# The Effect of Prevailing Wage Regulations on Contractor Bid Participation and Behavior: A Comparison of Palo Alto, California with Four Nearby Prevailing Wage Municipalities

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This sample of bids by union and nonunion contractors on and off municipal prevailing wage projects in the San Francisco Bay area of California provides the first empirical evidence examining the effects of prevailing wage regulations on contractor participation and bidding behavior. The data show that the presence of prevailing wage regulations does not decrease the number of bidders nor alter the bidding behavior of contractors relative to the engineer's estimate of the value of the project. Furthermore, in this heavily unionized area during an upswing in the business cycle, the presence of prevailing wage regulations did not discourage the participation of nonunion contractors nor reduce their chances of winning work.

## Introduction

IN THE UNITED STATES, PREVAILING WAGE REGULATIONS MANDATE WAGES AND BENEFITS TO BE PAID ON PUBLIC CONSTRUCTION IN THIRTY-TWO STATES, the District of Columbia, and on all federal construction projects. Municipalities may have their own prevailing wage laws in some states that themselves do not have state-wide regulations, and in the case of California, the subject of this study, certain municipalities may opt out of the state's prevailing wage regulation if they so choose. Mandated wages are by occupation and locality (a county in the case of federal projects) and are derived from employer surveys. The prevailing wage and benefit may be the mean or the mode or some switching between the two depending on each regulation's procedures and the prevalence of collectively bargained rates in the area.

The effects of prevailing wage regulations on the operations of construction labor markets and on the cost of public construction have been the subject

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of considerable research (Azari-Rad, Philips, and Prus 2002, 2003, 2005; Bilginsoy and Philips 2000; Dunn, Quigley, and Rosenthal 2005; Fraundorf and Farell 1984; Keller and Hartman 2001; Vincent and Mankkonen 2010). However, this literature has not addressed the question of the effect of prevailing wage regulations on the participation and bidding behavior of contractors. Nonetheless, some practitioners within the construction industry assert that prevailing wage regulations restrict the number of bidders and/or alter the composition of contractors in ways that raise public construction costs (Hook 2008). Other practitioners assert the opposite, that prevailing wage regulations permit more contractors and/or better contractors to bid on public projects (Elliott 2008). The only empirical study of this issue is a survey from 2001 of the opinions of public officials regarding the effect of prevailing wage regulations on the number of bidders. In this survey of city, county, and municipal utility and school officials in Kentucky conducted by the Kentucky Legislative Research Commission, 72 percent of the city officials, 71 percent of the county officials, 45 percent of the school officials, and 60 percent of the municipal utility officials agreed with the statement "prevailing wages decrease [the] number of bidders" on a public project. The survey gatherers reported: "Only six city, county, school or utility officials (3.8 percent of total) said that prevailing wage increases the number of bidders"[1] (Wilson et al. 2001).

This paper provides the first empirical study of actual contractor participation and bidding behavior on municipal construction by whether the public works were subject to prevailing wage regulations. We do this by exploiting variation in municipal regulations in California. California has two types of municipalities–general law cities and charter cities. Under current law, charter cities are "not required to comply with the [state] PWL with respect to public works contracts which are financed solely from city revenues. Rather, such [construction] contracts are municipal affairs."[2] Some charter cities, such as Eureka, choose to continue to enforce the state prevailing wage law while others such as Vista exempt municipal construction from prevailing wage requirements.

California state prevailing wage rates govern state and locally financed public works including all but charter cities that choose to opt out. The law is enforced by the Department of Industrial Relations but private parties have the right to sue under common law including class action suits (Berg 2010). The California Foundation for Fair Contracting serves as a clearing house for work-

[1] Survey responses were not weighted by the amount of public construction for which they may have been responsible (Wilson et al. 2001).

[2] STATE BUILDING AND CONSTRUCTION TRADES COUNCIL OF CALIFORNIA, AFL-CIO, Plaintiff and Appellant, v. CITY OF VISTA et al. (Super. Ct. No. 37-2007-00054316-CU-WM-NC), Apr 28, 2009, http://www.courtinfo.ca.gov/opinions/revpub/D052181.PDF, p. 3.

ers or contractors seeking redress for alleged wage violations.[3] The penalty for paying less than the promulgated prevailing wage includes back wages plus up to $50 per day for each worker violation (Solis Group 2009). In addition, in egregious cases, contractors can be disbarred from further bidding on state public works (Fryer and Motnerroza 2009). Cheating on prevailing wage rates is not uncommon. Contractors can pay below mandated rates or misclassify workers into lower rates or pay "under the table." But penalties can be substantial if the violation is substantial while enforcement can come either directly through the California Division of Labor Standards Enforcement or via private action.[4]

