

## **Prevailing Wage Regulations, Contractor Bid Behavior, and School Construction Costs in Maryland: Evidence from Side-By-Side Bids.**

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### **Abstract**

School districts in Maryland have the choice of asking contractors to submit two bids for the same construction project: one bid includes the payment of minimum prevailing wage and benefit rates, the other bid does not. These side-by-side bid data provide the unique opportunity to examine the impact of contractor bid behavior on the relative cost of the wage policy. Results from a fixed effects estimate of an unbalanced panel of nonunion roofing contractors indicate that the gap between the two bids decreases as the level of bid competition and accumulated contractor bid experience increases. The disparity in side-by-side bids is also influenced by a contractor's eagerness to win a project. Additional analysis illustrates how the sample average bid gap of 9.9% disappears under particular bid behaviors and outcomes.

## Introduction

Prevailing wage laws establish location and job-specific minimum wage and benefit rates for construction workers employed on public works projects. These standards apply to construction funded by the federal government, to building activity financed by 30 state governments, and by numerous municipalities.<sup>1</sup> Regardless of the jurisdiction, the purpose of the wage and benefit floor is to prevent large government projects from distorting local compensation standards.<sup>2</sup> Large projects may attract contractors from areas where wages are lower with competition between these low-wage, out-of-area builders and local establishments depressing area rates. The floor allows all contractors to compete without affecting wage and benefit rates that are determined in local construction labor markets. While research has examined the impact of the wage policy on local economic activity, safety and training in the construction industry, the racial composition of the construction labor force, and the provision of health and retirements benefits for construction workers, the public policy debate has centered on the impact of the wage floor on the cost of public construction.<sup>3</sup>

This paper contributes to the literature and the public policy debate by exploiting unique school construction bid data from Maryland. School districts in this state may request contractors to submit two bids for the same project: one bid requires the payment of prevailing

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<sup>1</sup> The Davis-Bacon Act applies to all federally assisted and funded construction with a value in excess of \$2,000. See “Davis-Bacon and Related Acts,” Wage and Hour Division, U.S. Department of Labor. Accessed at: <http://www.dol.gov/whd/govcontracts/dbra.htm>. At present, 30 states have prevailing wage laws. Indiana repealed its wage policy in 2015 with West Virginia repealing during the 2016 legislative session. For a list of the 18 other states without prevailing wage policies see “Dollar Threshold Amount for Contract Coverage,” Wage and Hour Division, U.S. Department of Labor. Accessed at: <http://www.dol.gov/whd/state/dollar2011.htm#1>. For an example of a municipal-level prevailing wage standard see “About Prevailing Wage,” Denver Auditor, City and County of Denver. Accessed at: <https://www.denvergov.org/content/denvergov/en/denver-auditor/prevailing-wage/about-prevailing-wage.html>.

<sup>2</sup> As an example see “The Davis-Bacon Act Protecting Wage Equality Since 1931,” Wage and Hour Division, U.S. Department of Labor. Accessed at: <http://www.dol.gov/whd/programs/dbra/Survey/conformancefaq.htm>.

<sup>3</sup> For examples of this research see XXXX, Lantsberg, and Manzo (2015), Azari-Rad (2005), Bilginsoy (2005), Bellman (2005), Kessler and Katz (2001), and Waddoups (2005).

wages, the other bid does not. These side-by-side bid data allow for an examination of the level of bid competition, accumulated contractor bid experience, and contractor motivation to win a project on the relative cost of projects covered by the wage policy. The results of the study provide insight into the cost impact of the wage requirements as well as illustrate how contractor bid behavior evolves and responds to prevailing wage requirements. The remainder of this paper is organized as follows. The next section contains a survey of the existing literature on prevailing wage regulations and school construction costs as well as a description on how the data used in this study differs from the information that is typically available. The data and the statistical model are described in more detail in the following sections. The paper concludes with a discussion of results and implications for future research addressing the cost implications of prevailing wage regulations.

### **Previous Research on Prevailing Wage Laws and School Construction Costs**

Most of the studies examining the cost effect of prevailing wage regulations focus on school construction as these projects are relatively uniform and numerous.<sup>4</sup> Many of the school studies use project-level data obtained from F. W. Dodge.<sup>5</sup> This organization collects and distributes project bid information to the construction industry. Dodge reports the winning bid for a project, but does not include change orders that determine final (total) project costs.<sup>6</sup> This is a uniform practice across all data used in this literature where the winning, low bid is the measure of total construction costs. The Dodge data also contain information on project location and bid letting date that allow researchers to determine if prevailing wage regulations apply.

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<sup>4</sup> See XXXX (2015a) for a comprehensive research review that includes various types of construction.

<sup>5</sup> See Dodge Data & Analytics. Accessed at: <http://construction.com/>.

<sup>6</sup> Change orders and cost overruns may be related to prevailing wage legislation. The single study that has been able to obtain data on cost overruns report that overruns for road construction in Utah tripled in the decade following the 1981 repeal of prevailing wage requirements in this state. See Philips, Mangum, Waitzman and Yeagle (1995).

Other detailed project-level data include measures of project size (square feet and number of stories), whether the project is new or an addition, and framing and flooring type, etc.

