A Comparison of Public School Construction Costs

In Three Midwestern States that Have Changed Their Prevailing Wage Laws in the 1990s

Kentucky, Ohio and Michigan

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Introduction

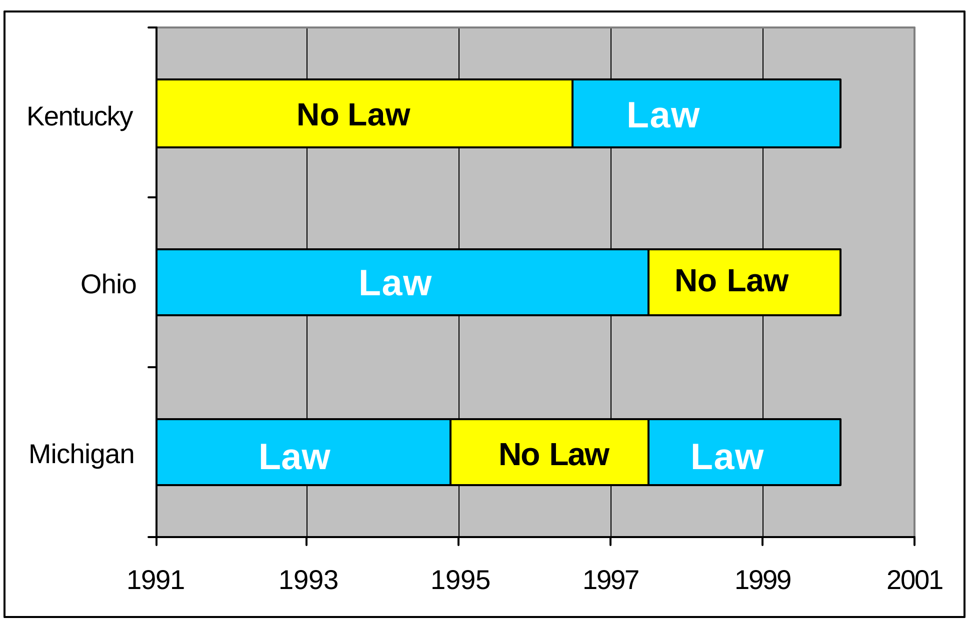
Proponents and critics of prevailing wage regulations have debated the merits of these regulations for some time. Proponents argue that these regulations promote the development of a skilled labor force in construction, improve work place safety, encourage quality construction, increase apprenticeship training and provide career opportunities in construction for local citizens. Proponents emphasize that prevailing wage regulations also induce contractors to provide health insurance and pension coverage that otherwise would be absent.

Critics of prevailing wage regulations concede some of the foregoing positions and contest others. But the main argument of critics of prevailing wage regulations is the contention that these laws raise public construction costs. This is a two-sided argument asserting that when prevailing wage regulations are applied they raise public construction costs and when these regulations are eliminated, public construction costs will go down. The magnitude of savings is thought to be substantial ranging anywhere from 10% to 30% or more of total construction costs.

This paper focuses on the specific question of whether or not the application of prevailing wage regulations raises costs, and if so, by how much. Those favoring this view theorize that prevailing wage regulations raise wage rates on public construction to higher levels than they otherwise would be. Increased wage rates should lead to increased construction costs that would be passed on to the government and eventually the taxpayer. Proponents of prevailing wage regulations counter that higher wage rates induce contractors to hire or train a more skilled and productive labor force. Higher wage rates also will encourage contractors to better manage their workers and provide them with better and more up-to-date equipment. These responses to higher wage rates may, according to this view, offset some or all of the costs of higher wage rates. Prevailing wage proponents also argue that a more skilled labor force leads to better quality construction that reduces downstream maintenance and repair costs.

