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Do Project Labor Agreements Raise Construction Costs?

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A Project Labor Agreement (PLA) is a form of "pre-hire" collective bargaining agreement between building trades unions and the construction clients that typically requires any firm that bids on a project hire workers through union halls and follow union rules on pensions, work conditions and dispute resolution. In return, unions agree not to strike for the duration of the project. Opponents argue that PLAs raise construction costs; proponents dispute this and say that labor peace ensures that PLA projects are finished on time. We measure the cost effect of PLAs using data on construction costs for 126 schools in Massachusetts between 1995 and 2003; our regression results show that PLAs raise the cost of school building by between $12 and $20 per square foot, or by between 9 and 15% of total costs. This is in line with anecdotal evidence on the PLA effect. However, a study by Belman et al. (2005), using fewer (70) observations but a fuller econometric specification, found no statistically significant PLA effect; we argue this imprecision is due to the small sample. We suspect that in this case the larger sample with fewer variables is more revealing than a smaller sample with more variables.

Keywords: *Project Labor Agreement, construction costs, Massachusetts schools*

Introduction

In 2005, Mayor Edward Lambert of the city of Fall River, Massachusetts, was confronted with a problem. The minimum bids on three major school construction projects had just come in at $86 million instead of the $63 million originally budgeted, threatening to derail the city's ambitious school construction plans.

After almost half a century without any school construction, Fall River, a city of 92,000, recently decided to rebuild eleven of its 34 schools over a ten-year period, aided by a commitment from the state to reimburse 90% of the cost. The first four new schools – all relatively straightforward elementary school projects – were opened in 2001-2004. The bids were solicited following the standard procedures required in Massachusetts: sealed sub-bids were first solicited for most of the major components of the work (roofing, electrical, masonry, and the like), and then bids were requested for a general contractor, who would typically use the services of most of the lower-priced sub-bids.

In 2005 the city solicited bids for the Kuss Middle School, but this time there was one difference: Project Labor Agreement (PLA) rules applied. Such rules typically require that all workers be hired through union halls, that non-union workers pay dues for the length of the project, and that union rules on pensions, work conditions and dispute resolution be followed. In return, unions agree not to strike for the duration of the project. Mayor Edward Lambert argued that labor peace would ensure that the construction project would not be delayed, and that the system would guarantee that local workers would be hired.

The city was taken aback when the minimum sub-bids on the Kuss construction project totaled $17.4 million, well above the original budgeted cost of $11.8 million. Several components of the project had few bidders, and nobody bid on the electrical work. The subsequent minimum bid for the general contract was no better, coming in at $45.7 million instead of the budgeted $36 million. Nor was the problem confined to the Kuss school. Two other building projects, for the Small and Slade elementary schools, were expected to cost $14.8 million (for the sub-bid components), but the minimum bids totaled $22.9 million, or 55 percent more than anticipated.

So in May 2006 the city of Fall River cancelled the Project Labor Agreement and started the bidding process for the three schools over again.

The Questions to be Addressed

The Fall River case raises a much larger question: What effects, if any, do Project Labor Agreements have on the cost of construction? And can these effects even be measured, given the great variety of construction projects?

We are able to address this question using data from a natural experiment – the boom in state-financed school building in Massachusetts over the past decade and a half, where some schools were constructed under PLA rules and others were not.

In the next section we describe Project Labor Agreements, trace their origins, and summarize the arguments that have been made both for and against them. We then trace the evolution of the school building program in Massachusetts, and explain how we constructed our data. The subsequent section presents our statistical results and then evaluates their robustness. This includes a discussion of the difficult trade-off that researchers often face between more observations with fewer variables (our case) and fewer observations with more variables (Belman et al. 2005). In the final section we return to the case of Fall River.

The Origins and Development of PLAs

What is a PLA?

A Project Labor Agreement is a form of "pre-hire" collective bargaining agreement between labor unions and the construction clients – typically the Federal or state government, municipalities or school districts, but also many private contractors – and refers to a specific project, contract or work location (GAO 1998). Project Labor Agreements are unique to the construction industry.

The terms of PLAs generally recognize the participating unions as the sole bargaining representatives for the workers covered by the agreements, regardless of the current union membership status of these workers. A PLA requires all workers to be hired through the union hall referral system. Non-union workers must join the signatory union of their respective craft and pay dues for the length of the project. The workers' wages, pension contributions and working hours and the dispute resolution process and other work and staffing rules are also prescribed in the agreement. PLAs supersede all other collective bargaining agreements and prohibit strikes, slowdowns and lockouts for the duration of the project (US GAO 1998).

