Should Prevailing Wages Prevail? Re-examining the Effect of Prevailing Wage Laws on Affordable Housing Construction Costs

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Abstract

The United States faces two parallel crises: one with affordable housing supply, and one with maintaining residential construction labor standards. Historically, issues with labor standards have been addressed on public works through prevailing wage requirements. Labor standards—while good for workers—may increase construction costs; higher costs, in turn, negatively impact low-income families by reducing supplies of affordable housing. In this paper, we re-examine whether this tradeoff exists and, if so, its extent and implications. We estimate that, because of the enhanced enforcement of labor and employment laws, prevailing wage requirements add only 0-3.3% to the costs of affordable housing construction.

1. Introduction

Policy makers often face tough tradeoffs when designing policies that work at cross purposes. The potential tension between providing affordable housing to low-income families and regulating construction labor standards is a case in point. Labor standards—while good for workers—may increase construction costs; higher costs, in turn, negatively impact low-income families by reducing supplies of affordable housing. In this paper, we analyze whether this tradeoff exists and, if so, its extent and implications.

Affordable housing units are residential housing that, through tax subsidies, vouchers, or other programs, are available at a lower rental cost than for similar unsubsidized units. Affordable housing can be single family houses, units in multi-family buildings, units in apartment buildings or units in mixed-use developments. The availability of affordable housing for U.S. low-income families is in crisis, as low-income families near or below the poverty line face a burdensome shortage of affordable housing (Aurand, Emmanuel, Yentel, Errico, and Pang 2018).[1] Through tenant-based rental assistance, public housing, project-based rental assistance, and homeless assistance grants, federal and state programs seek to alleviate this shortage. Success in increasing the stock of affordable housing stems, in part, from keeping the cost of new projects low while maintaining quality.

The construction labor market is likewise in crisis. In 2017, construction and extraction workers had the second highest rate of working poor in the US—65 percent above the overall labor market average and behind only farming, fishing, and forestry occupations.[2] In particular, in 2010, 22.4% of Hispanics working in construction, 30% of the construction labor force, were below the poverty line. This was 172 percent higher than the overall rate of working poor in the US labor market and 52 percent higher than the rate of working poor among Hispanics in the overall labor market.

The construction labor market crisis is characterized by low-wage segments (particularly residential construction), payroll fraud (particularly in the nonunion segment), workplace accidents (particularly among Hispanics and immigrants) and skilled labor shortages[3]. Just as government affordable housing programs are key policies aimed at alleviating the affordable housing shortage, prevailing wage policies are aimed at preserving labor standards, promoting training and collective bargaining, and mitigating workplace dangers rooted in inexperience, casual labor relations, and limited safety and skills training. The question arises whether affordable housing policy and public construction labor standards work at cross purposes by increasing the cost of public construction.

The effect of prevailing wage laws (PWLs hereafter) on the outcomes of construction projects (e.g., costs, safety, training, employment of under-represented minorities) have been matters of public controversy and scholarly debate since the passage of the first PWL in Kansas in 1891 (Phillips 2005). At present, the federal Davis-Bacon Act and the "little Davis-Bacon Acts" in 27 states establish prevailing wage rates on public construction projects. Ongoing controversies and focused political action have resulted in the repeals of 6 state laws in the last decade; further efforts can be expected in the next several years. Opponents of these laws argue they are raids by special interests, construction unions and signatory employers, on the public treasury that prevent citizens from receiving the full value of their taxes. Supporters argue PWLs offset the market distortions caused by the low bid requirements on public works. These requirements prevent the public authority from replicating the criteria used by private owners and encourage contractors to offer low bids at the expense of construction quality and employment conditions.

The body of peer-reviewed empirical literature finds that PWLs are associated with increased training of the construction labor force and better safety performance, but do not increase the costs of constructing schools or road maintenance (e.g., Azari-Rad, Philips, and Prus 2002, 2003; Bilginsoy 2005; Duncan, Philips, and Prus 2014; Duncan 2015). In contrast, evidence on the effect of PWLs on affordable housing broadly support the view that PWLs increase costs; estimates of the magnitude of their effects vary widely between studies (Dunn, Quigley, and Rosenthal 2005; Littlehale 2017; Palm and Niemeier 2018). Applying OLS to a 1997-2002 California state data set, Dunn, Quigley, and Rosenthal (2005; DQR hereafter) reported that projects built under PWLs had statistically significant 9-11% higher costs than comparable non-PWL projects. DQR (2005) also estimated instrumental variables (IV) models in which the prevailing wage was treated as endogenous. In contrast to their and other OLS estimates, DQR's IV estimates range as high as 37%.

The current study advances DQR (2005) and Littlehale (2017) with three contributions. First, DQR introduced the use of instrumental variables into the affordable housing literature. The prevailing wage may be endogenous because of correlations between high construction wages, construction costs and use of the prevailing wage. It may also be the result of developers choosing to participate in California state affordable housing programs that offer advantages but also come with a prevailing wage requirement. Internal evidence from DQR's work suggests that their instruments did not meet the relevance requirements for unbiased IV estimates. Second, we use this exploration of endogeneity to obtain robust estimates of the cost effects of PWLs on the costs of affordable housing. Using data from a recent California affordable housing survey, we instrument the first stage with information on projects' use of programs with prevailing wage requirements. We systematically test our instruments for relevance, discuss the exclusion restriction for each instrument, and consider variants of our models.