This paper tests these competing hypotheses regarding the cost-effects of prevailing wage laws. The focus will be on new public school construction in Kentucky, Ohio and Michigan over the period 1991 to 2000. These states and this time period were chosen because legislative and judicial changes in these states over this period form a natural experiment helpful in isolating the effects of these regulations on costs. In the 1990s, prior to July1996, Kentucky did not apply prevailing wage regulations to public school construction. Starting in July of 1996, the state's prevailing wage law regulated public school construction. By itself, this provides some before-and-after information about the effects of applying prevailing wages to school construction costs. Fortuitously, from the standpoint of science, Ohio in the 1990s did almost the opposite of Kentucky. Throughout the 1990s until July of 1997, Ohio applied its prevailing wage law to public school construction. Starting in July 1997, Ohio exempted public school construction from prevailing wage regulations. Thus, almost simultaneously, these neighboring states moved in opposite regulatory directions. The fact that Ohio lifted its law soon after Kentucky applied its law to public school construction helps this natural experiment isolate the effects of regulatory policy from other factors that change over time. From an experimenter's perspective, this is nice. But nicer yet, at around the same time, Michigan does yet a third thing with its prevailing wage law.

At the end of 1994, a judicial ruling suspended the application of Michigan's prevailing wage law to any public construction. This judicial suspension lasted until July of 1997 when a higher court ruling reapplied Michigan's prevailing wage law to all public construction, including schools. So Michigan suspended its law two-and-one-half years before Ohio, and Michigan reapplied its law in precisely the same month Ohio exempted schools from prevailing wage regulations. Figure 1 shows the variation in prevailing wage policies by state in the 1990s.



• Figure 1: Prevailing Wage Policy by State 1991-2000

With these variations in legal policies in hand, we are in a position to assess statistically whether or not changes in prevailing wage policies as they applied to public school construction raised or lowered the cost of building public schools.

The Data

The FW Dodge Corporation is a private company that provides bidding information to contractors. In so doing, the Dodge Corporation systematically gathers information on the "start" cost of construction projects. "Start" costs are the agreed-upon bid price of a project at the outset of a bid. The final cost of a project can vary from the start cost based on cost overruns. Proponents of prevailing wage regulations argue that one of the advantages of prevailing wage laws is that they reduce cost overruns. This argument asserts that absent prevailing wage regulations a cutthroat bidding system emerges where low-ball bidders undercut their competitors with unrealistically low bids in the hope and expectation that during the term of the project the contractor can recoup his profits through change orders. This argument asserts that prevailing wage regulations attract a set of bidders that will compete with each other over on-time completion, quality construction and productivity but eschew the strategy of low-ball bidding hooked into profiting from change orders.

We cannot test this argument with Dodge data because it does not include cost overruns subsequent to the acceptance of the bid. But with this one limitation in mind, the Dodge data form the single best source on school construction costs across states.

In addition to providing the accepted bid price, the dodge data indicate what kind of building project it is; what the total square feet of the project is; where the project will take place; when the bid was accepted; some details on the nature of the project, and other useful information.

This report uses data from 1991 t. We focus on new public school construction only. By eliminating renovation alterations and additions, we can focus on a relatively homogenous group of buildings—new public schools. We will ask the question—controlling for the size of these public schools, and where they took place, and when they were built, and whether they included a gymnasium-swimming pool facility—did the presence or the absence of prevailing wage regulations affect the total cost of the project? Table 2 describes the new schools used in this study.

Characteristic of Schools in Study	
Number of New Schools in Study	391
Average Square Foot Size of the School	86,415
Average Total Cost of the Project (Year 2000 dollars)	$8,483,937
Percent of All Schools	
Michigan	38%
Ohio	36%
Kentucky	26%
Percent of School with a Gym-Pool Facility	7%
Percent of Urban Schools	32%
Percent of Schools Built Under Prevailing Wages	49%

- Table 1: Description of the new schools used in the study

This study involves 391 new public schools built between 1991 and September 2000. Table 1 show that the average size of a school was 86,415 feet and the average total cost was $8,483,937 in year 2000 dollars. The consumer price index urban (CPI-U) was used to update earlier costs into year 2000 dollars.

Of the 391 new public schools in the study, Michigan accounted for 38%. Ohio accounted for 36% and Kentucky accounted for 26%. This reflects the relative size of the three states.

Dodge data indicated that 7% of the new schools included a swimming pool/gymnasium facility. In our statistical model we expect that even controlling for the size of the school project, the inclusion of such a facility is likely to raise the square foot cost of the new school.

Thirty-two percent of the new public schools were built in urban areas with the remaining 68% built in rural areas including smaller towns.

