Project Labor Agreements: A Research Review

Russell Ormiston
Allegheny College

Kevin Duncan
Colorado State University-Pueblo

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Executive Summary

Project labor agreements (PLAs) are pre-hire labor contracts between a construction owner or general contractor and labor organizations that establish the terms and conditions of employment on a specific construction project. PLAs insulate owners and contractors from construction risk and promote timely completion of construction projects by, among other things, ensuring timely access to skilled labor and banning work stoppages. In return, PLAs require that most blue-collar worker on the job site are selected through the union referral system.

While project labor agreements are commonly used to guide private-sector construction in the United States and Canada, their use by federal, state and local government has been a source of controversy for decades. These debates have waged over numerous issues, however the primary concern has been how PLAs affect taxpayer costs on public construction projects. To inform public policy debates, this report summarizes the economics research on public-sector PLAs that has been published since 2000 and attempts to reconcile disparate findings across studies. The primary takeaways of this report are as follows:

- *Economic research on project labor agreements is limited, especially within peer-reviewed, academic journals. What has been published is almost exclusively restricted to understanding the effects of PLAs on school construction.*

This review emphasizes the findings of economic studies in peer-reviewed academic journals, however there have only been a handful of such studies published since 2000. This review supplements the analysis by also highlighting a number of economic studies published outside of the academic press. Data availability is an obstacle in the pursuit of PLA research, causing scholars to direct their focus to one area—school construction—where PLA projects are relatively common and data are more accessible.

- *There has only been one peer-reviewed study that has investigated the relationship between PLAs and bid competition. The study found that PLAs did not have a statistically significant effect on the number of bidders on a project.*

A critical hypothesis in the controversy surrounding PLAs is that they reduce bid competition on public construction projects, thereby raising costs. In the lone peer-reviewed study to evaluate this question, Philips and Waitzman (2021) demonstrated that project labor agreements did not have a statistically significant impact on the number of bidders on community college projects in California. While this finding is consistent with research on the effects of prevailing wage laws on bid competition, it is acknowledged to be the outcome of a single peer-reviewed study and more research is needed.

- *The most recent and methodologically advanced peer-reviewed studies highlight that PLAs do not have a statistically significant effect on school construction costs.*

The relationship between project labor agreements and public construction costs has received the most attention of scholars. Philips and Waitzman (2021) and Belman et al. (2010) represent the most advanced analyses in the academic literature, with both studies concluding that PLAs did not significantly impact school construction costs in California and Massachusetts, respectively. Relatedly, Waddoups and May (2014) highlight that responsible contracting policies—which feature some of the same characteristics as PLAs—had effectively zero impact on school construction costs in Ohio.

- *Less-developed and non-academic studies proclaiming that PLAs substantially increase school construction costs likely suffer from a critical statistical shortcoming, leading to inflated cost estimates.*

There are numerous less-developed and non-academic studies touting that project labor agreements increase school construction costs by 15% to 20%, thereby contradicting the more advanced studies available in the academic press. This review highlights that these cost estimates appear to be inflated by a statistical issue known as "omitted variable bias." In essence, school construction projects covered by PLAs have been found to be larger, more complex, and more predominantly located in urban areas when compared to school projects not covered by PLAs. By not adequately accounting for differences between PLA and non-PLA projects, these studies appear to be misattributing part, if not all, of the cost differentials arising from increased complexity and urban location to the presence of a project labor agreement on such projects.

- *There is a considerable need for additional research on the economic effects of project labor agreements.*

Important public policy questions surrounding project labor agreements are conspicuously unstudied or understudied in the economics literature. Research on PLAs' effect on timely completion, craftsmanship, and training investments is nonexistent. The effect of project labor agreements on bid competition is still in its infancy. While there have been numerous studies on PLA effects on school construction costs, research on the cost impact of PLAs has been scant in other areas; the lone exceptions are two studies published outside of the academic press that reach conflicting conclusions as to whether PLAs have any effect on affordable housing construction costs in California. Most important to public policy considerations, the authors are not aware of an economic research study that systematically examines the cost effects of PLAs on a sample of the largest, most visible, and most expensive public projects (power plants, highways, bridges, etc.) that are at the heart of most public policy debates on this issue.

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Introduction

Project labor agreements (PLAs) are pre-hire labor contracts between a construction owner or general contractor and labor organizations that establish the terms and conditions of employment on a specific construction project. PLAs insulate owners and contractors from construction risk as these agreements typically ensure timely access to skilled labor, harmonize work scheduling provisions among trades, and include provisions that ban work stoppages regardless of whether there are strikes or lockouts in the local construction labor market. PLAs can also be used to advance other goals, such as the hire of apprentices, local workers, and those from underrepresented backgrounds. In return for these and other concessions, PLAs require that most blue-collar workers on the job site are selected through the union referral system.[1]

Variants of project labor agreements have been used by construction owners and developers to manage private-sector and public-sector construction for nearly 100 years.[2] They are ubiquitous in the private sector in the United States and Canada, employed by large companies—such as Apple, Toyota, Intel and Honda—with decades of experience overseeing large construction projects.[3] Nevertheless, the use of PLAs by federal, state and local governments has been a source of controversy.[4] Advocates of PLAs contend that the provisions of these contracts ensure timely completion of projects and higher quality workmanship, while opponents argue that these agreements discourage competition from qualified bidders and increase costs to taxpayers. The policy debate over public-sector PLAs will likely only increase after the Biden Administration issued an Executive Order in February 2022 mandating that PLAs were to be used on federal construction projects of $35 million or more.[5]

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[1] For more detail on the specifics of project labor agreements, see: Belman and Bodah (2010), and Philips and Waitzman (2021).