This paper examines a sample of 140 municipal projects built in 2006 and 2007 in five adjacent Northern California cities. All projects were municipal public construction, 122 of which in four cities were built under prevailing wage regulations and eighteen of which in one city were built absent these regulations.[5] The five cities examined include San Jose, Sunnyvale, Mountain View, San Carlos, and Palo Alto. Palo Alto municipal construction is not governed by prevailing wage requirements while city construction in the four other jurisdictions requires the payment of state-determined prevailing wage rates. As a charter city of California, Palo Alto chose to exempt itself from paying the California state prevailing wage rate in 1981 (Keene 2009). In 2002, Palo Alto joined an amicus brief in support of charter cities continuing to have the right to opt out of state prevailing wage regulations (Calonne 2002). While there was some support on the City Council at that time and subsequently through our study period to adopt a city prevailing wage or alternatively enforce the state law, the exemption has remained in effect through 2010.[6] In contrast, the surrounding jurisdictions unambiguously acknowledge the state prevailing wage law through this period.

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[3] http://www.ffccalifornia.com/Pages/aboutus.aspx.

[4] An example of debarment for violating prevailing wage regulations on state construction can be found in Stevenson (2010).

[5] The fact that we have fewer nonprevailing-wage projects and that they all come from one city is a limitation of our data. Future research should seek to expand the number of nonprevailing wage projects as well as the number of municipalities offering these projects. Nonetheless, a virtue of our data is that the adjacent cities under comparison are soliciting bids in the same construction market at the same time. Adding cities without prevailing wage regulations from another construction labor market presents problems as well.

[6] Palo Alto City Council Special Meeting minutes, November 12, 2002, pp. 95–38; Palo Alto City Council Special Meeting minutes, September 17, 2007, pp. 7–8; Sheyner (2009, 2010); Trout (2007).

Palo Alto and the surrounding cities are an area of relatively high union density[7] and typically, collectively bargained (i.e., union) wage and benefit packages by construction occupation constitute the proclaimed prevailing wage rates in the jurisdictions where prevailing wage regulations apply.[8] Also because these cities are within the same county, the mandated wage and benefits by occupation are the same at any given time period across each city participating in the state regulation.

The focus of this research is to ask questions regarding possible differences in the number or union status of contractors bidding on prevailing wage jobs compared to those bidding on Palo Alto nonprevailing wage work. Additionally, we will examine 83 of our sample's 140 projects, a subsample for which engineering estimates of the accepted bid price were available. In these cases, we will examine contractors' bids relative to the benchmark of the engineer's estimate by variation in prevailing wage requirements. Engineers' estimates in this area are typically provided by the designing engineer or architectural engineer although they may sometimes be done in-house by the city engineer.

Our focus will be on the behavior of four groups of contractors–those within our sample who only bid on Palo Alto projects, those within our sample who only bid on surrounding cities' projects and never on Palo Alto jobs, and those who bid on both Palo Alto projects and on the municipal projects of surrounding cities. We will split this last group into two, examining their bid behavior in response to increasing numbers of competitors when bidding on Palo Alto jobs compared with when they bid on surrounding city jobs.

With these data, we will ask the following questions: In these Northern California municipalities, are there more bidders on or off prevailing wage work? Are union contractors more likely to bid on prevailing wage projects? Are union contractors more likely to win prevailing wage jobs? Are winning bids more likely to be lower relative to the engineer's estimate on Palo Alto projects (i.e., on nonprevailing wage public work)? And finally, using an OLS linear regression model controlling for other factors and adjusting for potential clustering effects by contractor, we will ask whether contractors who only bid on nonprevailing wage work compared with contractors who only bid on pre-

[7] California construction in 2002 was more unionized than national construction (Milkman and Rooks 2003). In 2008, the Bay Area was the most unionized private sector area in California (Milkman and Kye 2008).

[8] For instance, the 2010 promulgated prevailing wage rates for Santa Clara County in which all these cities reside, are all union collectively bargained rates (e.g., inside wiremen = \$47.570 wage + \$10.580 health + \$10.850 pension + \$0.85 training + \$0.28 other = \$71.56/hour). In contrast, San Diego's inside wireman prevailing wage rate was \$49.24, Los Angeles was \$58.41, and San Francisco was \$75.60. These relative wage rates to some extent reflect relative costs of living but they also reflect relative unionization rates (http://www.dir.ca.gov/dlsr/pwd/index.htm).

vailing wage work bid differently as the number of competing contractors bidding on a job increases. Furthermore, do contractors who bid both on prevailing wage and nonprevailing wage public works change their bid response to increased competition on prevailing wage work compared with nonprevailing wage jobs?