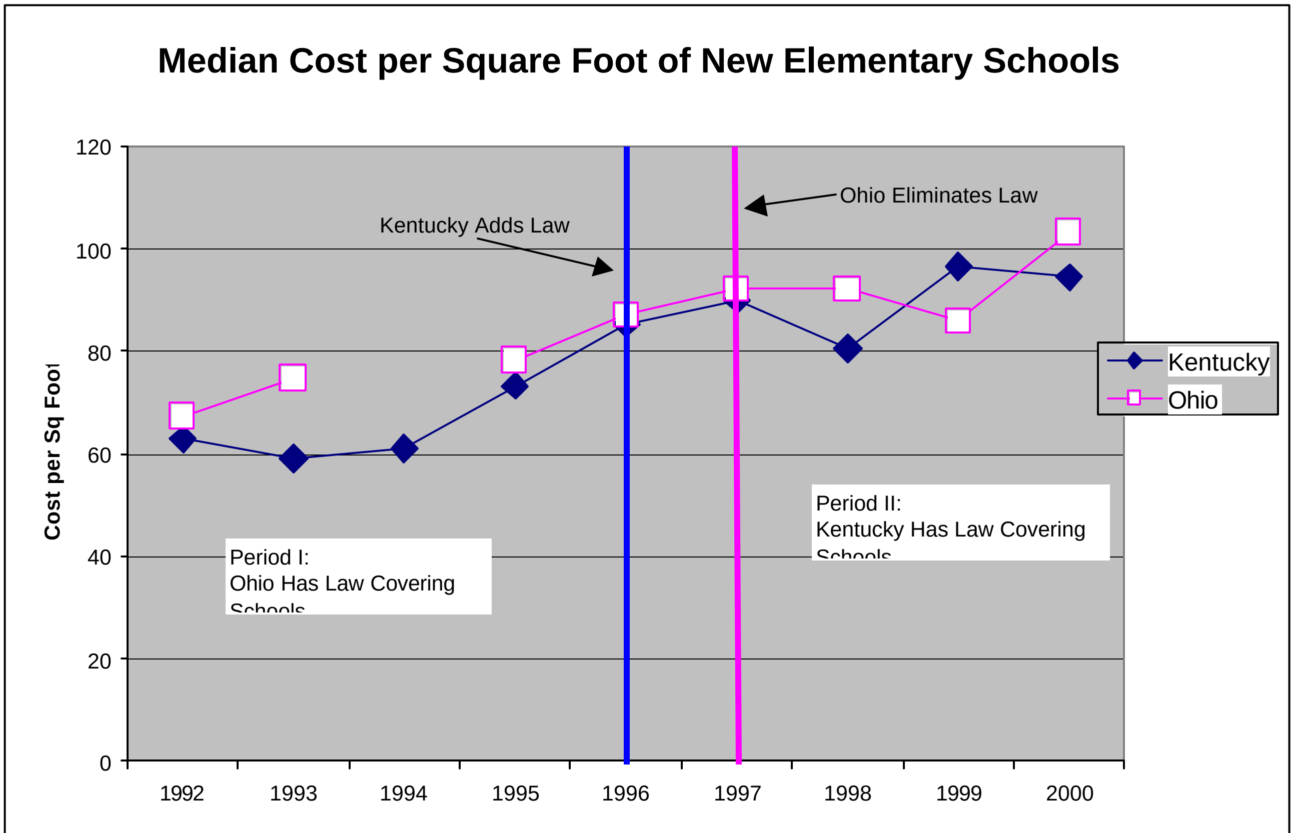
Almost half, 49% of the projects were built with prevailing wages while the remaining 51% were built without these regulations.

Table 2 shows the distribution of when the new public schools were built. Column c shows that 1991 had unusually few new public schools built, and the year 2000 had unusually many schools built. This reflects the two ends of the business cycle and building cycle. The year 1991 was a recession year and the economies of these states grew progressively from then through the 1990s. One result of this growth has been an expansion of school construction.