[2] For more on the history of project labor agreements, see Belman and Bodah (2010).

[3] See McFarland, Pam. (2022). "Federal Labor Proposal Flares Union, Industry Tensions," *Engineering News-Record*, published on August 22, 2022, and accessed on September 19, 2022 at: https://www.enr.com/articles/54646-federal-labor-proposal-flares-union-industry-tensions; "Project Labor Agreements in Ohio: A Survey of the Data and Cost-Benefit Outcomes" published by ACT Ohio located at: https://www.actohio.org/wp-content/uploads/2021/09/PROJECT-LABOR-AGREEMENTS-IN-OHIO.pdf.

[4] For some examples of private-sector PLAs, see "Project Labor Agreements in Ohio: A Survey of the Data and Cost-Benefit Outcomes" published by ACT Ohio located at: https://www.actohio.org/wp-content/uploads/2021/09/PROJECT-LABOR-AGREEMENTS-IN-OHIO.pdf.

[5] For the Executive Order issued by President Biden, see: https://www.whitehouse.gov/briefing-room/presidential-actions/2022/02/04/executive-order-on-use-of-project-labor-agreements-for-federal-construction-projects/. Further, the Biden Administration has proposed amending the Federal Acquisition Regulation in September 2022 on federal construction projects of $35 million or more (albeit with numerous exceptions). These proposed amendments can be accessed at the Federal Register here: https://www.govinfo.gov/content/pkg/FR-2022-08-19/pdf/2022-17067.pdf.

In order to inform this policy debate, this report represents a review of economic studies on project labor agreements published since 2000.[6] To be clear, economic research on PLAs is limited. Most glaringly, there is no known economic study on the effects of project labor agreements on construction outcomes on extremely large federal construction projects such as power plants and highway construction. Instead, due to data availability issues, research has been almost exclusively limited to the construction of public schools and community colleges. Further, the research is limited to examining the effects of PLAs on (a) the number of bidders on a project and (b) construction costs.

As an overview of the research findings, this study summarizes the disparate results of two distinct research streams. First, while there are relatively few well-developed, peer-reviewed studies of PLAs in academic journals—which are broadly recognized to be of higher quality in research circles—they point to a conclusion that PLAs do not have a statistically significant impact on construction costs or bid competition on school construction projects. In contrast, less developed research efforts appearing mostly outside of the academic press suggest that PLAs substantially inflate construction costs. In order to provide clarity for public policy conversations, this review will highlight the methodological differences between these two research streams and attempt to reconcile their findings.

Research: Bid Competition

Philips and Waitzman (2021) represents the only known peer-reviewed research study to specifically address the influence of public-sector PLAs on bid competition. To study this question, the authors analyzed bid openings for 263 construction projects among California community colleges between 2007 and 2016; within this sample, 88 were governed by project labor agreements while 175 were not (although all projects were subject to the state's prevailing wage law). After accounting for a variety of factors that may affect the number of bids on a project—including the fact that PLA projects were larger in size than non-PLA projects—the authors' analysis revealed that the presence of a project labor agreement did not have a statistically significant effect on the number of bidders on the project.[7]

Opponents of PLAs nevertheless argue that these agreements deter bid competition, specifically reducing participation among nonunion contractors (e.g., Burke and Tuerck, 2019, 2020). But Philips and Waitzman (2021) undermines this argument. While it is acknowledged that this represents the outcome of a single academic study, their results establish that PLAs did not affect the number of bidders on public projects. Further, while Philips and Waitzman (2021) could not distinguish between union and nonunion bidders in there dataset, there are two possible inferences from their results: (a) PLAs do not

[6] The authors acknowledge the publication of academic articles deliberating the legality of project labor agreements. This review, however, is focused solely on the economic literature and quantitative analyses of market outcomes associated with PLAs (e.g., number of bidders and costs). As a result, articles published in legal journals fall outside the purview of the current analysis.

[7] With the number of bidders as the dependent variable, the authors controlled for the size of the project—as measured by the value of the lowest bid—the month and year the project was let to bid, location of the project, and the community college district overseeing the construction.

significantly deter nonunion contractors from bidding and/or (b) any decline in bids from one subset of nonunion contractors—such as those reliant on low wages—is offset by increased competition from union and other nonunion contractors.

When considering the findings of Philips and Waitzman (2021), it is also important to highlight that all projects in their sample were covered by California's state prevailing wage law. The findings of the study, therefore, imply that PLAs do not represent an added barrier to contractors' bids on public projects covered by prevailing wage laws. However, the academic literature on the influence of prevailing wage laws on bid competition is robust and the consensus of these studies indicates that these regulations do not affect the number of bidders on a project. This has been demonstrated in research reports from across the country, including on public works projects in California (Kim et al., 2012), highway construction projects in Colorado and Kentucky (Duncan, 2015; Duncan et al., 2022), and school construction in Ohio and Nevada (Onsarigo et al., 2020; Duncan and Waddoups, 2020).[8] Importantly for the current conversation, research also demonstrates that the effect of prevailing wages on bid competition did not differ when union rates prevail (Kim et al., 2012; Onsarigo et al., 2020; Duncan and Waddoups, 2020).