## Data

Data on contractor bids and engineers' estimates for the period April 2006 to December 2007 were gathered from city records for Palo Alto, San Jose, Sunnyvale, Mountain View, and San Carlos. Data on the value for each of 567 bids submitted by 221 contractors for 141 projects were gathered including (1) the project's name, (2) project location, (3) the project's bid opening date, (4) whether the contractor was union or nonunion, (5) the value of the contractor's bid, and (6) the engineer's estimate of the project's accepted bid-price cost. Engineers' estimates were available for 83 of the 140 projects. From these data, we were able to calculate the number of bidders on each project and contractor rank order in the bidding as well as for projects where the engineer's estimate was available, the percent difference between each bid and the contractor's estimate.

## Comparison of Means

The purpose of this research is to assess the effect of prevailing wage regulations on the auction participation of contractors and the bid outcomes relative to engineer's estimates.

Table 1 shows the mean, median, minimum, and maximum value of the winning bids by city. Palo Alto had somewhat larger projects compared to surrounding municipalities. The median Palo Alto project came in at $764,917 while the next largest set of projects in Mountain View had a median value of $608,338.

Table 2 shows the number of projects in our sample by city. Palo Alto had eighteen projects upon which sixty-eight contractors bid for an average of 3.8 bidders per project. On Palo Alto projects, union contractors accounted for 84 percent of all bidders, and union contractors won 89 percent of all bid openings.[9] Thus, a higher percentage of union contractors bid on Palo Alto work

[9] This is based on the assumption that the contract was awarded to the lowest bidder, which is typical of public projects.

TABLE 1

Value of the Winning Bid on Projects by City

| City | Mean | Median | Minimum | Maximum |
|---|---|---|---|---|
| Palo Alto | $3,176,708 | $764,917 | $214,666 | $15,950,279 |
| Mountain View | $1,226,708 | $608,338 | $27,000 | $3,747,000 |
| San Carlos | $308,988 | $86,428 | $53,789 | $828,680 |
| San Jose | $1,841,686 | $523,363 | $89,505 | $14,154,490 |
| Sunnyvale | $665,432 | $218,000 | $45,472 | $9,217,548 |

TABLE 2

Characteristics of Projects and Bidders

| City | Number of projects | Number of bidders | Bidders per project | Union contractors as a percent of all bidding contractors (%) | Percent projects won by union contractors (%) |
|---|---|---|---|---|---|
| Palo Alto | 18 | 68 | 3.8 | 84 | 89 |
| Mountain View | 12 | 52 | 4.3 | 71 | 75 |
| San Carlos | 7 | 31 | 4.4 | 81 | 57 |
| San Jose | 80 | 341 | 4.3 | 73 | 74 |
| Sunnyvale | 23 | 73 | 3.2 | 77 | 87 |

and a higher percentage of union contractors won on Palo Alto work compared with the surrounding municipalities.

Table 3 shows within each city the percent distribution of projects by type. In comparison with the cities as a whole, Palo Alto had no city building construction, while 13.5 percent of all the projects were buildings, and Palo Alto had 47 percent water and sewer piping projects compared with 23 percent for this group of cities as a whole.

Table 4 compares the union status of bidding and winning contractors in Palo Alto to surrounding cites showing that on average, within our sample, union contractors bid more often and won more often in Palo Alto absent prevailing wage regulations compared with surrounding cities that do have prevailing wage requirements. Because Palo Alto did not do public building construction during our period, a subset of surrounding cities data that exclude building construction is included to provide a second comparison. The general pattern revealed in Table 4 is that away from Palo Alto union contractors bid on about three fourths of the city projects and win about three fourths of those projects. In Palo Alto, during our period, union contractors bid on 84 percent of the projects and won 89 percent of those projects. Two-group proportion comparison t-tests indicate that the percentage differences shown in Table 4 are not statistically significant ($p < 0.10$). Similarly, two-group mean compari-

TABLE 3

PERCENT DISTRIBUTION OF PROJECTS BY CITY AND TYPE

| | Mountain View | San Carlos | San Jose | Sunnyvale | Palo Alto | Total* |
|---|---|---|---|---|---|---|
| Airport construction | 0 | 0 | 5 | 0 | 0 | 3 |
| Street lighting and signals | 0 | 0 | 10 | 9 | 6 | 8 |
| Misc. including fiber optics, fencing, landfills, solar power | 0 | 0 | 5 | 4 | 6 | 4 |
| City bldgs. including city hall, offices, community centers, fire, and police | 17 | 0 | 18 | 13 | 0 | 13 |
| Parks and playgrounds | 25 | 0 | 13 | 17 | 11 | 13 |
| Curbs, sidewalks, and gutters | 8 | 14 | 3 | 13 | 0 | 5 |
| Streets, roads, and bridges | 42 | 29 | 20 | 13 | 17 | 21 |
| Water and sewer piping | 8 | 57 | 15 | 26 | 44 | 23 |
| Water and sewer treatment | 0 | 0 | 13 | 4 | 17 | 10 |
| Total | 100 | 100 | 102 | 99 | 101 | 100 |

NOTE: *Totals may not sum to 100 because of rounding error.

son t-tests indicate that the mean number of bidders per project are not statistically significantly different ($p < 0.10$).