Azari-Rad, Philips, and Prus (2002 and 2003) use Dodge data to examine school construction across the U.S. during the 1990s and fail to find any statistically significant evidence that schools built in states with prevailing wage laws are more costly. Philips (2014) examines new school construction in Kentucky, Michigan, and Ohio when these states enacted, suspended, or repealed prevailing wage policies in the 1990s and finds that there is no statistically significant difference in average square foot costs associated with fluctuations in state-level wage policies. In an analysis of Maryland school construction, Prus (1999) finds that schools built in counties with prevailing wage requirements are no more expensive than the cost of comparable facilities built in counties that do not have the wage policy. Both of the studies by Prus and Philips utilize Dodge data. On the other hand, Vincent and Monkkonen (2010) also use Dodge data to examine school construction across the U.S. between 1995 and 2004 and find a prevailing wage cost effect ranging from 8% to 13%.

Several other studies use data similar to Dodge to examine the effect of the introduction of prevailing wage requirements on school construction in British Columbia.<sup>7</sup> This wage policy is similar to several strong state-level policies in the U.S.<sup>8</sup> Bilginsoy and Philips (2000) use the Canadata and find that public school bid-costs under the wage policy did not differ in terms of statistical significance from the bids of public schools built before the introduction of the prevailing wage requirement. Duncan, Philips, and Prus (2014) examine the effect of British Columbia's prevailing wage standard by including a control group of private school projects.

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<sup>7</sup> See Canadata. Accessed at: <http://www.canadata.com/products.html>.

<sup>8</sup> For a description of this policy see Duncan, Philips and Prus (2014).

This difference-in-differences analysis indicates that before the introduction of the prevailing wage policy, the cost of building public schools was approximately 40% more expensive than the costs of comparable private schools. The differential between public and private school construction cost did not change after the wage policy was introduced. These authors have also used the British Columbian example to study the effect of prevailing wage laws on the productivity and efficiency of construction (See Duncan, Philips, and Prus 2012, 2009, and 2006). They find that prior to the introduction of the wage legislation, public school projects were 16% to 19% smaller, in terms of square feet, than comparable private structures (given the same project expenditure). This size differential did not change after the policy was in effect. These results suggest that prevailing wage requirements do not alter labor or other input utilization in a way that significantly affects the relative size of covered and uncovered projects. The authors also find that average total efficiency for public school construction is 94.6%. Average efficiency for projects covered by the introductory stage of British Columbia's construction wage legislation was 86.6%. By the time of the expansion of the policy 17 months later, the average efficiency of covered projects increased to 99.8%. These findings suggest that the introduction of prevailing wage laws disrupted construction efficiency. However, in a relatively short period of time, the construction industry adjusted to wage requirements by improving overall construction efficiency in a way that is consistent with stable total costs. A similar pattern was observed with respect to cost efficiency. While these studies utilize different sample configurations and statistical methods, they uniformly fail to find evidence that prevailing wages increase construction costs.

Atalah (2013a, 2013b) uses data obtained from the Ohio School Facilities Commission (hereinafter, OSFC) to test the hypothesis that prevailing wages increase school construction

costs in Ohio. These data are limited to information that identifies the school district, participating contractors, all bid submissions for a project, and project size. The advantage of these data is that there are over 8,000 bids in the OSFC data set. With this information, Atalah is able to compare bids submitted by contractors who are signatories to collective bargaining agreements and to those submitted by “open shop” contractors. While schools were exempted from Ohio’s prevailing wage law in 1997, union rates are the prevailing rates for other construction funded by the State of Ohio.<sup>9</sup> Consequently, Atalah’s union-nonunion comparison is an indirect test of the impact of prevailing wage and benefit rates, omitting any other unique administrative costs associated with the policy.

Results from the first study (Atalah 2013a) indicate that the lowest (winning) bid-costs per square foot for projects paying union wages are no more expensive than projects paying open shop rates. The exception is projects in the southern region of the state where bid-costs per square foot are 51% lower for construction based on *union* rates. This difference is statistically significant at the 0.0005 level. While Atalah’s first study examines the consequences of prevailing wage laws by comparing projects completed by union or nonunion workers, the second study (Atalah 2031b) compares the lowest bid-costs by trade (plumbing, electrical, etc.) and union status. These results indicate that bid costs per square foot were higher for five of 18 (27.8%) of the trades involved in school construction that paid union rates. There were no statistically significant differences in bid-costs per square foot for 72.2% (13/18) of the trades, regardless of union status.

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<sup>9</sup> See “Chapter 4115: Wages and Hours on Public Works,” LA Writer, Ohio Laws and Rules. Accessed at <http://codes.ohio.gov/orc/4115>.

Keller and Hartman (2001) use project cost data provided by the Pennsylvania Department of Education, applicable prevailing wage rates, and total compensation rates from a large nonunion contractor to examine the effect of Pennsylvania's prevailing wage requirement on school construction costs. By substituting nonunion wages for prevailing wage rates and adjusting for labor costs as a percent of total construction costs, these authors find that prevailing wages add 2.25% to the cost of building public schools. A shortcoming of the method used by Keller and Hartman is that their comparison of prevailing and open shop wage rates ignores the changes in labor productivity and utilization that take place when wages change in the construction industry. For example, Blankenau and Cassou (2011) report that the use of skilled and unskilled workers in the construction industry is sensitive to wage rates.<sup>10</sup> Additionally, Balistreri, McDonald, and Wong (2003) find that capital equipment replaces labor when construction wages increase.<sup>11</sup> Taken together, the results of these studies indicate that labor productivity and utilization change with wage rates in the construction industry. The method used in the study by Keller and Hartman does not take these changes into consideration when calculating the cost impact of prevailing wages. As a consequence, the estimate reported in this study is too high.