The well-developed research on prevailing wage laws is important in understanding the potential influence of PLAs on bid competition. First, the research demonstrates that a labor regulation does not necessarily reduce bid competition, likely because any potential deterrence in competition from one segment of the market in response to a project labor agreement may be offset by greater interest by contractors from other segments.[9] Second, research on prevailing wage should assuage concerns about California's law being a confounding factor in Philips and Waitzman (2021), further strengthening the likelihood that their results are generalizable across jurisdictions.

Outside of the academic press, the authors know of only two studies that have statistically analyzed the effect of project labor agreements on bid competition. Belman et al. (2007) examined 164 school construction projects in San Jose, California, and suggested that PLAs had no effect on the number of bidders per bid opening; the only predictive influence on bid competition was the business cycle (i.e., periods of greater construction activity were linked with fewer bidders per project).[10] Conversely, the Washington Policy Center published a 2019 report to suggest that PLAs decreased the number of bidders on public infrastructure projects in Western Washington State (Bachman, Burke, and Tuerck, 2019). However, Ward (2021) criticized the overly simplistic approach used in this more recent study, specifically its failure to include basic controls for the type of work involved and location of the project, specifically whether construction took place in higher-cost Seattle; this means that it cannot be ruled out that any presumed PLA-driven effect is instead the result of basic differences between PLA projects and non-PLA projects.

[8] Bilginsoy (1999) also found that the introduction of minimum construction wages in British Columbia was associated with an initial increase in bid competition that diminished over time.

[9] This is not necessarily a union vs. nonunion argument, as research demonstrates that nonunion contractors represent a significant portion of winning bids on prevailing wage projects (Kim et al., 2012; Duncan, 2015).

[10] Specific results from their statistical analyses were not provided in the study, but their text makes this trend clear.

Research: Construction Costs

School Construction

Individual Studies. While public policy debates over project labor agreements touch on numerous issues, perhaps the central consideration is whether PLAs affect public construction costs. Research on the cost effects of project labor agreements is somewhat limited in the academic literature over the last 20+ years. However, it is revealing that the most recent and advanced studies published in academic journals do not find evidence that PLAs are associated with a statistically significant effect on construction costs. This contradicts, older and less developed analyses mostly published outside of academic press that suggest a large and positive cost effect of project labor agreements.

Before reviewing individual studies, it is important to highlight that the vast majority of research on the potential cost effects of PLAs involves the analysis of school construction. This is largely because school construction is ubiquitous across the country, providing researchers access to a relatively large number of projects that have some underlying degree of similarity (as opposed to comparing two dissimilar projects, such as bridges and prisons). And since schools in some locations are built under PLAs and others are not, it allows researchers an opportunity to examine the potential cost effects of project labor agreements. However, schools are not *identical*, as many projects have unique features—such as the installation of a swimming pool or boiler system, urban construction, and so on—that can substantially affect the cost of construction. As will be described later, appropriately controlling for these differences across projects is of considerable importance in accurately isolating any cost effects attributable to project labor agreements.

In the most recent study published in academic press, Philips and Waitzman (2021) examined how PLAs affected costs among community college construction projects in California from 2007 to 2016. While their primary focus was on bid competition, the authors also had access to the project engineer's estimated cost for 99 construction projects. Using this measure to control for project size and complexity—since both would be expressly incorporated in an engineer's cost estimate—as well as project location and year of construction, the authors' statistical analysis revealed that the presence of a PLA had no effect on construction costs as measured by the lowest bid received on the project.

As a reminder, all public community college projects in California analyzed by Philips and Waitzman (2021) would presumably have been covered by the state's prevailing wage law. This therefore implies that PLAs had no effect on construction costs *after* incorporating any cost effects of prevailing wage. However, the academic research on the effects of prevailing wage law on school construction cost is robust and a clear consensus of studies reflects that prevailing wage laws do not have a statistically significant effect on school construction costs; for a review of these studies, see Duncan and Ormiston (2019). Putting these two results together, one can infer—but not prove—that the lack of any cost impact of PLAs would be consistent across states with and without prevailing wage laws.

Belman et al. (2010) represents the most comprehensive academic study of the potential cost impact of project labor agreements on public construction projects. For this study, the authors collected extensive data on 70 K-12 school construction projects built in Massachusetts between 1996 and 2002; of those, nine were built under a PLA while 61 were not. While the sample size is a bit small, Belman et al. (2010) is unique in the literature for collecting information on dozens of characteristics on each school construction project, far more than any other similar study published to date either within or outside academic press. This allowed the authors to more carefully account for differences between school construction projects, such as the installation of a swimming pool, the construction of a chiller, and the building of an auditorium. Analyzing this extensive data set, Belman et al. (2010) offers substantial evidence supporting the hypothesis that PLA projects are larger, more complex and feature more urban construction than non-PLA projects.[11]

In statistical models that sufficiently accounted for the size, complexity and location of school construction projects—specifically those built in Boston—Belman et al. (2010) discovered that there was no statistically significant relationship between project labor agreements and construction costs.[12] Perhaps just as importantly, Belman et al. (2010) used its extensive data on school projects to identify that overly simplistic statistical models were inaccurate in estimating the cost effects of project labor agreements. As will be discussed in more detail later, the authors highlighted that "lean" statistical models mistakenly conclude a large PLA cost effect that is, in actuality, the result of PLAs being used on more complex and more predominantly urban construction projects.