Project Labor Agreements in the United States originated in the public works projects of the Great Depression, which included the Grand Coulee Dam in Washington State in 1938 and the Shasta Dam in California in 1940. PLAs have continued to be used for large construction projects since World War II, including the construction of Cape Canaveral in Florida, the current central artery project (the "Big Dig") in Boston, and even private projects, such as the Alaskan pipeline and Disney World in Florida.

Why PLAs?

As PLAs have become more common in publicly financed construction projects, and as the number of non-union construction firms has grown, PLAs have become controversial. Opponents of PLAs argue that they raise the cost of construction both directly, because of the higher expense of following union rules, and indirectly because of diminished competition and hence fewer construction bids.

The direct effect on raising costs follows from the PLA requirements that all employees must be hired in union halls, pay union dues, contribute to union-sponsored retirement plans, and follow union work rules. The contractors and their employees are required to pay union wages, dues and contributions into union benefit plans even if they are covered by their own plans. And the work rules restrict the contractors from using their own more flexible operating rules and procedures. Note that these higher costs are not generally due to a union wage differential; in many areas, including Massachusetts and Connecticut, "prevailing wage" rules largely equalize the hourly wage cost of union and non-union workers for publicly-funded projects. .

Open-shop contractors contend that their competitive advantages, and especially the ability to work with just their own workforce, are nullified by the PLA; the use of a union hiring hall can force non-union contractors to hire union workers in preference to their own regular work force. The result is that in practice, if not in principle, they are unable to bid competitively on jobs that have a PLA requirement. In turn, the absence of open-shop bidders for PLA projects results in fewer bidders for the project, and with fewer bidders, the lowest bids come in higher than if open-shop contractors had participated. A number of critics see PLAs as a form of extortion, with an implicit threat that if a town does not agree to a PLA, then there is more likely to be disruption at the workplace.

Proponents of PLAs claim that the agreements provide for work conditions that are harmonious, and that they guarantee wage costs for the life of the contract (see, for instance, Bureau of Labor Education 2005). They contend that the provisions that prohibit strikes, slowdowns and lockouts keep the project on time and prevent cost overruns due to delays. They argue, furthermore, that the wage stipulations allow firms accurately to estimate labor costs for the life of the project and thus have more accurate bids; and that the union rules, along with union-sponsored training, make for a safer work environment, thereby reducing accidents and thus lowering the number of workman's compensation claims. In this view, workers' union certifications ensure the quality of the work and save money by avoiding costly mistakes.

Government Policy Toward PLAs

The executive branch of the federal government has been involved in the PLA debate for over a decade. The administration of George H. W. Bush issued an executive order in 1992 forbidding the use of PLAs on federally funded projects. The Clinton Administration rescinded that order in February 1993 and attempted to go further in 1997, when it planned to issue an executive order requiring all federal agencies to use PLAs on their construction projects. However, due to extensive lobbying, the President instead issued a memorandum encouraging the use of PLAs on contracts over $5 million for construction projects, including renovation and repair work, for federally owned facilities. President George W. Bush canceled the Clinton order on February 17, 2001 by issuing an executive order prohibiting PLAs on federally funded and assisted construction projects (US GAO 1998).

At the level of state and local government, backers of PLAs have pushed to require them on local construction projects, with mixed success. For instance, the Massachusetts legislature attempted to require PLAs for the rebuilding and repair of courthouses throughout the state in the 1990s, although after some negotiation PLAs were only mandated for courthouse construction projects in Boston, Worcester, and Fall River. The legislation created a commission to recommend establishing circumstances in which PLAs should be used, instructing it to consider the "appropriateness and function and the size, complexity and duration of the public construction projects" when deciding whether or not to use PLAs (Northrup and Alario 2000).

The courts have also played a role in determining when PLAs are appropriate. In 1988, a federal court directed the Massachusetts Water Resources Authority to clean up the pollution in Boston Harbor. The Authority's project management firm, IFC Kaiser, negotiated a PLA with the local construction unions for the project. The precedent-setting aspect of this PLA was that its use was mandated in the project's bid specifications (Northrup and Alario 2000, 12-13). A non-union trade group filed a lawsuit contending that requiring the PLA as a part of the bid specification violated the National Labor Relations Act. The case was appealed to the United States Supreme Court, which, in 1993, upheld the use of the PLA for the project.