So, our sample results suggest that the number of bidders was about the same in Palo Alto absent prevailing wage regulations compared with surrounding cities with prevailing wage regulations; the percent union of bidding contractors were about the same in both regulatory regimes, and nonunion contractor success rates were as good if not better on prevailing wage projects in surrounding cities compared with Palo Alto's nonprevailing wage projects. These results do not support the contention that prevailing wage regulations discourage bidding by nonunion contractors nor do our results support the

TABLE 4

SUMMARY COMPARISON OF UNION STATUS OF WINNING CONTRACTORS IN PALO ALTO AND SURROUNDING CITIES INCLUDING AND EXCLUDING BUILDING PROJECTS

| | Number of projects | Percent won by union contractors (%)* | Number of bidders | Percent union bidders (%)* | Bidders per project* |
|---|---|---|---|---|---|
| Surrounding cities (all projects) | 122 | 75 | 497 | 74 | 4.1 |
| Surrounding cities (excludes building projects) | 103 | 76 | 405 | 77 | 3.9 |
| Palo Alto | 18 | 89 | 68 | 84 | 3.8 |

NOTE: *None of the mean percentages nor mean number of bidders shown are statistically significantly different from each other in one- or two-tail tests at $p < 0.10$.

hypothesis that prevailing wage regulations reduce the number of bidders competing for work nor the argument that prevailing wage regulations prevent nonunion contractors from winning prevailing wage projects.

These conclusions are contextualized by the fact that Palo Alto and the surrounding area have a high construction unionization rate. These results may or may not hold for other areas of the United States with lower construction unionization rate. Also, the construction business cycle in the San Francisco Bay area was in a busy phase during 2006–2007. Results might be sensitive to the business cycle and possibly differ during a heavy downturn. Further research is needed to determine the generality of our results.

Table 5 shows, by city, the percentage difference between the lowest bid on projects and (1) the engineer's estimate of the cost of the project and (2) the median bid on that project. Not all projects had engineers' estimates. Of the eighteen Palo Alto projects in our sample, seventeen had engineers' estimates. Overall, 83 of the 140 projects had engineers' estimates. Thus, we have more median estimates (140) than engineers' estimates (83). The median bid may be interpreted as the collective judgment of bidding contractors regarding how much the project should cost while the engineer's estimate may be seen as a separate-from-the-bidding-process estimate of what the project should cost. Table 5 shows that by either benchmark, Palo Alto winning bids are not the furthest below the benchmark. On average, the lowest bid came in 15 percent below the engineer's estimate on seventeen projects in Palo Alto. On average, the lowest bid on all eighteen Palo Alto jobs came in 17 percent below the median bid. This put Palo Alto in the middle of the range relative to the engineer's estimate. Palo Alto's winning bids were among the least below the median bid. These results do not support the hypothesis that not using prevailing wage regulations sharpens competition and induces contractors to significantly reduce their bids.

TABLE 5

PERCENT DIFFERENCE BY CITY BETWEEN WINNING BID AND (1) ENGINEERS' ESTIMATE AND (2) THE MEDIAN BID ON THE PROJECT

| City | Mean difference between lowest bid and engineer's estimate | Number of projects with engineer's estimate | Mean difference between lowest bid and median bid | Total number of projects |
|---|---|---|---|---|
| Palo Alto | −15 | 17 | −17 | 18 |
| Mountain View | −27 | 1 | −15 | 12 |
| San Carlos | −32 | 6 | −24 | 7 |
| San Jose | −6 | 40 | −21 | 80 |
| Sunnyvale | −3 | 19 | −20 | 23 |

Table 6 shows the summary comparison by Palo Alto and surrounding cities of the mean percent difference between the winning bid and (1) the engineer's estimate and (2) the median bid. On average, on seventeen projects, the winning bid in Palo Alto was 15 percent below the engineer's estimate. Elsewhere, on average, on sixty-six projects, the winning bid was 8 percent below the engineer's estimate. This difference in means, however, is not statistically significant ($p < 0.10$). Almost identical results will be obtained if building projects outside of Palo Alto are excluded to correspond to the absence of building projects in our Palo Alto sample of infrastructure, parks, and roadwork. Thus, we cannot say with confidence that there is any difference between how the lowest bidder bids relative to the engineer's estimate in Palo Alto without a prevailing wage mandate compared with surrounding cities that regulate using prevailing wage requirements.