A third study offers an important contribution to this literature even if project labor agreements were only a part of their analysis. Waddoups and May (2014) examine responsible contracting policies (RCPs) on school construction costs in Ohio. Starting in 2000, some school districts in the state required contractors adhere to "high-road" employment practices—by providing their workers with prevailing wages and benefits (health insurance and retirement), participation in apprenticeship training, and the development of safety programs—in their bids. In addition to the fact that many of these provisions resemble those found in project labor agreements, the authors noted that a limited number of jurisdictions in the sample explicitly used PLAs to organize these responsible contractor requirements, thereby making them directly a part of the RCPs identified in the sample. To examine the effect of these policies on bid costs, the authors

[11] The differences between schools built under a PLA and those that were not were stark. On average, Belman et al. (2010) discovered that schools built under a PLA were larger (172,000 vs. 118,000 square feet), taller (3.3 vs. 2.6 stories), more likely to include demolition work (100% vs. 49%), and more likely to include additional features such as the installation of chillers (100% vs. 46%), science labs (100% vs. 66%), and auditoriums (89% vs. 31%). Further, and perhaps most importantly, the results showed that 33% of schools built under a PLA were in the Boston Public Schools; in contrast, just 2% of schools built without a PLA were in Boston.

[12] This conclusion is somewhat complicated by the fact that Belman et al. (2010) were relying on a relatively small sample (n=70) and a relatively large list of variables in their most complex statistical model; this introduced some degree of multi-collinearity and concerns about over-fitting in the most sophisticated model. However, the authors attenuated these concerns by demonstrating that even when accounting for a small set of additional controls—especially the location of projects within Boston—the cost effect of project labor agreements was not statistically significant at any reasonable level (see Table 3 of Belman et al. (2010)).

analyzed 319 schools built in the state between 1997 and 2008; of those, 63 were covered by responsible contractor policies. However, after controlling for basic elements of school construction projects, geographic location, and year of construction into account, the author's most advanced models indicated that responsible contractor requirements—which both resembled and included PLAs—had effectively zero influence on school construction costs.

An important characteristic of Waddoups and May (2014) is that approximately 98% of school construction projects included in their study were started after 1997, the year that school construction was exempted from Ohio's prevailing wage law. Consequently, much of the data involve the comparison of projects that were covered by responsible contractor policies to comparable projects that were not covered by other construction labor market standards. As a result, the findings of Waddoups and May (2014) that responsible contractor policies—which resemble PLAs and, in some cases, includes them—have effectively zero influence on construction costs is especially valuable in that it is the most statistically advanced study of such policies in a jurisdiction without the potential conflating effects of prevailing wage laws.

While the most recent and fully developed analyses in academic press offer consistent evidence that project labor agreements do not have a statistically significant impact on public construction costs, these studies contradict an older and less developed academic paper that instead found sizeable cost impacts of PLAs. Bachman and Haughton (2007) analyzed the cost impact of PLAs on a sample of 126 K-12 school construction projects in Massachusetts between 1995 and 2003. Using a lean statistical model that only accounted for the project size and whether a project was a new building, the authors' results reflect that PLAs increased construction costs $19 per square foot; variations of this result led the authors to believe that project labor agreements increased total construction costs by 9% to 15%.[13]

The Bachman and Haughton (2007) study is important in the context of economic research on PLAs beyond its role as a counterweight to more recent studies. At the time of publication, the authors of the study were affiliated with the Beacon Hill Institute—a think tank in Massachusetts—and the organization has replicated this work in a series of state-specific reports on the cost effects of project labor agreements in the construction of school buildings. These studies, which are not published in peer-reviewed journals, follow approximately the same template: an analysis of the effects of PLAs on school construction costs using an overly simplistic statistical model that captures differences in the size of projects and a limited number of other features.[14] While models' specifics have varied over time, their studies

[13] Bachman and Haughton (2007) err in repeatedly calling their study a "natural experiment" (p. 73). A natural experiment is a situation where there is random assignment of observations to a control (non-PLA) and treatment (PLA) groups. Belman et al. (2010) shows that the assignment of PLAs on school construction projects is anything but random; it varies systematically based on the size, complexity, and location of the project.

[14] Early PLA studies published by the Beacon Hill Institute featured very lean specifications. For instance, their early studies of Connecticut (Bachman et al., 2004) and New York State (Bachman and Tuerck, 2006) each included regression equations that featured a very limited number of variables: PLA, square feet, stories,

consistently report that PLAs are associated with a 15% to 20% increase in public construction costs (Bachman et al., 2004; Bachman and Tuerck, 2006; Bachman and Tuerck, 2017; Burke and Tuerck, 2019; Burke and Tuerck, 2020). Similarly lean statistical models yielded comparable results in a study of California schools by the National University System Institute for Policy Research (Vasquez et al., 2011) and in New Jersey schools by the state's Department of Labor and Workforce Development (NJLWD, 2010).

Reconciling Outcomes. The research on the effects of PLAs on school construction costs reveals a wide range of outcomes. On one hand, the most recent and fully developed studies in the academic press suggest that PLAs do not have a statistically significant effect on costs. On the other hand, an older academic paper and a series of non-academic reports suggest that PLAs are associated with enormous increases in costs. While a first instinct may be to simply defer to more sophisticated studies published in peer-reviewed journals, there is value in reconciling the disparate findings of these research efforts.

Taking a 50,000-foot view of the results, suggestions that PLAs increase total construction costs by 15% to 20% seem remarkably high. This is due to the fact that, on average, labor costs account for just 23% of total contractor costs in the construction industry according to an analysis of the 2017 Economic Census of Construction.[15] Taken together, this would mean that these overly simplistic studies are suggesting that project labor agreements almost double the labor costs on a project (assuming the price of materials and land is fixed).