Year	Number of New Schools	Percent of Decade's Total New Schools Built in Each Year	Percent of Each Year's New Schools Built Under Prevailing Wage Laws
a	b	c	d
1991	5	1%	20%
1992	44	11%	61%
1993	28	7%	68%
1994	10	3%	50%
1995	39	10%	33%
1996	49	13%	37%
1997	53	14%	49%
1998	33	8%	58%
1999	56	14%	71%
2000	74	19%	30%
Total	391		49%

- Table 2: The time distribution of new school construction within the study

Table 2 also shows the annual percent of each year's new school construction that was done using prevailing wages. The balance tends to be stable over time. The dip in 1995 and 1996 is due to Michigan suspending its law in those years. (Michigan split construction in 1997 with the first half not using prevailing wages and the second half using this regulation.) In the year 2000, Ohio has a major increase in school construction, all done absent prevailing wages. This accounts for the somewhat lower percentage of new school built with prevailing wages in that year.



• Figure 2: Median Cost of New Public Elementary Schools in Kentucky and Ohio by Year

Figure 2 gives a general sense of the experiment we are going to perform. In Figure 2, the median square foot cost to build a new elementary school in Kentucky and Ohio are compared for the years 1992 to 2000. These data are not deflated. They are in the actual dollars reported at the time. Consequently, it is not surprising that the median cost rises with time. In our statistical model, we will deflate these prices using the Consumer Price Index and ask the question whether controlling for inflation, new school construction costs are still going up. We will also control for a variety of other factors that cannot be controlled for in a simple figure such as the one above. Our additional controls include a control for possible economies of scale associated with larger schools, a control for the differences between urban and rural construction, a control for fancy facilities, a control for tight construction markets possibly pushing up the real cost of construction. With these controls in place, we will look at variations in prevailing wage policies. In Figure 2, changes in prevailing wage policies are shown by two vertical lines, one in 1996 representing Kentucky's application of a prevailing wage regulation. And a second vertical line in 1997 representing Ohio's exemption of public schools from prevailing wages. If these laws had an effect on costs, one might expect to see a change in the general relationship between median new public elementary school construction costs in the two states. Visually, this does not seem to appear. We will go beyond visual inspection to examine all 391 new schools and test whether or not, controlling for other factors, changes in prevailing wage regulations have made a difference.

Comparison of Mean Square Foot Cost

We begin our analysis with a simple comparison of the average or mean inflation-adjusted square foot cost of building a new school. The 391 new schools are broken down into those built in urban areas (126 schools) and those built in rural areas (265 schools). Urban areas include the areas around Cleveland, Columbus, Cincinnati, Dayton, Louisville, Lexington, Detroit, Flint, Grand Rapids and Lansing. Within each group of urban and rural schools, the schools are broken down into those built under prevailing wage regulations and those built without prevailing wages.

Table 4 shows the mean, standard deviation[1] and number of schools in each of four categories: 1) rural schools built without prevailing wages; 2) rural schools built with prevailing wages; 3) urban schools built without prevailing wages; and 4) urban schools built with prevailing wages.

	New Public Schools						
		Real (Inflation Adjusted) Square Foot Cost					
	a	**b**	**c**	**d**	**e**	**f**	**g**
1		**Rural Schools**			**Urban Schools**		
2		**Mean**	**Standard Deviation**	**Number**	**Mean**	**Standard Deviation**	**Number**
3	**No Law**	**$96**	$26	161	**$114**	$36	40
4	**Law**	**$98**	$24	104	**$114**	$34	86
5	**t-test**	-0.76			0.05		
6	**Statistically Significant Difference?**	No			No		

• Table 3: Comparison of the Real (Inflation-Adjusted) Square Foot Cost of New Public Schools by Urban and Rural Schools and Built without or with Prevailing Wages

[1] The standard deviation is, in essence the wiggle around an average. So for instance, if you had 5 children in a carpool ages 8, 9, 10, 11 and 12, the mean (or average) would be 10 years of age, and the standard deviation or wiggle around the mean would be 1.4 years.