Table 6 also shows that on eighteen projects in Palo Alto, the winning bid was, on average, 17 percent below the median bid, while elsewhere, on average, the winning bid was 21 percent below the median bid. Again, this difference in means is not statistically significant ($p < 0.10$). Closely similar results will be obtained if building projects are excluded from the comparison. So again, we cannot conclude with confidence that there is any difference between how the lowest bidder bids relative to the median bid in Palo Alto compared with surrounding prevailing wage jurisdictions. However, because other factors can influence the percent difference between the lowest bid and the engineer's estimate, we employ an OLS linear regression model to take into consideration these other influences.

## Regression Model and Results

We now turn to the bidding behavior of contractors based on whether, in our sample, they bid on Palo Alto projects only, both Palo Alto and surround-

TABLE 6

SUMMARY COMPARISON BY PALO ALTO AND SURROUNDING CITIES OF THE MEAN PERCENT DIFFERENCE BETWEEN THE WINNING BID AND (1) ENGINEER'S ESTIMATE AND (2) THE MEDIAN BID ON THE PROJECT

| City | Mean difference between lowest bid and engineer's estimate* | Number of projects with engineer's estimate | Mean difference between lowest bid and median bid* | Total number of projects |
|---|---|---|---|---|
| Palo Alto | −15 | 17 | −17 | 18 |
| Surrounding cities | −8 | 66 | −21 | 122 |

NOTE: *None of the differences shown are statistically significantly different from each other in one- or two-tail tests at $p < 0.10$; closely similar results will be obtained if building projects are excluded.

ing city projects, or on surrounding city projects only. Table 7 shows that six contractors bid nine times on five of Palo Alto's nineteen projects, and in our sample, which spans most of 2006 and all of 2007, these particular Palo Alto bidders did not bid on any other projects in our surrounding prevailing-wage-law cities. So we have six Palo Alto-only contractors.

By comparison, 182 contractors submitted 365 bids on 119 projects in surrounding cities and never submitted a bid on any Palo Alto projects. So, we have 182 never-Palo Alto bidders. There were thirty-one contractors who bid on both Palo Alto and surrounding work. These contractors submitted 191 bids on 91 projects.

Thus, of the 219 contractors in our sample, 17 percent bid on at least one Palo Alto project and conversely, 83 percent never bid on any Palo Alto project. Table 8 shows that the eighteen Palo Alto projects (out of a sample total of 140 projects) accounted for 24 percent of all the work in our sample. Thus, Palo Alto had 13 percent of all the projects, accounting for 24 percent of the dollar value of work and attracting 17 percent of all the contractors.

Table 9 shows the frequency distribution of the number of bidders per project by city. Five projects had only one bidder, and three projects had eight or more bidders. About 72 percent of the projects had between two and five bidders.

Table 10 shows the results of an OLS linear regression model with robust standard errors testing the relationship between the percent difference between a contractor's bid and the engineer's estimate as the dependent variable and (1) the number of bidders on the project, (2) the bid rank of the contractor, (3) the log of the value of the project as measured by the engineer's estimate, (4) the location of the project, (5) the union status of the contractor, (6) the date of the bid opening, and (7) a set of dummy variables for the type of project.

The regression model has the following form:

$$y = \beta_0 + \beta \times x + u, \quad u \tilde{} N(0, \sigma^2)$$

TABLE 7

Contractors Bids and Projects by Whether the Contractor Bid (1) on Palo Alto Projects Only, (2) Both Palo Alto and Surrounding City Projects, or (c) Surrounding City Projects Only

| City | Bidders | Bids | Projects |
|---|---|---|---|
| Palo Alto only | 6 | 9 | 5 |
| Both Palo Alto and surrounding cities | 31 | 191 | 91 |
| Surrounding cities only | 182 | 365 | 119 |
| Total | 219 | 565 | 140 |

TABLE 8

PALO ALTO CONSTRUCTION AS A PERCENT OF THE TOTAL VALUE OF CONSTRUCTION IN THE SAMPLE

| City | Total value of winning bids |
|---|---|
| Mountain View | \$14,720,497 |
| Palo Alto | \$57,171,027 |
| San Carlos | \$2,162,919 |
| San Jose | \$147,334,875 |
| Sunnyvale | \$15,304,926 |
| Total | \$236,694,244 |
| Palo Alto percent of total | 24 |