The inference that PLAs almost double labor costs seems implausible. This necessitates a critical analysis of the reasons why these non-academic studies might conclude that PLAs increase costs by 15% to 20%. First, the evidence strongly negates any presumption that the cost effect is driven by requirements that contractors pay union wages. The studies touting large PLA cost effects were conducted in states—such as Massachusetts, Connecticut and New Jersey—with prevailing wage laws. This means that, in many jurisdictions, the union wage on a project would be the legal standard with or without the PLA, implying that the purported PLA effect in those studies is not likely due to the payment of union wages. Further, the academic research is robust and clear that state prevailing wage laws have no effect on school construction costs, inferring that higher wages are offset by the use of higher-skilled workers and/or more capital-intensive construction practices (Duncan and Ormiston, 2019).[16]

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elementary school and new construction (Connecticut only). While these authors initially dismissed scholarly concerns that their models did not include enough variables (Tuerck et al., 2009), subsequent studies have implicitly incorporated such critiques and have expanded their variable list (e.g., Burke and Tuerck, 2020).

[15] U.S. Census Bureau, 2017 *Economic Census of Construction*, Construction: Geographic Area Statistics. Accessed at: https://www.census.gov/data/tables/2017/econ/economic-census/naics-sector-23.html.

[16] The common misconception that higher wages *must* equate to higher labor costs is contradicted by theory of "efficiency wages," a standard concept taught in any undergraduate labor economics class. This implies that, in the face of higher wages, some companies will employ more productive workers—either through hiring those with higher skill or investing in training—and substitute capital for labor (e.g., machines, technology). Under this theory, high-wage/high-skill employers can compete on costs with contractors who instead use a more labor-intensive, low-skill/low-wage employment model. For a larger conversation about efficiency wages in construction, see Ormiston et al. (2019).

Another common hypothesis offered is that union work rules are inefficient and drive up construction costs on PLA-built projects (Bachman and Haughton, 2007; Burke and Tuerck, 2019, 2020). But that position is contradicted by a well-established research literature in peer-reviewed journals comparing union and non-union bids on public construction projects, including schools. For example, Atalah (2013a, 2013b) found that in most cases there is no statistical difference between union and nonunion bids on Ohio school construction projects; in some case union bids are higher and in other cases, nonunion bids are higher. Duncan and Waddoups (2020) reached the same conclusion in studying union and non-union bids on Nevada school construction projects. Kim, Kuo-Liang, and Philips (2012) also did not find any statistically significant differences in union and non-union bids on municipal construction projects in California. In sum, any suggestion that PLAs substantially increase public construction costs because of union work rules is unrealistic in light of multiple academic studies directly comparing union and nonunion bid outcomes on these types of projects.

In their most recent studies, scholars affiliated with the Beacon Hill Institute hypothesize that a primary reason that PLAs drive up construction costs is because it deters non-union contractors from bidding on a project, thereby reducing bid competition (Burke and Tuerck, 2019, 2020). While it is acknowledged that research on this question is thin, there are reasons to be skeptical. Philips and Waitzman (2021) directly tested this hypothesis; while projects were already subject to California's prevailing wage law, they did not find evidence that PLAs significantly affected bid competition. Any concerns that the state's prevailing wage law is masking any deleterious effects of project labor agreements, however, is assuaged by numerous studies showing that these state laws also did not affect the number of bidders on public projects (Duncan, 2015; Duncan et al., 2022; Duncan and Waddoups, 2020; Kim et al, 2012; Onsarigo et al, 2020). Finally, concerns that PLAs deter nonunion contractors are undermined by studies showing no statistically significant difference in union and nonunion bids on school construction projects in Ohio and Nevada (Atalah, 2013a, 2013b; Duncan and Waddoups, 2020). Given that academic research on the question of PLA effects on bid competition is limited to a single article, the authors of the current study cannot dismiss the possibility that future research may reach different conclusions. However, at this time, the only available peer-reviewed study to directly analyze the effects of PLAs on bid competition contradicts any presumption that PLAs raise costs by reducing the number of bidders.

Given the shortcomings of all feasible explanations linking PLAs to a 15% to 20% increase in public construction costs, the authors of the current study instead advance a hypothesis—originally proposed by Belman et al. (2010) and others—that these inflated results are instead the byproduct of a statistical error known as "omitted variable bias." To explain this, some methodological background is required. In a simple world, the easiest way to determine whether project labor agreements affect public construction costs would be to directly compare the average construction costs of projects built under PLAs to the average costs of those that were not. But there is a fundamental problem that would render such an analysis worthless: projects built under PLAs are typically much larger, more complex, and more often involve urban construction compared to projects constructed without a PLA, a conclusion confirmed by Belman et al. (2010). In fact, project labor agreements are often

used *because* of the overwhelming size or complexity of a particular construction project. That is why, in the private-sector, PLAs are more prevalent in the construction of power plants and manufacturing facilities than they are in the construction of big-box stores and fast-food restaurants.

Given these systematic differences between PLA projects and non-PLA projects, every study of this subject employs a statistical approach—*regression analysis*—that allows researchers to account for differences in size, complexity, and location between projects in order to isolate the cost effect attributable to *just* the project labor agreement. It is therefore imperative that researchers fully account for the differences between projects in their regression models. Otherwise, the PLA variable in the model will implicitly be representing *both* the presence of a project labor agreement *and* all the additional complexity of PLA projects not otherwise accounted for in the model. As a result, "omitting" variables that represent important differences in the size, complexity, or urban location of projects will cause an inadequate regression model to overstate the cost effects of PLAs; in the parlance of economic research, such results will be statistically "biased."