This survey of the literature indicates that the preponderance of research fails to find a statistically significant prevailing wage cost effect. One reason why prevailing wages may not affect construction costs is that labor costs (wages and benefits) are typically a low percent of total construction costs. According to data from the *Economic Census of Construction*, labor

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<sup>10</sup> In this study skilled workers are defined as those with more than a high school degree while unskilled workers have less than a high school education. The elasticity of substitution between these two grades of labor is approximately 9.0.

<sup>11</sup> The estimated elasticity of substitution between capital and labor for the construction industry is inelastic for both the long and short-run.

costs (wages and benefits) represent about 23% of total construction costs for the entire U.S. construction industry in 2012.<sup>12</sup>

While most of the previous studies utilize data that includes controls for project size and local economic conditions, it is also important to consider the influence of contractor incentives and bid behavior on the relative cost of projects covered by prevailing wage requirements. Contractors, particularly nonunion establishments who pay rates below prevailing levels, may adjust their bids on prevailing wage projects as they become more familiar with the requirements. Bids may also change with the level of bid competition, or eagerness to win a project. These issues have been largely ignored in the literature.<sup>13</sup> The side-by-side bid data for school construction in Maryland provide an opportunity to explore these issues when two bids are submitted by the same contractor for the same project, under equal local economic and market conditions. The side-by-side bids arise from the characteristics and provisions of the prevailing wage standard in Maryland.

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<sup>12</sup> The *Economic Census of Construction* for 2012 does not report labor costs as a percent of total costs. This ratio must be calculated based on other data. Here, labor cost as a percent of total construction cost is derived by dividing total construction worker payroll, plus proportionally allocated total fringe benefits, by the net value of construction work. The net value of construction is based on the value of work completed by a contractor, less the value of work subcontracted to other contractors. The *Economic Census of Construction* defines construction worker payroll as the gross earnings paid in the reporting year to all construction workers on the payroll of construction establishments. It includes all forms of compensation such as salaries, wages, commissions, dismissal pay, bonuses, and vacation and sick leave pay, prior to deductions such as employees' Social Security contributions, withholding taxes, group insurance, union dues, and savings bonds. The *Economic Census of Construction* defines the net value of construction as the receipts, billings, or sales for construction work done by contractors, less the value of construction work subcontracted to others. The net value of construction does not include contractor business receipts from retail and wholesale trade, rental of equipment without operator, manufacturing, transportation, legal services, insurance, finance, rental of property and other real estate operations, and other nonconstruction activities. Receipts for separately definable architectural and engineering work for others are also excluded. Nonoperating income such as interest, dividends, the sale of fixed assets, and receipts from other business operations in foreign countries are also excluded. See Construction: Geographic Area Series: Detailed Statistics for Establishments: 2012. Accessed at: See Construction: Geographic Area Series: Detailed Statistics for Establishments: 2012. Accessed at:

[http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN\\_2012\\_US\\_23A1&prodType=table](http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_23A1&prodType=table).

<sup>13</sup> The single study that has examined this issue examines bid behavior as contractors switch from highway resurfacing projects funded by the federal government (and are covered by the Davis-Bacon Act) to projects that are funded by the State of Colorado that are not covered by a prevailing wage standard. See Duncan (2015b).



## **Maryland's Prevailing Wage Policy, Side-By-Side Bids, and Contractor Bid Behavior**

Prevailing wage rates for construction projects receiving funding from the State of Maryland are determined for all 23 counties and the City of Baltimore.<sup>14</sup> Minimum rates for projects covered by Maryland's prevailing wage regulation are determined by the following process: the prevailing wage rate is the rate paid to 50% or more of local workers in a detailed job classification. If fewer than 50% of local workers in a classification receive the same wage, the prevailing wage is the rate paid to at least 40% of the local workers in the classification. If fewer than 40% of local workers in the same job classification earn the same wage, the prevailing wage rate is the average wage (weighted by the number of workers receiving different wage rates).<sup>15</sup> Between 2000 and 2014 prevailing wage requirements in Maryland applied to school construction projects with a value of at least \$500,000 and when state funding was 50% or more of project construction costs. As of July 1, 2014 prevailing wages are required on projects with a value of at least \$500,000 and when state funding is 25% or more of total construction costs.

School districts have the choice of opting out of prevailing wage requirements by accepting less than 25% in state funding (or less than 50% prior to July 2014). When projects are expected to be close to either the \$500,000 value threshold or to the minimum state funding contributions, school districts may ask contractors to submit two bids for the same project; one based on the payment of prevailing wages with the other ignoring this minimum wage

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<sup>14</sup> See "Compliance Frequently Asked Questions (FAQs) - Prevailing Wage for State Funded Construction Contracts," Department of Labor, Licensing, and Regulation, State of Maryland. Accessed at: <https://www.dllr.state.md.us/labor/prev/prevwagefaqs.shtml>.

<sup>15</sup> See: House Bill 860 "Prevailing Wage Law – Applicability to the University of Maryland System, Morgan State University, and St. Mary's College of Maryland," Fiscal and Policy Note, First Reader, Department of Legislative Services, Maryland General Assembly, 2016 Session. Accessed at: [http://mgaleg.maryland.gov/2016RS/fnotes/bil\\_0000/hb0860.pdf](http://mgaleg.maryland.gov/2016RS/fnotes/bil_0000/hb0860.pdf).

requirement. These side-by-side bids allow a school district to determine which pay schedule is most advantageous by comparing the decrease in state funding to the bid-cost savings associated with avoiding the payment of prevailing wages. For example, if the side-by-side bids of the lowest submissions indicate a project cost savings of 20% by opting out of the wage policy, and if state funding for the project decreases by 10% if the wage regulations are avoided, it is practical for the school district to opt out of wage policy coverage.