TABLE 9

DISTRIBUTION OF BIDDERS PER PROJECT ON PROJECTS WITH ENGINEERS' ESTIMATES

| | Frequency of the number of bidders | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Number of bidders | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Mountain View | | | | | 1 | | | | |
| Palo Alto | | 1 | 5 | 6 | 3 | 2 | | | |
| San Carlos | | | | 3 | 2 | | 1 | | |
| San Jose | 1 | 9 | 5 | 7 | 4 | 5 | 6 | 1 | 2 |
| Sunnyvale | 4 | 3 | 5 | 1 | 5 | | 1 | | |
| Column total | 5 | 13 | 15 | 17 | 15 | 7 | 8 | 1 | 2 |
| Percent of all 83 projects (%) | 6 | 16 | 18 | 20 | 18 | 8 | 10 | 1 | 2 |

where $\beta_0$ is a constant, $\beta$ is a vector of coefficients of independent variables, and, u is an error term with mean 0 and variance $\sigma^2$. In the regression model, we control clustering that causes the variance–covariance matrix to be block-diagonal because there are several bidders who bid multiple times on various projects. For those, there may be correlated bidding behavior that would violate the independently distributed errors assumption as well as the identically distributed assumption.[10]

[10] Ignoring the within-bidder correlations leads to inconsistent estimates of the variance–covariance matrix (Cameron and Trivedi 2005). The cluster-robust standard errors are calculated based on the equation:

$$\mathrm{Var}[\hat{\beta}|X] = \frac{N-1}{N-k}\frac{n}{n-1}(X'X)^{-1}\left(\sum_{c=1}^{n}\ddot{u}_n'\ddot{u}_n\right)(X'X)^{-1}$$

where $Nc$ is the number of observations in the $c$-th cluster, $k$ is the number of independent variables, $n$ is the number of cluster, $X$ is the $1 \times k$ vector of independent variables, $\ddot{u}_n = \sum_{i=1}^{N_k} \hat{u}_i x_i$ ($\hat{u}_i$ is the i-th residual from the $c$-th cluster).

TABLE 10

Ordinary Least Squares Linear Regression Predicting the Percent Difference Between a Contractor's Bid and the Engineer's Estimate ($N$ = 340)

| 1 | Dependent variable = percent difference between bid and engineer's estimate | Estimated effect (i.e., coefficient) | Robust standard error |
|---|---|---|---|
| 2 | Number of bidders on project | | |
| 3 | Contractors bidding on Palo Alto only | −3.44 | 2.23 |
| 4 | Contractors bidding on both Palo Alto and surrounding cities jobs | | |
| 5 | When bidding on Palo Alto jobs | −4.27* | 2.46 |
| 6 | When bidding on surrounding city jobs | −5.06*** | 0.93 |
| 7 | Contractors bidding only on surrounding cities jobs | −5.03*** | 0.89 |
| 8 | Bid relative to winning bid: | | |
| 9 | Second bidder relative to the lowest bidder | 13.21*** | 3.40 |
| 10 | Third bidder relative to the lowest bidder | 20.59*** | 3.53 |
| 11 | Fourth bidder relative to the lowest bidder | 27.86*** | 3.32 |
| 12 | Fifth bidder relative to the lowest bidder | 36.67*** | 4.02 |
| 13 | Sixth bidder relative to the lowest bidder | 38.21*** | 4.12 |
| 14 | Seventh bidder relative to the lowest bidder | 51.15*** | 8.29 |
| 15 | Eighth bidder relative to the lowest bidder | 50.05*** | 5.86 |
| 16 | Ninth bidder relative to the lowest bidder | 50.00*** | 4.41 |
| 17 | Log of the engineer's estimate | −1.99* | 1.21 |
| 18 | Mountain View relative to Palo Alto | 8.20 | 13.67 |
| 19 | San Jose relative to Palo Alto | 14.15 | 11.90 |
| 20 | San Carlos relative to Palo Alto | −10.381 | 12.02 |
| 21 | Sunnyvale relative to Palo Alto | 8.44 | 12.64 |
| 22 | Union contractor relative to nonunion contractor | 3.10 | 2.77 |
| 23 | Date of bid opening | −0.005 | 0.01 |
| 24 | Airport construction | 19.77*** | 7.84 |
| 25 | Misc. including fiber optics, solar, fencing, landfills, etc. | 41.24*** | 9.44 |
| 24 | Fire, police, office, community centers, and other public buildings | 22.67*** | 4.53 |
| 25 | Parks and playgrounds | 22.36*** | 4.03 |
| 26 | Sidewalks, curbs, and gutters | 20.08*** | 5.14 |
| 27 | Roads, streets, and bridges | 20.17*** | 3.92 |
| 28 | Water and sewer piping | 28.58*** | 3.77 |
| 29 | Water and sewage treatment | 10.50*** | 3.91 |
| 30 | Constant | 90.13 | 179.93 |
| 31 | *R*-square | 0.42 | |

Notes: significance levels: ***significant at 1 percent, *significant at 10 percent.