The most recent and fully developed peer-review studies offered in this section provide compelling evidence that inflated estimates of the cost effects of PLAs in non-academic studies are likely the result of incomplete analyses that suffer from this form of statistical error. This is most clearly demonstrated in Belman et al. (2010). To demonstrate the problems of an overly simplistic approach, the authors started by estimating a simple model that did not account for any project differences besides square footage; the results reflect that PLAs are associated with 15% higher construction costs, an outcome that was statistically significant. This result is unsurprising given that, in this simple model, the PLA variable is accounting for (a) the presence of a project labor agreement, (b) the increased complexity on PLA projects, and (c) the greater likelihood that a PLA project was being built in an urban area. However, as the authors incrementally added other controls to account for project complexity and urban construction—thus better isolating the effect solely to the presence of a project labor agreement—the estimated PLA effect declined sharply and was not statistically significant in even modestly complete regression models (see Table 3 in Belman, et al. (2010)).

The same pattern is exhibited in Philips and Waitzman (2021) and Waddoups and May (2014): overly simple models show a positive cost effect that effectively disappears after additional controls are added that account for the complexity and location of projects. This trend across multiple peer-reviewed studies offers clear evidence that studies relying on lean statistical models to proclaim that PLAs substantially increase school construction costs are overstating the effect, likely by a substantial margin. This directly impacts studies published by researchers affiliated with the Beacon Hill Institute. Their studies—especially their early ones—relied on simple models that included few controls. The findings from the peer-reviewed research would therefore indicate that Beacon Hill's inflated estimates of the cost effects of project labor agreements are likely the result of omitted variable bias.[17] This

[17] To be clear, the authors of the current study have no way of *proving* the influence of omitted variable bias in the reports published by scholars affiliated with the Beacon Hill Institute. To do so, the authors would need

hypothesis is further supported by the extremely low "fit" of the statistical models employed by BHI researchers when compared to more fully developed models in the academic literature.[18] Similar conclusions can be reached in evaluating Vasquez et al. (2011) and the NJLWD (2010).[19]

Concerns over omitted variable bias entail more than just the number of variables in a model, but also the exclusion of particularly important variables. In the context of isolating the cost effects of PLAs, an "important" variable would be something that is highly predictive of a PLA being used and is independently associated with higher or lower construction costs. In reviewing the research on project labor agreements, one variable stands out as critical: location. For a variety of reasons, PLAs are more often used in urban school construction projects. As highlighted by Belman et al. (2010), urban school construction is often more expensive for reasons that have nothing to do with project labor agreements. As a result, a statistical model that fails to account for the location of a school project produces a PLA cost effect that is overstated; in these situations, the PLA variable would be implicitly accounting for both (a) the presence of a project labor agreement and (b) the increased cost of urban construction.

The influence of urban construction on the estimated cost effects of project labor agreements is consistent throughout both the academic and non-academic research. In a study of Massachusetts school construction, Belman et al. (2010) demonstrated that the inclusion of a control for Boston schools reduced the magnitude of the estimated PLA cost effect nearly in half.[20] Philips and Waitzman (2021) found the same result when including location in their model of construction costs of California community college projects. Waddoups and May (2014) showed that while a simple model reflected that responsible contracting policies increased construction costs by 10% on Ohio school projects, that effect went to zero upon the simple inclusion of variables accounting for the city in which the construction occurred (Cleveland, Columbus, Cincinnati, etc.). Finally, while Vasquez et al. (2011) headline findings from a simple model that suggests PLAs increase school construction costs in California by 13% to 15%, a deeper dive into their results reflect that the inclusion of a variable accounting for construction within the Los Angeles Unified School District caused the estimated effect

access to the underlying data and, even then, that might be enough: omitted variable bias is often the result of simply not having data on important variables that should be included in a fully specified model.

[18] In econometrics, a general goal of model building is that the model better "fits" the data. To measure this, economists often rely on a commonly-cited metric called "R-squared." While an imperfect measure, R-squared represents the proportion—ranging from 0% to 100%—of the amount of variation in the dependent variable that is accounted for by variation in the independent variables included in the model; generally, the higher number the better. The preferred models employed by Belman et al. (2010) had R-squared values ranging from 35% to 95%, Philips and Waitzman (2021) reported R-squared values over 96%, and Waddoups and May (2014) featured R-squared values over 80%. These results are in stark contrast to studies published by the Beacon Hill Institute, such as 10% in Burke and Tuerck (2020), 18% in Burke and Tuerck (2019), and 21% in Bachman and Tuerck (2017).

[19] The NJLWD (2010) noted that it had little data on school characteristics and, as a result, estimated an overly simple regression model that only featured controls for the size of the school, whether it was an elementary school, whether it was built in Northern or Southern New Jersey and whether it had a PLA.