The comparison of mean real square foot costs can be seen in rows 3 and 4, columns b and e. Considering rural schools first, the average or mean real square foot cost of schools built without prevailing wages was $96 per square foot while the mean real square foot cost of schools built with prevailing wages was $98 per square foot. There were 161 new rural schools built without prevailing wages in the sample and 104 new rural schools built using prevailing wages in this sample. (See column d, rows 3 and 4). The standard deviation is a statistical measure of the wiggle around each mean. It is used to construct a statistical test of whether or not the $2 difference in the average cost of construction per square foot is statistically significant. The statistical test is called a t-test. Typically, for there to be statistical significance, the t-statistic must be around plus or minus 2. In this case for rural schools where the difference is $2 per square foot, the t-statistic shown in column b, row 5 is -.75. What this means is, statistically speaking, there is no difference between the average square foot cost found for rural schools built with prevailing wages compared to the average square foot cost of schools built without prevailing wages.

Considering schools built in urban areas, in the sample, 126 new schools were built in urban areas with 40 being built without prevailing wages and 86 being built with prevailing wages. The average or mean real (inflation-adjusted) square foot cost of urban schools built with and without prevailing wages was almost equal. Indeed, rounding to whole dollars, they are equal at $114 per square foot (in year 2000 dollars).[2] Again, the t-test indicates that any minor difference in these two means (in this case 34 cents) is not statistically significant. Another way of putting this is: the difference in average real square foot construction cost for new public schools is due to random differences and statistically, the averages are equivalent. This conclusion holds both when comparing urban schools and when comparing rural schools built with and without prevailing wages.

A Statistical Model of New Public School Construction Costs

Table 4 presents the results of a statistical model of new public school construction costs. The model is called an ordinary least squares linear regression model. This type of statistical model is very commonly used by economists, epidemiologists and others studying social phenomena. The particular model in Table 4 uses the 391 new public schools built in Kentucky, Ohio and Michigan over the 1991 to 2000 period as data to help predict the effects of various factors on total new construction costs. The focus variable in

[2] If you do not round to whole dollars, the mean for schools built without prevailing wages was $114.17 and with prevailing wages it was $113.83.

the equation is the last variable in the model shown in gray on line 12. But before we get to this issue, let us examine the other aspects of the model.

	Model		Coefficient	t-statistic	Significance level	Statistically Significant?
1	a	b	c	d	e	f
2		(Constant)	4.45	16.05	0%	Yes
3	Size	Natural Log of the Total Square Feet of the Project	1.00	41.59	0%	Yes
4	Business Boom	Time (in years)	2.9%	5.58	0%	Yes
5	Location	School was built in Ohio	-12.6%	-3.70	0%	Yes
6		School was built in Kentucky	-14.6%	-4.03	0%	Yes
7		School was built in an urban area	10.5%	3.41	0%	Yes
8	Special Facilities	School had a gym/pool facility	9.2%	1.69	9%	Yes
9	Timing	School was started Winter quarter	-5.6%	-1.21	23%	No
10		School was started Spring quarter	-10.9%	-2.75	1%	Yes
11		School was started Summer quarter	-2.7%	-0.63	53%	No
12	Law	School was built with prevailing wages	0.7%	0.26	79%	No
13	**Total Cost of School**	**Natural log of real (inflation adjusted) total start cost of each new school (in year 2000 dollars)**				
14	Model statistics	Adjusted R-square (a goodness of fit statistic) = .85				
15		Number of new schools in the sample = 391				

- Table 4: A Linear Regression Model of the Total Square Foot Cost of Building New Public Schools in Kentucky, Ohio and Michigan Focusing on the Effect of Prevailing Wage Regulations

The first key factor in the model is the size of each of the 391 new schools. The coefficient of 1.00 says that as the square foot size of the school increases, the total cost of the school increases proportionately.[3] The second variable is simply time measured in years. This variable captures the fact that building costs have been rising faster than inflation in the 1990s. The cost data in the model are inflation adjusted using the Consumer Price Index. The time variable indicates that after adjusting for inflation, new public school construction costs in these three states have been rising at 2.9% per year from 1991 to 2000. This result is statistically significant. The reason building costs have been rising faster than inflation is because the economic boom has led to a very vigorous boom in building leading to heavy demand for construction services.