The level of observation is the contractor bid on a particular project. The number of bidders on the project is broken into four categories based on the characteristics of the observed contractor: (1) the number of bidders for those contractors who never bid off of Palo Alto projects, (2) the number of bidders for those contractors bidding only on Palo Alto projects, (3) the number of bidders for contractors bidding both on and off Palo Alto projects when they are bidding on Palo Alto projects, and (4) the number of bidders for contractors bidding on both types of projects when they are not bidding on Palo Alto jobs.

The size of the project measured by the log of the engineer's estimate, the rank of the bidder, the type of project, and a time trend are control variables. Project size and type control for the aforementioned facts that Palo Alto's projects tended to be larger. Lines 9 through 16 in Table 10 show the model's estimates of how far the second through ninth bids are from the engineer's estimate relative to the contractor's bid. So, in general, the model predicts that the second bid will be about 13 percent higher than the first bid, the third bid about 21 percent higher, and so on. These are all relative to the first or lowest bid, and all these results are statistically significant.

Line 17 presents the log of the value of the project as measured by the engineer's estimate. This captures the opportunity cost of losing a bid with larger projects being more valuable, and contractors more likely to shave their bids to win these more valuable projects. The negative sign on this variable indicates that contractors do reduce their bid in percentage terms relative to the engineer's estimate when project size increases. This negative sign may also reflect the greater ease of estimating new construction that tends to be specified compared to renovations. While we do not have direct evidence in our data regarding new construction versus renovations, in general, within types of construction, smaller projects tend to be renovations while larger projects tend to be new construction. New construction projects provide greater specification and requirement certainties and therefore are somewhat easier to accurately estimate leading possibly to a closer convergence of the engineer's estimate to the contractor's bid. Lines 24 through 29 provide dummies for the type of project with the reference being traffic signal and street lighting construction. Traffic lighting and signals are fairly standard construction, which are relatively easy to estimate. Not surprisingly other types of construction lead to statistically significant greater predicted divergence between the bid and the engineer's estimate. Atypical construction under the miscellaneous category is the most difficult to precisely estimate compared with traffic lighting probably due to the miscellaneous category containing unique or not-often-repeated types of projects (e.g., solar power plant). Water and sewer piping tends to be somewhat more difficult to accurately estimate compared with most other construction types in the model.[11] Recall that Palo Alto (along with San Carlos) has a disproportionate percentage of water and sewer piping projects (Table 3). Line 23 shows an additional control variable, the

[11] However the estimated coefficients are only statistically significantly different from water and sewer piping in the cases of roads–streets–bridges and water–sewer treatment.

date of the bid opening. During the almost 2-year period of our sample, there is no trend in the percent difference between the low bid, and the engineer's estimate associated with the business cycle.

One set of focus variables are the city variables shown in rows 18 through 21 in Table 10 with Palo Alto being the omitted city. The hypothesis is that the distance between bids and the engineer's estimate is lower in Palo Alto (the omitted reference) because Palo Alto does not have prevailing wage regulations and therefore attracts more competitive bidding behavior leading to bids closer to the engineer's estimate. This is not supported by the results of this regression model where three of the four estimated coefficients are positive but none are statistically significant. A second hypothesis argues that prevailing wage regulations encourage the use of union contractors and that, in turn, raises bid costs because all other things being equal, union contractors bid higher than nonunion contractors relative to the engineer's estimate. In Table 10, the results shown in line 22 for union contractors relative to nonunion contractors does show that the point estimate of the distance between the engineer's estimate and the union contractor's bid is 3.1 percentage points greater than that for nonunion contractors. However, this result is not statistically significant.[12] Thus, these data do not support the proposition that union contractors typically submit higher bids than nonunion contractors.

Our primary focus variables show how contractors' bidding behavior changes with increased number of bidders. In lines 3 through 7, we have parsed contractors into four groups. Group one on line 3 is contractors, who in our sample, only bid on Palo Alto projects. Group four on line 7 is contractors who, in our sample, only bid in surrounding cities and never bid on Palo Alto projects. Groups two and three are one group of contractors, those bidding both on and off Palo Alto projects, divided into events when they bid on Palo Alto jobs and events when they bid on surrounding cities' projects. The questions we ask here are two: First, as the number of bidders on a project rises, is the behavior of contractor groups one (only Palo Alto) and four (never Palo Alto) different? That is, do contractors who only bid on Palo Alto projects respond differently when facing more bidders on those projects compared with contractors who never bid on Palo Alto projects when they face more bidders? The second question is as follows: do the same contractors who bid on both Palo Alto and surrounding prevailing wage projects change their bidding behavior on Palo Alto projects compared with surrounding city projects as the number of bidders increases?

[12] An unreported regression limiting the sample to winning bids yields similar statistically insignificant results for union contractor bids relative to nonunion contractor bids.