[20] Compare Models 2 and 4 in Tables 2 and 3 of Belman et al. (2010).

to drop by more than one-half in all models, making the PLA effect no longer statistically significant.[21]

These findings directly call into question the reliability of statistical models that do not account for differences in location or urban construction. For instance, Bachman and Tuerck (2017) touted that PLAs increased school construction costs in Ohio by 13%. However, their approach did not attempt to account for geographic factors despite the findings of Waddoups and May (2014) which illuminated their importance in their study of Ohio school construction costs published just a few years before. Similar recent studies of school construction costs in New Jersey (Burke and Tuerck, 2019) and Connecticut (Burke and Tuerck, 2020) exhibit the same weakness, touting large estimated PLA cost effects but failing to account for the location of the projects.[22,23]

In sum, the authors of the current report believe that studies concluding that PLAs increase school construction costs by 15% to 20% likely suffer from a statistical error--*omitted variable bias*—that has led these reports to overestimate the size of the cost impact of these agreements. While this is not something that the authors of this report can necessarily *prove* without access to each study's underlying data, it is a logical conclusion from an analysis of Belman et al. (2010) and the similarity in statistical patterns revealed in Philips and Waitzman (2021) and Waddoups and May (2014). This conclusion is further supported by evidence undermining alternative theories. While it is acknowledged that peer-reviewed research on project labor agreements is thin, the evidence available in existing studies—when combined with relevant studies on prevailing wage laws, responsible contracting policies, and union-nonunion bidding on public construction—casts doubt that such cost effects are attributable to union wages, union work rules, or bid competition.[24] Future research is necessary, however, to more thoroughly investigate these issues.

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[21] Vasquez et al. (2011) offers a detailed accounting of issues surrounding collinearity between the PLA variable and that of the LAUSD in the more complete model. For the direct comparison highlighted in this study, see Charts 6 and 7 of that report.

[22] It would appear that only two PLA studies authored by researchers have affiliated with the Beacon Hill Institute have accounted for location in any way. First, Haughton et al. (2003) explicitly examined school construction in the Greater Boston area. While this does not absolve all locational concerns—this would presumably include schools downtown and in the suburbs—their results suggested that PLAs increased costs 22%. However, this finding is complicated by the fact that their regression model includes only a few variables—square footage and whether a project was new construction—meaning that it almost certainly suffers from omitted variable bias from other factors. The same story could be told of Bachman and Haughton (2006), in a study of school construction in New York State. In order to account for differences in the cost of urban construction—specifically New York City—the authors incorporate county-by-county cost factors provided by the New York State Education Department. While their results from this study suggest that PLAs increase costs by 20%, their model also likely suffers from substantial omitted variable bias given an overly simplistic model that only controls for square footage, number of stories, and whether the project was an elementary school.

[23] The New Jersey Department of Labor and Workforce Development (2010) did include a control for whether schools were built in the northern or southern part of the state. However, its study did not identify urban (vs. non-urban) construction.

[24] Beyond omitted variable bias, there is another statistical concern that may explain the disparate nature of research outcomes: the outcome being measured. While the most recent and sophisticated peer-reviewed studies examine how PLAs affect *total construction costs*, non-academic works—which are the ones touting

Large Municipal Projects

As a reminder, the singular focus of economists on the cost effects of project labor agreements on school construction is mostly attributable to their ubiquitous nature that provides researchers with a (relatively) large sample of somewhat comparable public projects. While the findings offered in the research on schools would presumably have relevance for many types of institutional construction projects undertaken by government entities, the applicability of the results to *all* forms of public construction is an open question. To date, the authors are not aware of an economic research study in the academic or non-academic literature that systematically examines the cost effects of PLAs on a sample of the largest and most visible of public projects (nuclear power plants, bridges, etc.). This is unsurprising given that such projects are less frequent and more disparate than schools, thereby making economic analyses far more challenging. As a result, the authors can make no claim regarding the cost influence of project labor agreements on large public construction projects that are sufficiently different from the institutional-type construction reflected in the building of public schools.[25]

Affordable Housing

While the effects of project labor agreements on school construction costs represents a well-contested terrain, there have also been two economic studies—both published outside of peer-reviewed journals—that have examined the effects of PLAs on the costs of affordable housing in Los Angeles. In a study published by the RAND Corporation, Ward (2021) assessed how PLAs associated with Proposition HHH affected construction costs on 97 affordable housing projects for which contractors applied for funding between 2017 and 2020. Using a relatively robust set of controls and an advanced regression technique, the author claims that PLAs increased affordable housing projects by 14.5% holding other

large and statistically significant effects—have exclusively relied on models analyzing the *cost per square foot* of a project. While it is recognized that cost per square foot is a common metric employed by contractors, Belman et al. (2010) showed it to (a) be an inferior measure when used for economic modeling purposes and (b) inflate the estimated cost effects of project labor agreements. To demonstrate how the choice of which model to use may artificially inflate the estimated cost impacts of PLAs, Belman et al. (2010) analyzed both cost measures using identical models. For example, in the most basic model—controlling only for square footage—the statistical approach focusing on total construction costs suggested PLAs increased costs by 15%. Meanwhile, the same model that used the other metric implied that PLAs increased costs by $28.57 per square foot. How non-academic studies have tried to make these two values comparable is by taking this cost per square foot metric ($28.57) and then dividing it by the average cost per square foot of all projects in the sample ($150.05) to conclude that PLAs increase costs by, in this case, 19%. Considering that studies that tout large PLA cost effects have exclusively relied on the statistically inferior cost-per-square-foot models, it suggests that a small part of their findings—in this simple case, four percentage points—may be attributable to this form of specification error.