Based on an examination of 266 side-by-side bids for 67 separate school construction projects, the Public School Construction Program found that, on average, bids based on prevailing wage rates were 11.7% higher than bids without prevailing wages. This cost impact is based on the comparison of all bids including the lowest bid for projects built between January 2012 and December 2015. This gap persists when only low bids are considered. For example, for the subset of roof replacement projects there were a total of 83 bids on 17 roofing projects between 2012 and 2015. The average gap between prevailing wage bids and bids that were not based on the payment of prevailing wages is 9.67%. The gap between the 17 lowest bids is 9.10%. The result obtained from the analysis of side-by-side bids is viewed as “incontrovertible evidence” that prevailing wages increase construction costs.<sup>16</sup>

The evidence based on the side-by-side comparisons is at variance with earlier research of Maryland schools. As described above, Prus (1999) finds no statistically significant cost difference in schools built in counties with and without prevailing wage requirements. An important difference is that Prus examines an array of school projects (new construction and

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<sup>16</sup> See page 34 of “The Cost of School Construction: A Comparison of the Monarch Global Academy and Conventional School Facilities.” Report to Governor Larry Hogan and the Board of Public Works. October 28, 2015. See page 3 of Appendix 1 for a description of the data. Accessed at: <http://www.pscp.state.md.us/Reports/Monarch%20Final%20Report%2010-28-15.pdf>.

renovations) while the side-by-side analysis is based on projects that are close to the project value and state funding thresholds. This is a critical distinction that influences contractor incentives, the disparity in side-by-side bids, and the implied cost estimate of prevailing wages. When school districts request side-by-side bids they are sending a signal to contractors that some state funding may be sacrificed *if* significant savings can be promised by avoiding the payment of prevailing wages. Under these circumstances, contractors, particularly nonunion contractors have an incentive to inflate estimates on prevailing wage bids.

To illustrate, consider a project with one nonunion bidder. Without any competition, both bids, with and without the payment of prevailing wages will be inflated. If this contractor wishes to avoid the payment of prevailing wage rates and other requirements of the policy including the submission of certified payrolls, apprenticeship registration, arranging benefits that meet prevailing standards, and other administrative responsibilities, the bid based on the payment of prevailing wages will be particularly inflated.<sup>17</sup> Expanding this concept to a more realistic setting with multiple bidders suggests that when bid competition is low and the likelihood of winning is relatively high, the difference in side-by-side bids may be relatively large. A tacit or collusive agreement to increase disparity in side-by-side bids may be made between contractors when bid competition is low. This type of arrangement is in the best interest of all nonunion contractors bidding on projects requesting two submissions and may be considered self-reinforcing to some extent. However, in a more competitive situation, the disparity in side-by-

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<sup>17</sup> For a description of Maryland's law see "Prevailing Wage – Division of Labor and Industry," Maryland Department of Labor, Licensing & Regulation. Accessed at: <https://www.dllr.state.md.us/labor/prev/>.

side bids may collapse as the likelihood of winning decreases and uncertainty over how other bidders will behave increases.<sup>18</sup>

Contractor experience with bidding on prevailing wage projects, as well as the dual-bid format, may also influence the gap in bids. Those who are new to prevailing wage projects may have greater uncertainty regarding all of the attendant requirements and regulations associated with the wage policy. As a consequence, less experienced contractors may pad these bids accordingly. As experience with this bidding format and the wage policy increases, contractors may reduce the disparity in bids that do and do not require the payment of prevailing wages. This suggests that relatively new bidders will have larger differences in side-by-side bids and that the gap between bids will decrease with accumulated bid experience.<sup>19</sup>

When a contractor is motivated to win a project, regardless of whether prevailing wages are required, it is likely that differences in side-by-side bids are reduced. This outcome may be observed during the peak bid season. For the counties and projects (roof replacements) examined in this study, 41% of all projects are open to bidding in March with 48% of all bids submitted during this peak month. It is likely that contractors who are very eager to win projects during the peak season submit low bids regardless of the payment of prevailing wages. Several other factors such as a backlog of unfinished work or the desire to work with a particular owner may also influence a contractor's motivation to win a project.<sup>20</sup> When a nonunion contractor is

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<sup>18</sup> Based on information provided by personnel from the Public School Construction Program, bidders on public works projects in Maryland know the number and identity of bidders for a project. This information would facilitate agreements between contractors.

<sup>19</sup> The data used in this study span 4 years and are insufficient to identify entrant bidders. Others have examined the bids of new contractors. Li and Philips (2012) find that the bids of entrants are more widely dispersed around the central bid tendency. De Silva, Dunne and Kosmopoulo (2003) find that entrants bid more aggressively than incumbent firms.

<sup>20</sup> Previous research indicates that bids are higher when a contractors' productive capacity is obligated to previously awarded projects. See Jofre-Bonet and Pesendorfer (2003).

not eager to win, both bids may be higher with the bid based on prevailing wages being particularly high. Under these conditions, a contractor's bid may also be less competitive and finish with a higher ranking/place. This illustration suggests that if a contractor is highly motivated to win a bid, regardless of prevailing wage coverage, it is expected that the bid ranking will be lower as well as the disparity is side-by-side bids.

