research^[5];
- The reliable and accurate separation of bids into new, additions and alterations and testing the variance between the two groups for each type of construction.

REFERENCES

- [1] U.S. Department of Labor, "Wage and Hour Division (WHD) - Davis-Bacon and Related Acts," 2008. [Online]. Available: <http://www.shrm.org/legalissues/federalresources/federalstatutesregulationsandguidanc/pages/davis-baconactof1931.aspx>.
- [2] OLSC, "S.B 102 Report - The Effects of the Exemption of School Construction Projects from Ohio's Prevailing Wage Law," Ohio Legislative Service Commission, Columbus, OH, 2002.
- [3] M. Filardo, J. Vincent, P. Sung and T. Stein, "Growth & Disparity: A Decade of U.S. Public School Construction," Building Educational Success Together, Washington, DC, 2006.
- [4] J. M. Vincent and P. Monkkonen, "The impact of state regulations on the costs of public school construction," *Journal of Education Finance*, pp. v. 35 n. 4, p. 313-330, 2010.
- [5] S. Dunn, J. M. Quigley and L. A. Rosenthal, "The Effects of Prevailing Wage Requirements on the Cost of Low-Income Housing," *Industrial & Labor Relations Review*, pp. Volume 59, number 1, pp 141 to 157, 2005.
- [6] M. J. Welsh, "Comparison of Union And Non-Union Bids on Ohio School Facilities Commission Construction Projects," Bowling Green State University, Bowling Green, OH, 2008.
- [7] H. F. Weisberg, "Analysis of Regression and Surveys in Ohio LSC Report on SB 102 on Claimed Cost Savings from Exempting School Construction from Prevailing Wage Requirements," 8 July 2002. [Online]. Available: <http://www.ohiostatebtc.org/docs/Weisberg%20Report.pdf>.
- [8] J. Addison and B. Hirsch, "Union Effects on Productivity, Profits, and Growth: Has the Long Run Arrived?," *Journal of Labor Economics*, (Jan.), , pp. Vol. 7, No. 1 pp. 72-105, 1989.
- [9] R. Freeman and J. Medoff, "Unionism, Price-Cost Margins, and the Return to Capital," National Bureau of Economic Research, Cambridge, Mass, 1983.
- [10] Statistical Assessment Service at George Mason University, "What does it mean for a result to be "statistically significant"?," August 2012. [Online]. Available: http://stats.org/in_depth/faq/statistical_significance.htm.
- [11] A. J. Thieblot, "The Davis-Bacon Act, Labor Relations and Public Policy Series- Report No. 10.," University of Pennsylvania Press, Philadelphia, 1975.
- [12] J. P. Gould and G. Bittlingmayer, *Economics of Davis Bacon Act*, Washington, DC: American Enterprise Institute studies in economic policy, 1980.
- [13] M. J. Prus, "The Effect of State Prevailing Wage Laws on Total Construction Costs," 1996.
- [14] M. J. Prus, "Prevailing Wage Laws and School Construction Costs: An Analysis of Public School Construction in Maryland and the Mid Atlantic States," Prince George's County Council, Prince George's County, Maryland, 1999.
- [15] P. Phillips, "Kentucky's Prevailing Wage Law: Its History, Purpose, and Effect," University of Utah, 1999.
- [16] P. Phillips, "A Comparison of Public School Construction Costs in Three Midwestern States," University of Utah, 2001.
- [17] K. Duncan, P. Philips and M. Prus., "The Effects of Prevailing Wage Regulations on Construction Efficiency in British Columbia," *International Journal of Construction Education and Research*, pp. Vol. 5, No. pp. 1-1, 2009.
- [18] M. Gillena, D. Baltz, M. Gassel, L. Kirsch and D. Vaccaro, "Perceived safety climate, job demands, and coworker support among union and nonunion injured construction workers," *Journal of Safety Research*, p. 33- 51, 2002.
- [19] D. C. May and J. Waddoups, "Construction Procurement Policies That Address Health Insurance: A Cost Analysis," The Center for Construction Research and Training, Concord, NH, 2009.
- [20] Construction Labor Research Council, "Wages, Productivity and Highway Construction Costs," Construction Industry Labor-Management Trust, 2004.
- [21] H. Azari-Rad, P. Philips and M. J. Prus, "State prevailing wage laws and school construction costs," *Industrial Relations*, pp. 43 (3): 445-457, 2003.
- [22] S. G. Allen, "Unionized Construction Workers are More Productive," *The Quarterly Journal of Economics*, pp. 99 (2): 251-274, 1984.
- [23] K. Duncan, P. Philips and M. Prus, "Prevailing wage legislation and public school construction efficiency: a stochastic frontier approach," *Construction Management and Economics*, pp. Volume 24, Issue 6, pages 625-634, 2006.
- [24] S. G. Allen, "Can Union Labor Ever Cost Less?," *The Quarterly Journal of Economics*, pp. 102 (2): 347-373, 1987.
- [25] Ohio School Facilities Commission, "About OSFC: What We Do: Financial Partnership," 2008. [Online]. Available: <http://www.osfc.state.oh.us/whatwedo/FinancialPartnership.html>.
- [26] Ohio School Facilities Commission, "Ohio School Facilities Commission 2008 Ohio School Design Manual," 2008. [Online]. Available: <http://osfc.ohio.gov/OSDM/2010OhioSchoolDesignManual.aspx>.
- [27] Ohio School Facilities Commission, "Ohio School Facilities Commission - About OSFC: What We Do: Facility Planning," 10 October 2008. [Online]. Available: <http://www.osfc.state.oh.us/whatwedo/FacilityPlanning.html>.
- [28] P. Byrnes, R. Fare, S. Grosskopf and a. C. A. K. Lovell, "The Effect of Unions on Productivity: U.S. Surface Mining of Coal," *Management Science*, pp. Vol. 34, No. 9 - 1037-1053,

- 1988.
- [29] D. Belman and P. B. Voos, "Union Wages and Union Decline: Evidence from the Construction Industry," *Industrial and Labor Relations Review*, pp. Vol 60, pp 67-87, 2006.
- [30] C. B. Howley, "Don't Supersize Me: The Relationship of Construction Cost to School Enrollment in the U.S.," 23 February 2008. [Online]. Available: http://web.maynard.k12.ma.us/MSBA/School_Construction_Cost_Research.pdf.
- [31] Ohio School Facilities Commission, "About OSFC: What We Do," 2007. [Online]. Available: <http://www.osfc.state.oh.us/home/whatwedo.html>.
- [32] Ohio School Facilities Commission, "About OSFC: Mission," [Online]. Available: <http://www.osfc.state.oh.us/home/mission.html>. [Accessed 12 September 2007].
- [33] Derolph, v.the state of Ohio, 1997.
- [34] M. N. Fraundorf, J. P. Farrell and a. R. Mason, "The Effect of the Davis-Bacon Act on Construction Costs in Rural Areas," *The Review of Economics and Statistics*, pp. Vol. 66, No. 1, pp. 142-146, 1984.
- [35] D. Kessler and L. Katz, "Prevailing Wage Laws and Construction Labor Markets," *Industrial and Labor Relations Review*, pp. 259-274, 2001.
- [36] OLSC, "S.B 102 Report - The Effects of the Exemption of School Construction Projects from Ohio's Prevailing Wage Law," Ohio Legislative Service Commission, Columbus, OH, 2002.