[3] In other studies, I have found in some cases that there were economies of scale in school construction costs. Namely, as school size increased, total cost went up but more slowly than total size went up. The absence of economies of scale among these 391 schools may be due to the relative homogeneity of the buildings in the sample

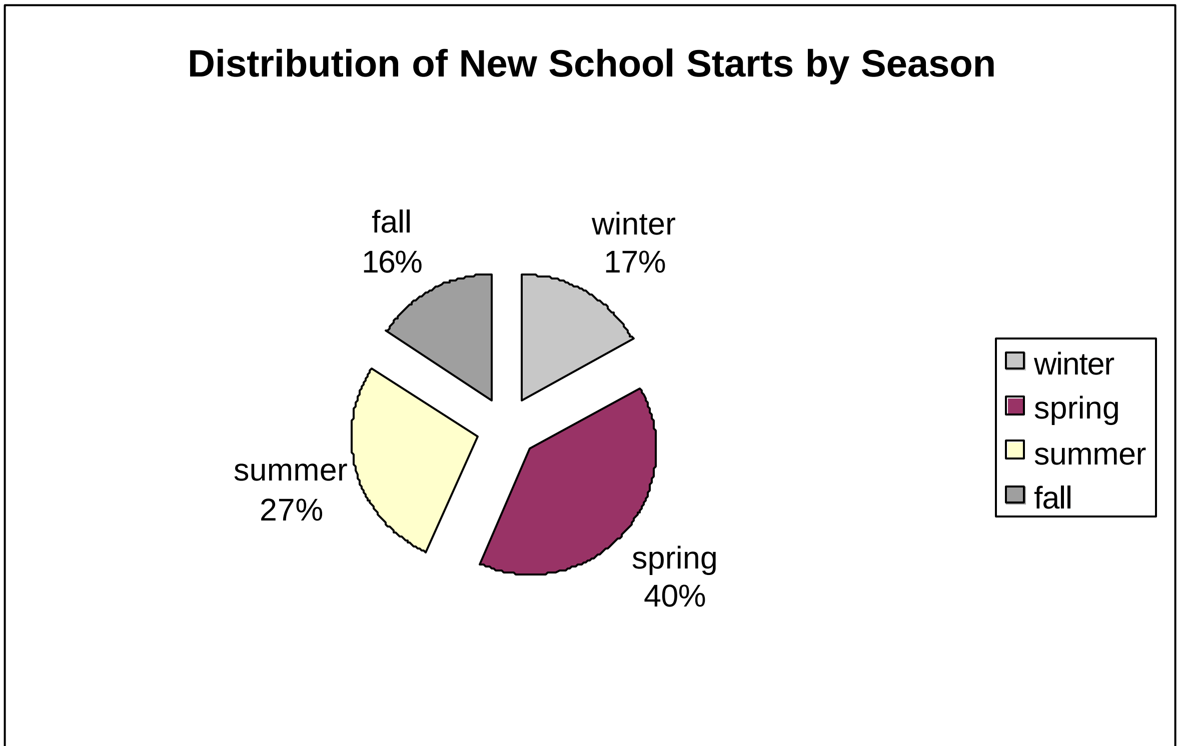
Rows 5, 6 and 7 in the model present three variables that control for where the school was built. Row 7 indicates whether or not the school was built in an urban area. Urban schools cost 10.5% more than rural schools controlling for other factors such as the size of the school. Rows 5 and 6 indicate whether or not the school was built in Ohio (row 5) or Kentucky (row 6). In the case of urban schools, the reference point was rural schools. In the case of Kentucky and Ohio, the reference point is Michigan. The model indicates that new Ohio schools cost 12.6% less than Michigan schools while new Kentucky public schools cost 14.6% less than Michigan new public schools. These results, too, are based on controlling for other factors such as the size of the school, when the school was constructed, whether or not the school was urban or rural and whether or not the school was built under prevailing wage mandates.

Rows 9, 10 and 11 indicate in what season the school was started. Row 9 indicates schools started in the winter quarter (January, February or March). Row 10 indicates schools started in the spring. And row 11 indicates schools started in the summer. In all three of these cases, the reference point is schools started in the fall. These seasonal variables get at the question of whether breaking ground on a new school in the face of winter weather raises the cost of building that school.