The policy change in 2014 that lowered the threshold for prevailing wage coverage to school projects receiving 25% of funding from the state may also affect the behavior of contractors and their side-by-side bids. According to information reported by the Department of Legislative Services, this policy change made virtually all K-12 projects funded by the State of Maryland eligible for the payment of prevailing wages that exceeded the \$500,000 value threshold.<sup>21</sup> Under these conditions, nonunion contractors participating in projects requesting side-by-side bids may have responded to expanded prevailing wage coverage by inflating bids based on prevailing wages if they wished to avoid the requirements of the wage policy. This explanation suggests that the disparity in side-by-side bids will be larger after the July 1 policy change.

### **Side-By-Side Bid Data and Results**

Data for the study were obtained from the Public School Construction Program, Interagency Committee on School Construction, Board of Public Works, State of Maryland. From January 2012 to December 2015, the Public School Construction Program collected 266 side-by-side bids for 67 school construction projects completed throughout the state. These

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<sup>21</sup> See House Bill 860, "Prevailing Wage Law – Applicability to the University System of Maryland, Morgan State University, and St. Mary's College of Maryland," Fiscal and Policy Note, Department of Legislative Services, Maryland General Assembly, 2016 Session. Accessed at: [http://mgaleg.maryland.gov/2016RS/fnotes/bil\\_0000/hb0860.pdf](http://mgaleg.maryland.gov/2016RS/fnotes/bil_0000/hb0860.pdf).

projects largely consist of renovation work involving a variety of trades and tasks such as carpentry, concrete, demolition, drywall, electrical, flooring, HVAC, masonry, and roofing, etc. Roof replacement projects are selected for this study due to the relative homogeneity of these types of projects and the relatively large number of projects and bids. Over the period there were 83 side-by-side bids by 18 different contractors on 17 roof replacement projects located in Carroll, Frederick, Howard, and Washington counties. Since 75 of these bids were submitted by 10 contractors who participated in at least two projects between 2012 and 2015, an unbalanced panel of nonunion contractors was created for the statistical analysis.<sup>22</sup>

Table 1 includes data on the lowest and highest differences in contractor side-by-side bids. To illustrate, consider Contractor #1. In one of these bids submitted by this contractor, the difference between the prevailing wage bid and the bid without prevailing wages was as low as 5.3%. In another bid by this same contractor, the difference in side-by-side bids was as high as 30.1%. There is considerable variation between contractors. This is evidenced by the average difference in bids (see column 4 in Table 1). For example, the average bid difference for Contractor #1 is 12.7% and 5.5% for Contractor #2. The variation between contractors is also revealed by the range in lowest and highest differences. Contractor #5 submitted at least one bid where there was no difference between the prevailing wage and non-prevailing wage bid (where the lowest bid difference is 0.0%). On the other hand, Contractor #6 had one bid where the difference was as high as 42.1% (see highest bid difference for #6). The averages for the 75 bids

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<sup>22</sup> Information from Roofers Local 30, United Union of Roofers, Waterproofers, and Allied Workers of Philadelphia, Pennsylvania, was used to identify roofing contractors who are signatories to collective bargaining agreements. The single union roofing contractor included in the master data file bid on only one project over the time period. According to information provided by the Fair Contracting Foundation, union contractors are hesitant to bid on projects requesting side-by-side bids due to the uncertainty regarding the outcome and whether prevailing wages will be paid or not.

included in the study indicate a mean low difference in side-by-side bids of 3.9%, a mean high of 20.5%, and an overall average gap in the two bids of 10.2%.

(Insert Table 1 here)

Differences in side-by-side bids may be due to the payment of prevailing wage and benefit rates when contractors plan to use the same workers and production methods on a project. The substitution of skilled for unskilled labor and capital equipment for all grades of labor that typically accompanies wage increases in the construction industry requires time or the entry of contractors with varying skilled workforces and capital intensities.<sup>23</sup> The resulting changes in labor productivity and utilization may mitigate some of the cost effect of higher wage rates. However, in the side-by-side bid format, the contractor may face inflexibilities that prevent substitutions with increased wage rates passing directly through to bid-costs. This may explain some of the difference in side-by-side bids, but the disparities reported in Table 1 are too large to entirely attribute to labor costs. Many of the “highest bid differences” reported in Table 1 are greater than labor costs for this type of construction activity. Information from the most recent *Economic Census of Construction* indicates that labor costs (wages and benefits) for specialty trade roofing contractors in Maryland are approximately 19.3% of total construction costs. A bid, like that of Contractor #6 which is 42.1% higher with the payment of prevailing wages is approximately 2.2 times larger than percent labor costs for these types of projects. If the effect of prevailing wages is isolated from other factors that also influence construction costs, the impact of prevailing wages on bids should be fairly uniform from one project and bid to the next. For example, if prevailing wage rates add 10% to the cost of roof replacements, the side-by-side

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<sup>23</sup> See Blankenau and Cassou (2011) and Balistreri, McDaniel, and Wong (2003) for estimates of the elasticities of substitution between skilled and unskilled labor and between capital and labor in the construction industry.

bids should uniformly vary by about 10%, depending on wage differences between counties and over time.

Another possible explanation for varying side-by-side bids is that, while roof replacements are relatively homogenous projects, some may require sheet metal work. Without the payment of prevailing wages, a nonunion contractor would likely have a roofer with suitable experience perform this work with the same rate of pay. But, Maryland's prevailing wage regulations, like the federal Davis-Bacon Act and most other state laws, set wage rates for workers performing specific jobs. As a consequence, under the wage policy an employee who splits their time between roofing and sheet metal work must be paid the rates for each job classification accordingly. On average, the total hourly prevailing wage compensation of sheet metal workers is 27.9% higher than the comparable compensation for roofers.<sup>24</sup> This substantially higher rate may appear to explain some of the bid differences reported in Table 1. However, this implication must be tempered by the fact that labor costs are a low percent of total roofing construction costs. Even if all employees were upgraded to the sheet metal rate, it would affect a relatively small component of total costs and bids. For example, if all roofer labor costs rose by 27.9% to the sheet metal rate and labor costs are 19.3% of total costs, overall costs would increase by about 5.4% ( $27.9\% \times 19.3\%$ ), assuming that all else is unchanged. The variation in side-by-side bids that cannot be explained by differences in wage rates and the absence of input substitution suggests that factors other than the payment of prevailing wages have an impact on bid differences.