PLAs and Construction Costs

A Natural Experiment

Although there is substantial anecdotal evidence that PLAs raise construction costs, no studies have provided formal statistical evidence of such an effect. To compare PLA with non-PLA costs it would be necessary to compare construction projects of a similar "cost, size, scope, and timing" – for instance road repairs – where some projects are done with a PLA in place, and others are not. Situations such as this are rare, and even when they occur, the relevant information is difficult to obtain (GAO 1998, p.12).

There is, however, one suitable "natural experiment" that makes it possible formally to compare the costs of PLA and non-PLA projects. Driven by an increase in the student population, and encouraged by financial support from the state, many of the roughly one hundred towns and cities in the greater Boston area have financed the construction of new schools over the past several years.

The School Building Assistance Program in Massachusetts has aided public school construction for more than half a century. The program began in 1948 as a three-year effort to provide resources to local communities for the building of schools for the "Baby Boom" generation, with a 25% percent reimbursement rate for the local school districts (Massachusetts 2000). The program has since grown substantially, and has widespread political support (e.g. Klein 2003). After several extensions, today "the school building assistance program is the largest capital grant program operated by the Commonwealth…and the costs of the school building assistance program are increasing at an unsustainable rate" (Massachusetts 2000). In 1999, the program offered, on average, a 69% reimbursement rate for the construction and financing costs of school projects. Over the period 1991-1999 the Commonwealth of Massachusetts made total contributions to the program of more than $1.7 billion. A report entitled *Reconstructing the School Building Assistance Program Policy Report,* published in 2000, predicted that by FY 2002 "this program will achieve 'budget buster' status."

Some towns had PLAs in effect during the construction bidding process while others did not. Based on this information it was possible to measure the PLA cost differential; the details of how we have done this are given below.

Data Sources

The first step in identifying the effects of Project Labor Agreements is to specify and estimate a model of the determinants of the cost of constructing new schools; a PLA variable can then be incorporated in the estimating equation in order to test whether there is a statistically significant PLA cost differential.

The dependent variable is the construction cost per square foot. As discussed below, we have two cost measures; the first is *winning bid cost*, which is the amount that the lowest-cost contractor bid for the job; the other measure is *actual cost*, which is the amount that the project actually costs. The actual cost is typically higher than the bid cost, because it takes into account "change orders" that modify the original project, but of course it can only be measured when the project has been completed.

Among the most important determinants of project costs per square foot ("Csqft") are:

a. The size of the project ("size"). This is typically measured in square feet, and is included in order to accommodate the possibility of increasing returns to scale: larger schools are expected to cost less per square foot of construction.
b. A dummy variable, set to one if the project consists of new construction rather than a renovation ("New"); and
c. A dummy variable, set to one if the project is undertaken under a Project Labor Agreement ("PLA"). This is the effect that we are interested in measuring.

More compactly, the equation to be estimated is:

$$\text{Csqft} = a + b.\text{size} + c.\text{size}^2 + d.\text{New (yes=1)} + e.\text{PLA (yes=1)} + \varepsilon \qquad (1)$$

Ideally, a number of other variables would be included too, essentially to pick up the special features of each construction project – is there a gym, a pool, tiled floors? Unfortunately, we were not able to gather information at this level of detail, and surprisingly, the Commonwealth of Massachusetts does not keep adequate or detailed information on the schools that are built largely at its expense! However, the coefficient on the PLA variable will only be biased if the omitted variables are systematically correlated with whether a project used a PLA or not.

The data we use cover school construction projects in the greater Boston area for the period 1995 through 2003. We started with data on bid costs and other variables from F.W. Dodge, part of the McGraw-Hill Construction Information Group. This enabled us to construct a list of school building projects, and we then contacted town and school district officials, construction companies, and architectural firms in order directly to obtain data for each project, including the base construction bid, the size of the project measured in square feet, whether there was a PLA requirement on the project, and the nature of the construction (new or addition versus renovation). Every observation on bid or actual costs provided by Dodge was verified using at least one other source, usually in writing.