Comparing the always-Palo Alto contractors with the never-Palo Alto contractors, for the always group, an increase of one additional bidder will lead to a −3.44 percentage point lowering of the distance between the contractor's bid and the engineer's estimate. For the never-Palo Alto group, an increase of one more competitor leads to a −5.03 percentage point change in the distance between the contractor's bid and the engineer's estimate. These estimates are not statistically significantly different from each other.[13] The evidence is that the force of competition is similar on both prevailing wage and nonprevailing wage projects.[14] But these are different groups of contractors. What about the same contractors' behavior but on and off of Palo Alto projects? Lines 5 and 6 in Table 10 show that as the number of competitors on a project increases by one more contractor, the "both" contractors when bidding on a Palo Alto project will reduce their bid relative to the engineer's estimate by −4.27 percentage points. On surrounding cities' prevailing wage projects, one more competitor induces a bid reduction of −5.06 percentage points relative to the engineer's estimate. These two point estimates also are not statistically significantly different from each other.[15] Thus, different contractors respond to competition in a similar fashion on and off prevailing wage jobs and *a fortiori* the *same* contractors bid in the same way in responding to additional competitors whether they are on a Palo Alto job or a prevailing wage job in a surrounding city.[16]

Thus, this model indicates that there is no difference, in general, between the bidding behavior of contractors on or off Palo Alto jobs, which is to say on or off prevailing wage municipal projects in responding to additional competitors.

## Conclusions and Limitations

This paper asks whether the presence or absence of prevailing wage regulations in an area of high union density affects the number of bidders on regulated compared to unregulated municipal projects. In our sample of 219 contractors submitting 565 bids on 140 projects, 18 of which were not made under prevailing wage regulations, while the remaining 122 were, we found no

[13] *p*-Value of a Wald test after the regression equation is 0.48.

[14] Contractors typically have a good idea of the number of other contractors who will bid on a project based on records associated with contractors examining the specifications of the project prior to bidding on it and/or participation at pre-bid conferences with the owner. There also may be informal information revealing the probable number of bidders on a project.

[15] *p*-Value of a Wald test after the regression equation is 0.75.

[16] Similar results are found if the sample is restricted to just the winning bids on projects.

evidence to support the proposition that the absence of prevailing wage regulations attracted more bidders per project or more nonunion bidders per project. On average, in Palo Alto (the nonprevailing wage jurisdiction), a higher percentage of union contractors bid on work and a higher percentage of union contractors won work compared with prevailing wage projects in surrounding cities during the same time period. On the other hand, on average, a larger number of nonunion contractors bid on prevailing wage municipal work in surrounding communities compared with Palo Alto. None of these results are consistent with the hypothesis that the absence of prevailing wage regulations attracts more contractors or more nonunion contractors.

In our subsample of eighty-three projects for which engineers' estimates are available, we found no evidence that contractors changed their bidding behavior based on whether or not they were bidding on a prevailing wage project. Furthermore, we did not find that bids on Palo Alto nonprevailing wage jobs were lower than the engineer's estimate relative to bids on surrounding municipal prevailing wage work. Nor did we find that union contractors tended to bid higher relative to the engineer's estimate compared with nonunion contractors.

Our experiment examining the response of contractors to additional competitors on particular projects found no statistically significant difference between contractors based on whether they bid only on nonprevailing wage jobs, only prevailing wage jobs or both. Basically, any additional contractor bidding on a project leads to an approximately $-4.5$ percentage point downward movement in the contractor's bid relative to the engineer's estimate regardless of whether it is a prevailing wage job. In particular, examining the behavior of "both" contractors who bid on Palo Alto work and also bid on prevailing wage municipal work in surrounding cities, we found no statistically significant difference in their bidding behavior relative to the engineer's estimate on or off prevailing wage projects.

Our data are limited to a set of adjacent cities in the San Francisco Bay area of California during the years 2006–2007. This is a relatively highly unionized area within the overall U.S. construction industry during the period of relatively high construction activity. It remains to be seen whether our empirical results specific to this study generalize to other areas of the United States where construction unionization rates are lower or the business cycle is at a less vigorous stage. Furthermore, in our time period, Palo Alto (the nonprevailing wage jurisdiction) did not engage in constructing office or other city buildings. Thus, our comparison and results pertain primarily to civil engineering rather than building construction. Also, we do not address the question of cost, *per se*.

Nonetheless, this paper provides the first empirical answer to one salient issue: Do prevailing wage regulations reduce the number of bidders on projects, discourage nonunion contractors from bidding on projects, alter the dynamics of the bidding project, or fatten the bid relative to the engineer's estimate? We find no evidence in our sample to support any of these propositions.

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