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<sup>24</sup> Prevailing Wage data used in this illustration was obtained from Informational Rates Prevailing Wage, Department of Labor, Licensing, and Regulation, State of Maryland. accessed at: <https://www.dllr.state.md.us/PrevWage/web/content/PWRequestRates.aspx>



The unbalanced panel of 75 bids by nonunion roofing contractors is used to examine the impact of contractor bid behavior on differences in side-by-side bids by estimating the following one-way fixed effects model:

$$\% \text{ Difference in Bids}_{it} = \beta_0 + \beta_1 \text{ Contractor}_i + \beta_2 \# \text{ Bidders}_{it} + \beta_3 \text{ Bid History}_{it} + \beta_4 \text{ Bidder Rank}_{it} + \beta_5 \text{ Peak Bid Month}_{it} + \beta_6 \text{ 2014 Policy}_{it} + \beta_7 \text{ Real Midpoint Bid}_{it} + \beta_8 \text{ County}_{it} + \mu_{it}$$

where *% Difference in Bids* is the difference between the prevailing wage bid and the bid without prevailing wages, divided by the bid omitting prevailing wages (x 100) for roof replacement bids submitted by contractor *i* in time period *t*. *# Bidders* equals the number contractors who submitted a bid for each of the 17 projects. *Bid History* is the accumulated bid experience of each contractor. This information is collected using the longitudinal aspect of the data set where the number of project bids submitted by each contractor is traced from 2012 through 2015.<sup>25</sup> *Bidder Rank* is equal to the order of each bid submitted by the contractors included in the panel. *Peak Bid Month* equals one for bids submitted in March, zero otherwise. *2014 Policy* is a binary variable equal to one for the projects that were completed after the July 1, 2014 prevailing wage policy expansion that lowered the state funding threshold to 25%, zero otherwise. Since this variable captures a time component, year dummy variables are not included for a two-way fixed effects estimate. Since the effects described above may vary with the size of a project, the *Real Midpoint Bid* is added as a control. This variable is the inflation-adjusted midpoint between a contractor's side-by-side bids and allows for the effects of the number of bidders, and bid history, etc. to be measured taking the contractor's perceived value of the project into consideration. *County* is another control variable that takes into consideration regional

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<sup>25</sup> There were a few occasions when projects shared the same bid date. When this is the case, the measure of bid history is the same for both projects.

differences in market and economic conditions. *County* is a dummy variable identifying projects in Carroll, Frederick, and Howard counties with Washington County as the reference category.

$\mu$  is the error term.

## Results

Summary statistics for the variables included in the model are reported in Table 2. The average difference in prevailing wage bids and bids estimated without the payment of prevailing wages submitted by nonunion roofing contractors is about 10%. Across the 10 contractors this difference was as low as 0.0% and as high as 42%. The number of bidders ranges from two to eight participants per project with an average of 5.3. The bid history of these contractors is traced longitudinally between 2012 and 2015 and ranges from the first bid to a high of 13 bids with an average of 4.6. It is not possible to determine bid history before 2012, so the measure used here is based on the accumulation of bid experience during the period of the study. The bid ranking of any contractor ranges from the first to the eighth position with an average of about third place. Roofing projects are open to bids in six months of the year.<sup>26</sup> The peak month for bidding on roof replacement projects is March when 41% of the projects are let and 48% of the bids are placed. One-third (25) of the bids were placed after the policy change in July of 2014 that reduced the state funding threshold to 25% of construction costs. Fifty of the bids were placed under the previous state funding threshold of 50%. The distribution of roof replacements was unevenly distributed with 57% of projects located in Howard County, 21% in Frederick, 16% in Carroll, and 5% in Washington County. The inflation adjusted midpoint between the bid

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<sup>26</sup> Bids are considered in January, February, March, May, August, and December.

based on the payment of prevailing wages and the bid omitting the wage requirement is approximately \$1.2 million.<sup>27</sup>

(Insert Table 2 here)

Regression results for the fixed effects estimate are reported in Table 3.<sup>28</sup> Because there are *a priori* expectations regarding the effects of the number of bidders, bid history, contractor bid rank, peak bid month, and the 2014 policy change, the coefficients for these variables are evaluated with one-tailed tests. All other coefficients are evaluated with two-tailed tests. Results indicate that the effect of another bidder decreases the gap between bids that are, and are not based on prevailing wage rates by approximately 1.6 percentage points. Findings also support the notion that as contractors gain experience with side-by-side bidding, the gap between the two bids decreases. The coefficient for Bid History reveals that the gap in side-by-side bids decreases by about 1.2 percentage points with each bid experience. The effects of bid competition and bid history are significant at the 0.05 level.

(Insert Table 3 here)

Model estimates also support the view that eagerness to win a project affects differences in bids. An increase in bid ranking or place increases the gap by approximately one-percentage point while side-by-side-bids submitted during the peak month of March are closer by 8 percentage points. Both of these results are significant at the 0.01 level.