We then excluded all projects with a valuation below $5 million, on the grounds that projects of this size are typically too small to be of interest to union contractors. We further focused our study on school construction projects between 40,000 and 400,000 square feet in size, in order to exclude abnormally small or large projects. Our sample comprises the 126 projects for which we had data, 21 (17%) of which involved PLAs, the remainder of which did not.[1] Several towns, attempting to realize economies of scale savings, included construction at multiple school sites in a single bid as one large project. We had no choice but to treat these multiple school cases as one construction project and therefore as one observation in our statistical analysis.[2] For these projects, we followed standard practice and used the base construction bid for the project and divided it by the sum of the new and renovated square footage for all the schools within the project to determine the cost per square foot.

Construction costs rose during the period under consideration (1995 through 2003), so it was necessary to express all costs in constant (2001) prices. This was achieved by deflating with an appropriate cost index, which was based on two components that were given equal weight. The first component was a wage index, based on total wages and salaries for construction workers in Massachusetts, divided by the total number of workers in that sector (US Bureau of Economic Analysis, Tables SA05 and SA25). The second component was based on the national producer price index for intermediate materials, supplies, and components.[3]

Basic Results

A comparison of the key characteristics of the school construction projects in towns with a PLA ("PLA projects") with those where there was no such agreement ("non-PLA projects") is shown in Table 1. The table shows that the cost per square foot is $18.26 higher for PLA than for non-PLA projects. A formal t-test, allowing for unequal variances, shows this difference to be highly statistically significant; the p-value for the null hypothesis of no difference is 0.001, based on a t-statistic of 3.672.[4] However, this test is not conclusive, because it is possible that PLA projects are systematically different – for instance larger, or concentrated on new buildings rather than renovations.

Table 1. Summary Statistics for Construction Projects by PLA Status

Variable	Winning construction bid in millions of 2001 dollars	Size of project (square feet)	Construction bid cost/square foot in 2001 dollars*	Number of stories
Mean				
PLA	$22.92	151,213	$152.46	3.11
Non-PLA	$16.95	131,440	$134.20	2.39
Difference	*$5.97*	*19,773*	*$18.26*	*0.72*
SD				
PLA	$ 10.71	69,432	$ 19.99	0.76
Non-PLA	$ 7.77	67,656	$ 24.44	0.78
Minimum				
PLA	$7.37	45,190	$128.56	1
Non-PLA	$6.30	45,000	$72.72	1
Maximum				
PLA	$42.31	286,650	$202.93	4
Non-PLA	$40.89	383,000	$199.26	4

Total sample size is 126, with 21 PLA projects and 105 non-PLA projects. Costs are measured in 2001 dollars; see text for details.

To determine whether or not the difference in PLA versus non-PLA projects is robust to differences in project size and type, we estimated equation (1), with the results that are presented in Table 2. These show that PLA projects add an estimated $18.83 per square foot (in 2001 prices) to the bid cost, controlling for whether or not the project involves new construction, and controlling for the project's square footage. The finding is highly statistically significant. The equation also shows that projects involving new construction, rather than renovations, experience significantly higher costs per square foot, as one would expect.

Table 2. Ordinary Least Square Estimates of Real Construction Bid Cost per Square Foot

Variable	Coefficient	Standard Error	p-value (one-tailed test)
Constant	138.69	4.96	0.00
PLA	18.83	3.93	0.00
New	17.89	2.72	0.00
Square Feet	-12.36	4.97	0.00

Adjusted R^2 is 0.31. Sample size is 126. Square footage is measured in 100,000s.

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[1] PLA contracts were in effect in the following towns: Boston, Lawrence, Lynn, Malden, Medford, Milton, and Waltham (for two of the four schools in the data set). The Classical High School project in Lynn is considered a PLA project since our construction bid information predates the lawsuit that overturned the PLA requirement and forced the project to be re-bid without a PLA requirement.

[2] These include projects in the towns of Andover, Beverly, Brockton, Haverhill, Fall River, Lancaster, Medford, Taunton, Walpole and Weston.

[3] From the *Economic Report of the President*, February 2003. We used the "other" subcomponent of "Intermediate Materials, Supplies, and Components" within the producer price index.

[4] A test of the equality of the variance in cost per square foot between the PLA sample and the non-PLA sample yields a p-value of 0.305, so one cannot reject the null hypothesis of equal variances. A t-test of the equality of means, assuming equal variances, gives a t-statistic of 3.212 and a p-value of 0.002, again strongly indicating that there is a difference in cost per square foot between PLA and non-PLA projects.