The model indicates that schools started in the winter were 5.6% cheaper than schools started in the fall. But this result is not statistically significant. The lack of statistical significance means that you cannot be sure there really is any difference in the total cost of schools started in the winter compared to the fall. In the case of schools started in the spring, they were 10.9% cheaper than schools started in the fall (again controlling for other factors such as the size of the school, whether it was an urban or rural school, etc.). In this case, the results of the model are statistically significant. That is, this statistical model indicates that you can be confident that breaking ground in the spring will lead to lower cost new school construction compared to breaking ground in the fall.[4] Breaking ground in the summer is estimated to be 2.7% cheaper than breaking ground in the fall, but this is not a statistically significant difference. The point of these results, however, is clear. Don't break ground into the teeth of winter. It will cost you. Indeed, the model shows that by starting in the spring instead of the winter saved enough money for each school to include a gymnasium/pool facility in its specifications. The 7% of all schools that had such facilities paid 9.2% more total costs, controlling for other factors. And compared to starting in the fall, starting in the spring would have offset the cost of a swimming pool.

[4] In most cases in the FW Dodge data, the start date is the date of bid acceptance. Given that there will be some lag between bid acceptance and ground breaking, fall probably means late fall and spring probably means late spring. Also, given the probable cause of increased costs associated with breaking ground in the late fall is weather, the effect of this seasonal factor is probably stronger in the colder areas within the sample of Michigan, Ohio and Kentucky.

Figure 3 shows that for the most part, school boards and contractors know this. Fully 40% of all new public schools in Kentucky, Ohio and Michigan started in the years 1991 to 2000 were started in the spring. Fall starts—the most expensive start time—accounted for only 16% of all starts. However, whatever drove schools boards to start schools in the fall compared to the spring also led them to pay a 10% premium for this choice of when to break ground.



• Figure 3 : Percent Distribution of New School Starts by Season for Kentucky, Ohio and Michigan, 1991-2000

The Effect of Prevailing Wages on Costs

Controlling for seasonality, controlling for differences in rural and urban construction costs, controlling for the size of the project and controlling for the state in which the project was built, the model estimates that using prevailing wage regulations raised school construction costs by 7/10th of 1%. But again, this is not a statistically significant result. In effect, the model says there is no effect on total costs associated with prevailing wages.

How can this be? Prevailing wage rates insure that all contractors must pay the wage rates that prevail for an occupation in an area. Without this regulation, contractors are free to pay whatever they want (or the market will allow). The fact is that prevailing wage regulations induce contractors to hire a more skilled labor force and equip them with better, more up-to-date, tools, materials and equipment. It also induces management to compete over better management strategies and techniques. Thus, the higher wage rates are offset to a large extent by higher skilled, better equipped, and better managed workers.

It may be, however, with more observations, we would find that the 0.7% higher cost associated with prevailing wage regulations would turn out to be statistically significant. And, in a market where the government is obliged to accept the lowest bidder regardless of the reputation or history of the contractor, that 0.7% difference could lead to an entire changeover in the contractors doing business in building schools. But we must remember that this model is based on start costs—accepted bid price. The ultimate cost of a new school includes cost overruns and the downstream cost of maintenance. The potential 0.7% savings may be an offer for school boards to become penny wise and pound foolish.

Conclusion

A simple comparison of the mean (or average) inflation-adjusted square foot cost of building 391 new public schools in Kentucky, Ohio and Michigan broken down by urban and rural schools finds no statistically significant difference between those public schools built with prevailing wages and those public schools built without this regulation. A more complex statistical model that estimates new public school construction costs based on the size of the project, whether it was an urban or rural school, which state built the school, and at what time of the year the school was built again finds no statistically significant effect on total new school construction costs associated with whether or not the school was built with prevailing wages. While net effect of prevailing wage regulations is apparent, school boards can save 10% on new school construction costs by starting in the spring and not breaking ground in the face of winter weather. While 40% of all new schools do start in the spring, 16% of new schools had to pay this 10% penalty by starting as winter approached.

The data used in this study come from FW Dodge reports and show the start cost—or accepted bid price—of the new school. Final cost of new public school include cost overruns and downstream maintenance costs. The higher wage rates required by prevailing wage regulations insure that all contractors bidding on the job will use skilled labor when building the school. If you have to pay for the high-priced spread, you might as well buy it. Thus, prevailing wage regulations offer school boards some assurance that the project will be skillfully built and workers on the job will be carefully managed. Consequently, prevailing wage regulations provide some assurance against cost overruns and downstream maintenance costs.