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<sup>27</sup> Bids are adjusted for inflation with the “Producer Price Index by Industry: Roofing Contractors, Nonresidential Building Work,” U.S. Bureau of Labor Statistics. Available from the Federal Reserve Bank of St. Louis, accessed at <https://research.stlouisfed.org/fred2/series/PCU23816X23816X>.

<sup>28</sup> Standard errors reported in Table 3 are corrected for heteroskedasticity.

Differences in side-by-side bids increased by 4.5 percentage points after the expansion of the prevailing wage policy in 2014. This effect is significant at the 0.10 level. Since the effect of the policy change is measured by comparing bids submitted before and after July 1, 2014, other factors that changed over this time period may also influence the estimated 4.5% increase. One possible influence is the increase in prevailing wage rates over time that would inflate bids if the wage policy applies. However, growth in prevailing wage rates for roofers/waterproofers in the four Maryland counties included in this study was relatively low over the period of the study. Between 2012 and 2015 the prevailing wage and benefit rates for this job classification increased by an average of 3.5%.<sup>29</sup> This increase is substantially lower than the 9.2% increase in the producer price index for roofing contractors over the same period.<sup>30</sup> These data suggest that prevailing wage growth in Maryland increased proportionately less compared to overall costs for nonresidential roofing contractors. Also, given that labor costs are a low percent of total costs for Maryland roofing contractors, the impact of the increase in prevailing wages on total costs is disproportionately low. If wages increase by 3.5% and labor costs are 19.3% of total costs, the effect of the wage increases is approximately 0.7% ( $3.5\% \times 19.3\%$ ).<sup>31</sup> Consequently, the change in prevailing wage rates is insufficient to account for the 4.5% increase in side-by-side bids after 2014.

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<sup>29</sup> In Carroll and Howard Counties the total prevailing rate (wages and benefits) increased by 2.1% between 2012 and 2015. The corresponding percentage change was 2.4% in Washington County and 7.5% in Frederick County. Data were obtained from “Prevailing Wage Information Rates,” Department of Labor, Licensing and Regulation, State of Maryland. Accessed at: <https://www.dllr.state.md.us/PrevWage/web/content/PWRequestRates.aspx>.

<sup>30</sup> See “Producer Price Index by Industry: Roofing Contractors, Nonresidential Building Work,” U.S. Bureau of Labor Statistics. Available from the Federal Reserve Bank of St. Louis, accessed at <https://research.stlouisfed.org/fred2/series/PCU23816X23816X>.

<sup>31</sup> This method of estimating the increase in total costs due to an increase in prevailing wage rates is over-simplistic as other factors that change with wages (such as labor productivity and use of capital equipment) are ignored. This method is used here to illustrate that the impact of wage increases on total costs is very low.

It is also unlikely that the mere expansion of the policy to projects receiving at least 25% in state funding would increase contractor costs and bids. If prevailing wages have a cost impact, it would be measured directly at the level of the project. That is, if a contractor bids on a project that requires prevailing wages and if the contractor expects increased costs as a result, the bid on that project will be higher. The policy change in 2014 would not have an across-the-board impact on project costs and bids. The impact of prevailing wages would still be measured at the project level, regardless of the change in the state funding threshold. Bid-costs may increase if the expansion of the policy reduced bid competition. However, the 4.5% increase in side-by-side bids after July 2014 is measured with the level of bid competition held constant.<sup>32</sup> The remaining explanation is that the increase in side-by-side bids is due to the reaction of nonunion contractors who are ‘promising’ greater saving without the payment of prevailing wages at a time when prevailing wage coverage is expanding.

Holding all other factors constant, differences in side-by-side bids are larger in Frederick and Howard counties compared to Washington County (by about 14 and four percentage points, respectively). While the impacts for these two counties are significant at least the 0.05 level, there is no statistically significant difference in bids between Carroll and Washington counties. The estimate for Real Midpoint Bid is essentially zero in terms of magnitude and statistical significance. This finding indicates that the difference between the two bids does not vary with project size. The results of the F test indicate that the null hypothesis that all coefficients equal zero is rejected at the 0.01 level.<sup>33</sup> The model explains 42% of the total variation in side-by-side

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<sup>32</sup> When the statistical model is estimated without a control for the number of bidders, the measured effect of the 2014 policy change increases to 6.27% with a computed z-statistic of 3.36. Additionally, the two academic studies that examine the effect of prevailing wage laws on bid competition both fail to find a statistically significant impact. See XXXX (2015a) and Kim, Chang, and Philips (2012).

<sup>33</sup> The critical F statistic is 5.35 at the 0.01 level.

bids. The F test implying that individual contractor effects are zero is also rejected at the 0.01 level.<sup>34</sup> This test result indicates that the fixed effects estimate is preferred to an OL estimate that does not control for individual contractor effects.

The results reported in tables 2 and 3 can be used to illustrate changes in side-by-side bids as the regression equation is solved with a given value of one variable, holding all other variables at their averages. For example, consider changes in the overall average gap in roof replacement bids of 9.9% (as reported in Table 2) when accumulated bid history changes from its average value of 4.64 bids to the maximum number of 13 bids. With the 13<sup>th</sup> bid the difference between bids based on the payment of prevailing wage and tenders that do not adhere to the wage policy collapses to – 0.4%, holding all else constant. Similarly, if the number of bidders is at its maximum value of eight competitors, bid rank equals first place, and bids are submitted in the peak month of March (with all other variables held at average values), the average gap in side-by-side bids vanishes as the average falls from 9.9% to – 0.6%. While these illustrations do not take into account the confidence intervals of the coefficients or the standard error of the estimate when solving the regression equation, these exercises illustrate the extent to which the difference in bids that are based on the payment of prevailing wages and comparable bids that do not include prevailing wages vary with changes in the bid behavior and outcomes.