With an adjusted $R^2 = 0.31$, the equation "explains" a respectable 31% of the variation in construction bid costs across towns. Clearly, other factors also influence the cost of construction – the exact nature of the site, the materials used for flooring and roofing, the outside finish, and the like. As a practical matter, collecting viable information at this level of detail, for all 126 projects, would be almost impossible. Thus our equation necessarily excludes these unobservable variables. However, this does not undermine our finding of a substantial PLA effect, because for the PLA effect shown here to be overstated, it would have to be the case that PLA projects systematically use more expensive materials, or add more enhancements and "bells and whistles," than non-PLA projects. Our conversations with builders, town officials and architects suggest that PLA projects are not systematically more upscale, which gives us some confidence that the PLA effect shown here is real.

Robustness

It is important to explore the robustness of our results. In other words, is there still a PLA effect if we only look at elementary school construction, or new projects, or mid-size projects, or if we use actual costs rather than bid costs. The results of such exercises are summarized in Table 3.

The first column indicates the sample, or sub-sample, used in estimating the regression equation. The first four rows use the largest possible sample, but vary in which other variables are included in the equation.

Table 3. Regression Estimates of the "PLA Effect" for different Sub-Samples and Model Specifications

	PLA effect ($/sq ft)	p-value	Other variables included[k]	Sample size (# of PLA projects)	Adjusted R^2	Mean cost/sq ft	
						Non-PLA projects	PLA projects
Bid cost/sq ft							
All observations	**18.83**	**0.000**	**New, sqft**	**126 (21)**	**0.31**	**134.2**	**152.5**
All observations	19.09	0.000	New, sqft, sqft2	126 (21)	0.31	134.2	152.5
All observations (weighted)[a]	20.51	0.000	New, sqft	126 (21)	0.39	134.2	152.5
All observations[b]	17.86	0.004	New, sqft, sqft2, floors, element, distance	117 (18)	0.29	134.4	152.5
All observations[b]	12.91	0.036	New, floors, element, distance	117 (18)	0.23	134.4	152.5
Elementary schools only	12.49	0.053	New, sqft, sqft2	76 (15)	0.12	140.4	149.7
Jr. Hi & Hi schools only	34.60	0.000	New, sqft, sqft2	50 (6)	0.51	125.5	159.5
Memo: p value[c]		*0.04*					
New construction only	14.90	0.003	Sqft, sqft2	85 (16)	0.12	141.7	151.9
Renovations only	25.67	0.056	Sqft, sqft2	41 (5)	0.23	119.9	151.0
Mid-size projects only[d]	19.92	0.001	New, sqft, sqft2	74 (16)	0.31	128.1	152.4
Small projects only[e]	14.41	0.095	New, sqft, sqft2	64 (7)	0.19	141.2	156.2
Large projects only[f]	20.01	0.003	New, sqft, sqft2	62 (14)	0.32	125.9	150.6
Actual costs/sq ft							
Sample 1[g]	16.51	0.012	New, sqft, sqft2	62 (14)	0.40	133.6	153.1
Memo: bid costs[h]	16.92	0.009	New, sqft, sqft2	62 (14)	0.45	128.8	149.4
Memo: p value[c]		*0.77*					
Sample 2[i]	11.80	0.094	New, sqft, sqft2	50 (10)	0.44	133.0	146.2
Memo: bid costs[j]	11.52	0.093	New, sqft, sqft2	50 (10)	0.50	127.3	141.1
Memo: p value[c]		*0.86*					

Notes: Maximum sample size: 126. The baseline regression is in first row (boldface) and reproduces the results shown in Table 2. [a]Weighted regression, where observations were weighted by the size (in square feet) of each project. [b]Smaller sample size because values were missing for some variables. [c]Tests difference in PLA effect between the previous two rows. [d]Only projects between 100,000 and 300,000 square feet. [e]Less than 118,500 square feet (median project size in sample). [f]Greater than 118,500 square feet (median project size in sample). [g]Largest available sample for which actual costs were reported. [h]Excludes observations where reported actual cost equaled reported bid cost. [i]Actual costs were, on average, $4.48 higher than bid costs, for this sample. [j]Actual costs were, on average, $5.56 higher than bid costs, for this sample. [k]New = 1 if new construction, 0 if renovation. Sqft = number of square feet in project. Sqft2 = number of square feet squared. Floors = number of stories. Element = 1 if elementary school, 0 otherwise. Distance = miles from Boston.