Peter Philips grew up in Compton and Pomona, California. He received his B.A. from Pomona College in 1970 where he majored in economics and received the Leland Backstrand Graduating Senior Award in Economics. Philips received his M.A. in economics (1976) and his PhD in applied economics (1980) from Stanford University. Philips is a Professor of Economics at the University of Utah. He is co-editor of *Three Worlds of Labor Economics* (M.E. Sharpe, 1986) and coauthor of *Portable Pensions for Casual Labor Markets: the Central Pension Fund of the Operating Engineers* (Quorum Books, 1995). Philips has published widely on the canning and construction industries in journals such as the *Journal of Education Finance, Industrial and Labor Relations Review, Industrial Relations, Business History,* the *Journal of Economic History, Historical Methods, The Journal of Economic Literature, Oxford Encyclopedia of Economic History* and the *Cambridge Journal of Economics.* Philips has been a consultant for the U.S. Labor Department analyzing the supply of cannery labor in California, and he has worked as an expert on the Davis-Bacon Act for the U.S. Justice Department. The Davis-Bacon Act regulates wage payments to construction workers on federal public works. Philips is a respected expert on prevailing wage laws and on employment, training wages and benefits in the construction industry. He has testified before state legislative committees in Ohio, Indiana, Kansas, Oklahoma, New Mexico and California on their state prevailing wage laws. Along with other researchers at the University of Utah, Philips has analyzed the effects of prevailing wage laws on public construction costs, construction worker incomes, apprenticeship training, worker safety and minority access to construction work.

Philips is the senior labor economist at the University of Utah. He teaches a wide range of courses in the area of labor economics, econometrics, labor law, collective bargaining and economic history. Philips has received awards for his teaching and community service, including University of Utah Public Service Professorship, the University of Utah Presidential Teaching Scholar Award and the University of Utah, College of Social and Behavior Science Superior Teacher Award. Philips is married with two children.

Appendix

Simple Comparison of One Year Before and One Year After Legal Change in Kentucky, Ohio and Michigan

The following is a simple comparison of the average or mean square foot cost of new public schools one year before compared to one year after a change in the prevailing wage law in the three states—Kentucky, Ohio and Michigan.

Kentucky applies prevailing wage regulations to public school construction in July of 1996. Ohio exempts public schools from prevailing wage regulations in July of 1997. A Michigan court suspended the application of prevailing wage regulations in the state in December, 1994. A second court reapplied prevailing wage regulations in July of 1997.

These variations allow for four simple 12-month before-and-after comparisons--one for Kentucky, one for Ohio and two for Michigan. In this simple comparison there is no adjustment for inflation and no statistical tests for equality of means. All that is presented is the raw averages and the number of new public schools that comprise each average.

Average Square Foot Cost						
	Before	**# Schools**	**After**	**# Schools**	**Legal Change**	**Cost Change**
Kentucky: No-Law to Law	$86	17	$86	15	Enactment	$0
Ohio: Law to No-Law	$77	7	$90	18	Repeal	$13
Michigan: Law to No-Law	$83	14	$94	5	Suspension	$11
Michigan: No-Law to Law	$101	40	$108	9	Resumption	$6

- A 1: Simple Comparison of Mean Square Foot Cost of New Public Schools for the 12 Months Before and After a Policy Change

Table A1 shows that for Kentucky, the mean square foot cost of 17 schools built in the 12 months prior to the application of prevailing wage regulation to public school construction equaled the mean square foot cost of 15 new public schools built in the 12 months after the application of prevailing wages. In Ohio, there was a $13 increase in the mean square foot cost of new school construction subsequent to the repeal of the application of prevailing wages to public school construction. In the case of Michigan, when the law was suspended, the mean square foot cost of new public school construction rose in the subsequent 12 months by $11 per square foot. When Michigan reapplied prevailing wages to public school construction, the mean square foot cost rose again by $6 per square foot.

Other factors that might influence these changes include inflation, tightening construction markets, and the mix between urban and rural schools. These factors are controlled for in the econometric model presented in the main body of this report.