## **Conclusion**

The data typically used in studies examining the effect of prevailing wage laws on construction costs allows for the measurement of the policy impact while controlling for other project characteristics that may also be related to costs. The influence of contractor bid behavior

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<sup>34</sup> The relevant critical F statistic is 2.72 at the 0.01 level.

has largely been ignored. The side-by-side bid data for Maryland public school tenders provide an opportunity to examine the effects of the level of bid competition, accumulated contractor bid experience, and motivation to win on the relative cost of projects covered by prevailing wage regulations. Results from the fixed effects estimate of an unbalanced panel of roofing contractors indicate that the gap between bids that require and do not require the payment of prevailing wages decreases as the level of bid competition and accumulated contractor bid experience increases. The disparity in side-by-side bids is also influenced by a contractor's eagerness to win a project. Additional analysis illustrates how the average gap between the two bids of 9.9% disappears under particular bid behaviors and outcomes. This evidence from nonunion contractors in Maryland springs from the unique circumstances of this state's prevailing wage policy. Yet, the results provide insights into how contractors, particularly nonunion contractors respond to the requirements of the wage policy.

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Table 1. Percent Differences in Side-By-Side Bids (With and Without the Payment of Prevailing Wages) by Contractor for Roof Replacements, 2012-2015.

| Contractor Identity | Lowest Bid Difference | Highest Bid Difference | Average Bid Difference |
|---------------------|-----------------------|------------------------|------------------------|
| Contractor #1       | 5.3%                  | 30.1%                  | 12.7%                  |
| Contractor #2       | 1.8%                  | 16.7%                  | 5.5%                   |
| Contractor #3       | 3.4%                  | 33.1%                  | 10.2%                  |
| Contractor #4       | 3.4%                  | 15.4%                  | 11.7%                  |
| Contractor #5       | 0.0%                  | 5.3%                   | 3.2%                   |
| Contractor #6       | 8.9%                  | 42.1%                  | 17.4%                  |
| Contractor #7       | 1.1%                  | 5.7%                   | 3.0%                   |
| Contractor #8       | 8.1%                  | 17.7%                  | 13.5%                  |
| Contractor #9       | 1.5%                  | 26.8%                  | 14.7%                  |
| Contractor #10      | 5.7%                  | 12.5%                  | 9.8%                   |
| Overall Averages    | 3.9%                  | 20.5%                  | 10.2%                  |

Source: Public School Construction Program.

Table 2. Summary Statistics of Side-By Side Contactor Bids (with and without Prevailing Wage Rates), Roof Replacement Projects, Fiscal Year 2012-2015

| Variable                  | Mean                       |
|---------------------------|----------------------------|
| % Difference in Bids      | 9.940<br>(7.704)           |
| # Bidders                 | 5.293<br>(1.514)           |
| Bid History               | 4.640<br>(2.990)           |
| Bidder Rank               | 3.107<br>(1.805)           |
| Peak Bid Month<br>(March) | 0.480<br>(0.503)           |
| 2014 Policy               | 0.333<br>(0.478)           |
| Carroll County            | 0.160<br>(0.369)           |
| Frederick County          | 0.213<br>(0.412)           |
| Howard County             | 0.573<br>(0.498)           |
| Washington County         | .053<br>(0.226)            |
| Real Midpoint Bid         | \$1,178,718<br>(610,602.8) |
| N                         | 75                         |

Source: Public School Construction Program, State of Maryland. Standard deviations in parentheses.

Table 3. Fixed Effects Regression Results of Side-By Side Contactor Bids (with and without Prevailing Wage Rates), Roof Replacement Projects, Fiscal Year 2012-2015.

Dependent Variable = % Difference in Bids.

| Variable                           | Coefficient                       |
|------------------------------------|-----------------------------------|
| # Bidders                          | - 1.558 <sup>λλ</sup><br>(.737)   |
| Bid History                        | - 1.242 <sup>λλ</sup><br>(.532)   |
| Bidder Rank                        | 1.021 <sup>λλλ</sup><br>(.257)    |
| Peak Bid Month<br>(March)          | - 8.005 <sup>λλλ</sup><br>(2.252) |
| 2014 Policy                        | 4.500 <sup>λ</sup><br>(2.647)     |
| Carroll County                     | 0.625<br>(0.369)                  |
| Frederick County                   | 13.948 <sup>***</sup><br>(2.181)  |
| Howard County                      | 4.775 <sup>**</sup><br>(2.069)    |
| Real Midpoint Bid                  | -0.0001<br>(0.0001)               |
| Constant                           | 18.110 <sup>**</sup><br>(5.828)   |
| N                                  | 75                                |
| F                                  | 211.24                            |
| R2 (overall)                       | 0.423                             |
| F test, all individual effects = 0 | 4.58                              |

Source: Public School Construction Program, State of Maryland. Standard errors corrected for heteroskedasticity in parentheses. <sup>λλλ</sup> Significant at the 0.01 level (one-tailed test), <sup>λλ</sup> Significant at the 0.05 level (one-tailed test), and <sup>λ</sup> Significant at the 0.10 level (one-tailed test). <sup>\*\*\*</sup> Significant at the 0.01 level (two-tailed test), <sup>\*\*</sup> Significant at the 0.05 level (two-tailed test), and <sup>\*</sup> Significant at the 0.10 level (two-tailed test).