Our analysis proceeded by running separate regressions for

1. elementary and non-elementary schools;
2. new construction projects and renovations;
3. mid-size projects (100,000 to 300,000 square feet) only;
4. small projects (defined as below the median of 118,500 square feet) and large projects;
5. the largest available sample that allowed us to use final costs (rather than bid costs); and
6. a smaller sample, using final costs but excluding those cases where reported final costs equaled reported bid costs.

The "PLA effect" column shows the estimate of the effect of having a PLA on the cost of construction (in dollars per square foot, in 2001 prices), and the adjoining "p-value" column measures the statistical significance of these coefficients. In every case the PLA effect is statistically significant at the 10% level or better. The size of the PLA effect differs somewhat, depending on the sample examined and the other variables that are included.

The results of the "baseline" regression analysis presented in Table 2 are reproduced here in the first row; this equation has the virtue of including as many observations as possible, while being parsimonious in the use of variables.

In analyzing the robustness of our results, four points are worth making. First, there appears to be a significantly larger PLA effect for junior high and high schools ($34.60/sq.ft.) than for elementary schools ($12.49/sq.ft.). Second, the PLA effect for new construction ($14.90/sq.ft.) is smaller than for renovations ($25.67/sq.ft.); perhaps renovations are harder to predict accurately. Third, the PLA effect for mid-sized projects – defined as those between 100,000 and 300,000 square feet – is, at $19.92/sq.ft., similar to that for the sample as a whole ($18.83/sq.ft.).

Fourth, and most interestingly, the PLA effect is essentially the same whether one uses bid costs or actual costs of construction. Of the 126 projects, information on actual construction costs was reported in only 62 cases; for this sub-sample, the PLA effect was $16.51/sq.ft. for actual costs and $16.92/sq.ft. for bid costs. For twelve cases, the project was reported to be "on budget," which we took to mean that reported actual cost was the same as the reported bid cost. While this is certainly plausible, we did experiment by removing these cases and estimating the PLA effect with the remaining 50 cases. For the restricted sub-sample the PLA effect was $11.80/sq.ft. for actual costs, which is very similar to the effect for bid costs ($11.52/sq.ft.) for this same group.

An examination of the residuals for our preferred equation (row 2 in Table 3) does not show evidence of heteroscedasticity. A Brausch-Pagan test for heteroscedasticity yielded a chi-square value of 2.55 with an associated p-value of 0.11, which justifies our use of ordinary least squares. However, as a robustness check we re-ran our preferred equation using the Huber-White feasible generalized least squares estimator; compared to the OLS results, this raised the standard error on the PLA coefficient from 4.957 to 4.990 and reduced the t-statistic from 3.80 to 3.77. The p-value stayed at 0.000 (to three decimal places), confirming the basic finding of a statistically strong effect of PLAs on construction costs.

In using OLS we are implicitly assuming that each observation (here, a school building project) carries equal weight in the regression. However, we also estimated our preferred equation using weights, where each project is given a weight that is in proportion to the square footage that it represents. This means that a project of 150,000 square feet, for instance, would have twice as much weight in the equation as a project of 75,000 square feet. The weighted regression shows a PLA effect of $20.51/sq.ft., again highly statistically significant.

The Belman Critique

After Haughton et al. (2003a, 2003b) published a study that argued, using a sample of 54 school projects undertaken in Massachusetts between 1995 and 2001, that PLAs substantially raised construction costs, a team led by Dale Belman was commissioned to examine the issue further (Belman 2005). The team was able to gather relatively detailed information from "architects, contractors and school officials" on the characteristics of recent construction, including final (i.e. actual) construction cost, for 70 schools in Massachusetts for which construction was complete by 2001-02. Belman et al. then regressed the construction cost per square foot on a set of independent variables that included whether the job was done under PLA rules.

The parsimonious specifications, which were similar to the ones we used, arrived at estimates of the PLA effect that were comparable to the ones we report above. But the important point is that when Belman et al. add additional variables, the PLA effect becomes statistically non-significant (although the estimated coefficient is still always positive). They argue that the more complete models are appropriate, because they better capture the

Table 4. Regression Estimates of the Determinants of Massachusetts School Construction Cost (from Belman et al. 2005)

	Model 2		Model 4		Model 5	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
PLA	32.31	2.31	13.80	1.18	23.28	1.19
Area ('000 sq. ft.)	-1.1	-5.33	-1.1	-4.63	-0.6	-1.19
Area squared (m)	0.00262	4.66	0.00276	4.00	0.00111	0.71
Elementary	-27.02	-3.41	-27.10	-3.33	-26.90	-2.15
Private	-24.88	-0.58	-39.34	-0.82	9.10	0.30
Other variables			(3 other)		(24 other)	
Boston			34.11	2.10		
Constant	237.26	14.41	219.57	9.27	132.17	2.21
R^2	0.323		0.388		0.626	

Source: Belman et al. (2005), Table 2.