[25] In the absence of research directly examining the cost effects of project labor agreements on large infrastructure projects, Duncan and Ormiston (2019) demonstrate that an emerging consensus of studies reflect that state prevailing wage laws—which may proxy for union wages required in a PLA—have no effect on the costs of highway construction projects.

factors equal. This additional cost comes on top of any cost increase attributable to California's prevailing wage law.[26]

In a working paper published by the University of Utah, Philips and Littlehale (2015) found the opposite results. In assessing the costs of project labor agreements on a sample of 130 affordable housing projects built in Los Angeles County between 2008 and 2012, the authors used a series of statistical techniques—including regression analysis—and indicated that there was no statistically significant relationship between PLAs and construction costs.

Given these two conflicting studies, it would be fair to acknowledge that there is not currently a consensus on whether PLAs affect construction costs on affordable housing projects. However, a more-established research stream linking prevailing wage laws and affordable housing construction costs may be informative. The consensus that has begun to emerge is that prevailing wage laws have increased construction costs on affordable housing in California. However, the most recent and statistically advanced paper on the subject—Hinkel and Belman (2022)—highlight that some inflated cost estimates in the literature are likely due to statistical error and that a more accurate assessment is that prevailing wage laws may increase construction costs by only up to 3.3%.

Given this outcome, the authors of the current study do not dismiss the possibility that PLAs may increase construction costs on affordable housing, even if the magnitude of such an effect would be in question. On the surface, this would seem to be contradictory to earlier conclusions that PLAs did not affect construction costs of school projects. But there is no contradiction here. In fact, this pattern is entirely consistent with the more established research on prevailing wage laws. Duncan and Ormiston (2019) highlight a clear consensus in the academic research on state prevailing wage laws that these regulations do not affect the construction costs of large municipal projects like schools or highways, but slightly increase costs on affordable housing. Ormiston et al. (2017) theorizes that this difference in the cost effects of labor regulations is because (a) residential construction requires relatively less skill, making high-wage, high-skill workers less cost effective on these projects and (b) that the residential sector features substantial higher rates of illegal and cost-saving labor practices, an outcome confirmed in Juravich et al. (2021). This latter explanation suggests that some of the higher costs associated with project labor agreements on residential projects—if it exists—may, in fact, be the higher costs associated with legal wage and employment practices in that sector of the industry.

Research: Timely Completion, Construction Quality and Apprenticeships

As highlighted often in this review, the research on project labor agreements is unusually thin when compared to other labor policies in the construction industry (e.g., prevailing wage laws). What has been published in the academic press has focused almost entirely on investigating the common arguments made by opponents of PLAs: their purported effects on bid competition and construction costs. However, economic research has yet to

[26] For a full review of how California's prevailing wage law may affect affordable housing construction costs, see Hinkel and Belman (2022).

systematically examine the points most commonly offered by advocates of project labor agreements: that they ensure access to skilled labor, promote timely completion of projects, support apprenticeship training, and increase overall craftsmanship.[27] These are important economic questions, especially in light of the current nationwide "shortage" of skilled construction tradesworkers that would presumably increase the risks to timely completion and cost control to construction owners, developers and contractors.[28]

Conclusion

This study summarizes the current state of economic research on project labor agreements, specifically examining how they affect bid competition and costs on public construction projects. It is acknowledged that the academic research on these topics is unusually thin and is largely limited to school and community college construction. However, it is revealing that the most recent and methodologically advanced studies in the academic press reflect that project labor agreements do not have a statistically significant impact on school construction costs or bid competition. This contradicts the findings of older and less developed studies mostly published outside of academic journals. As highlighted in this current review, there is considerable evidence to suggest that studies touting large and significant PLA cost effects on school construction likely suffer from a critical methodological defect that biases their results. However, because research is limited to a narrow set of projects and only addresses two questions, the authors acknowledge that any answers provided in this review are not definitive. As a result, the authors strongly encourage additional research efforts to more thoroughly investigate the costs and benefits associated with public-sector (and private-sector) project labor agreements.

Given the limited state of economic research on PLAs, the authors of the current study keep coming back to two logical arguments when thinking about the big picture surrounding this issue. First, the controversy surrounding public-sector PLAs is puzzling given that project labor agreements are ubiquitous in the private-sector in both the United States and Canada. Many companies that employ them are highly advanced firms with decades of experience overseeing large construction projects. While it may be believable that companies *may* be willing to spend a bit more to ensure timely completion of a project or accrue other benefits—consistent with the tenets of a PLA—it would seem illogical that these large, experienced, profit-seeking firms would use project labor agreements if they single-handedly increased costs by 15% to 20% as is claimed in some non-academic studies.

Second, the authors find projections that PLAs increase construction costs by 15% to 20% to be implausible given that labor costs represent, on average, 23% of total contractor costs in the construction industry. Taken together, this would mean that these researchers are suggesting that project labor agreements would almost double the labor costs on a project (assuming the price of materials is fixed). This result strains credulity. This presumption is

[27] At this point, all references to timely completion in the academic and non-academic research appear to be anecdotal (e.g., Tuerck et al., 2009).

[28] For example, see: https://www.cnn.com/2021/07/08/economy/construction-worker-shortage/index.html.

especially puzzling considering that many of these studies were conducted in states with prevailing wage laws, which would minimize wage differentials between workers on projects built with and without a PLA. In defending these staggering cost estimates, some have hypothesized that these are attributable to reduced bid competition on PLA projects and the authors acknowledge the possibility that future research confirms this outcome. However, at present, the lone peer-reviewed study on the subject demonstrates that project labor agreements do not affect the number of bidders on public projects. In addition, numerous academic studies have highlighted that union and nonunion bids on school construction projects are, in many cases, indistinguishable. These two points undermine any presumed connection between PLAs, bid competition, and increased construction costs.

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