Notes: The "other variables" include the number of stories, and dummy variables that indicate whether project had a basement/required demolition/a boiler/chiller/central air conditioning/unit ventilators/was ground coupled/unitary packaging/had a steep roof/combination/swimming pool/cafeteria/band room/auditorium/elevators/gymnasium/kitchen/library/science labs/vocational rooms/required extensive grading/athletic facility/tennis courts. All the regressions use data for schools constructed in Massachusetts. The sample size is 70.

variations inherent in construction projects. The results of a representative selection of their regressions are shown in Table 4.

It is not clear that these results make a compelling case for the irrelevance of PLAs. The weakened PLA coefficient in Model 4 is largely due to the inclusion of a dummy variable for Boston, where three of the nine PLA schools in the sample were located. This means that the PLA effect is largely measured based on the effects of the six PLA schools located outside Boston. Model 5 omits the Boston variable, but tries to estimate coefficients for 30 variables using just 70 observations. Not surprisingly, this reduces most of the coefficients to insignificance, including the PLA effect (t=1.19 in this case). A cautious conclusion would be that the sample used is not large enough to permit one to conclude that PLAs have no significant effect on costs. Belman et al. close their paper on a similar note; after arguing that "estimates obtained from small samples can be influenced by unusual data" then go on to say that "although this does not invalidate the research, it suggests caution in accepting such estimates as the last word on this subject." It was a similar concern that prompted us to expand our initial sample of 54 school construction projects (Haughton et al. 2003) to an eventual total of 126 (Bachman et al. 2003; Tuerck and Bachman 2006).

Conclusions

Mayor Lambert took a step toward reducing his budgetary dilemma when, in May 2006, the city of Fall River cancelled its Project Labor Agreement and once again put out the Kuss, Slade and Small school projects for bid. The resulting bids (without PLAs) were 6.4% lower than the original bids (with PLAs), saving the city $5.8 million. Shortly thereafter, still without a PLA, the city received 62 sub-bids on a project to rebuild the Letourneau school ($1.5 million over budget), compared with just 24 sub-bids on the very comparable project to rebuild the Small school ($4.7 million over budget when bid under a PLA).

The Fall River case is dramatic, but is it compelling? It is, in the end, just an anecdote – albeit a good one – and without further information it is hard to judge whether the central message, which is that PLAs are costly, is more broadly applicable.

More convincing, perhaps, are the econometric results. They are based on a natural experiment that allows us to control for much of the heterogeneity in building projects by focusing just on school building in Massachusetts between 1995 and 2003. Parsimonious models of the influences on the bid cost of building (per square foot), using data on 126 schools, consistently show a strong "PLA effect" that varied from about $12 to $20 per square foot, equivalent to between 9 and 15 percent of the total cost.

Yet not everyone is convinced by these findings. Belman et al. (2005) were able to gather more detailed information, including final (i.e. actual) construction cost, for 70 schools in Massachusetts for which construction was complete by 2001-02. [5] Their parsimonious specifications found results similar to the ones we report above. However, the PLA effect, while remaining positive in all cases, became statistically non-significant when additional variables were included in the equation. With 30 variables

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[5] The study was sponsored by the National Electrical Contracting Foundation at a cost of $139,000.

and 70 observations, this is surely unsurprising, as the PLA effect risks being buried in noise.
Which is likely to be more credible – a larger dataset with fewer variables, or a smaller dataset with more variables? This is a common dilemma; given budget constraints, should, for instance, household surveys collect more detailed information from a modest number of households, or less detail from a larger sample?

In the case of Project Labor Agreements, we remain persuaded that they raise the costs of construction substantially – based on our sizeable sample. The Belman et al. (2005) results do not find a statistically significant effect in more complete models, but that does not necessarily mean that there is no such effect; it is more likely that their data are not extensive enough to pick up any effects with sufficient clarity.

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