Third, we examine whether these estimated increases in the costs of affordable housing can be reasonably attributed to "theft" by special interests or are a cost of ensuring labor and employment laws are followed. Current research on residential construction employment markets find that payroll fraud, the misclassification of workers as independent contractors, off-the-books payments, not paying costs of legally mandated social insurance, not paying employees promised compensation, and an elaborate structure of subcontracting and shell companies reduce labor costs by 20 to 40% (Ormiston, Belman, Brockman, and Hinkel 2020). These practices have become widespread and have been institutionalized, are part of the *de facto* business plan of at least one large homebuilder and serve to both reduce costs and protect firms from effective regulation (Ormiston et al. 2020). In contrast with most of residential construction, projects built under PWLs are required to file certified payrolls and additional requirements and penalties that make payroll fraud more difficult. We use estimates of the cost savings from misclassification to determine the degree to which PWLs raise construction costs above those associated with builders adhering to labor standards.

Using data collected by a California state survey of new affordable housing construction in 2001–2011, we find that endogeneity is sensitive to the instruments in the first stage. Our preferred construction cost model, in which the prevailing wage is endogenous, uses two instruments. A reviewer expressed concern with one of the instruments; we address this by estimating a model in which it is a control, rather than an instrument. The remaining instrument remains valid, but the PW fails a test for endogeneity. Whether OLS or IV estimation is appropriate depends on specific exclusion restrictions, restrictions not subject to direct statistical testing. We also replicate DQR's work using our more recent data with their specification and preferred instruments. Their instruments were too weak to proceed to estimate the second stage cost model.[4]

We estimate both OLS and IV models of the prevailing wage cost effects. Our OLS models indicate the PW raises costs by 5–6%. The PW is endogenous in our preferred IV model; it has a negative, non-statistically significant cost effect of -6.3%, and our instruments pass a test for relevance and the endogeneity of the prevailing wage. It is, however, estimated with limited precision; a 95% confidence interval includes our OLS estimates. There is then evidence that PWLs could increase affordable housing construction costs by 0-6%. Further calculations lead us to conclude that if PWLs increase the cost of affordable housing, this modest increase is, in main, the costs of doing residential construction legally and of not engaging in payroll fraud and other practices that exploit workers and taxpayers. Prevailing wage requirements are then a foundation for implementing the societal consensus about minimum working standards and conditions.

2. Background

The federal Davis-Bacon Act of 1931 requires contractors and subcontractors working on federally funded or assisted projects exceeding $2,000 to pay their laborers no less than the wages and fringe benefits that prevail for laborers and mechanics performing similar work on similar projects in the same geographic area (U.S. Department of Labor n.d.). The Wage and Hour Division (WHD) of the U.S. Department of Labor determines mandated PW rates by trade, area, and type of construction by surveying private construction employers where federal projects are scheduled. PWLs are designed to equalize compensation paid on public projects with those paid on private projects for similar work in each locality (U.S. Department of Labor 2015). Twenty-seven states and numerous cities have “little Davis-Bacon” laws applying to state and local public works and publicly financed construction, some substantially predating the federal act. The stated goals of these regional laws differ, ranging from the preservation of local labor standards to ensuring a workforce that is safer and supporting apprenticeship training to provide a more skilled workforce (Duncan and Ormiston 2018). Those who oppose these laws view them as a raid by unions and organized contractors on the public till, arguing that they interfere with the operation of free markets and create inefficiencies and rents to be shared by the beneficiaries of these laws.

With the support of the American Legislative Exchange Council (ALEC), legislatures in Indiana, West Virginia, Kentucky, Michigan, Wisconsin, and Arkansas have recently debated and repealed their PWLs (ALEC 2020; Duncan and Ormiston 2018). These repeal campaigns have underlain a growth in peer-reviewed literature examining PWLs. Duncan and Ormiston (2018) report that in addition to increasing craft workers' wages, improving workplace safety, and increasing access to well-known construction apprenticeship programs, the body of the literature finds that PWLs do not raise costs of school construction and highway maintenance projects (see Duncan and Ormiston 2018 for a thorough literature review).[5]

3. Affordable Housing: A Break from the Consensus

The effect of PWLs on the costs of affordable housing construction has been addressed in three peer-reviewed studies (DQR 2005; Littlehale 2017; Palm and Niemeier 2018). California is the only state that covers both public and private affordable housing projects in its state law (DQR 2005).[6] All find that PWLs result in higher project costs for affordable housing, although the estimates range from 5 to 37%.

All three studies use detailed California state surveys of affordable housing construction. DQR (2005) analyzed the construction of 205 affordable housing projects in California between 1997 and 2002. They estimated OLS models in which the prevailing wage was treated as exogenous and IV models in which the prevailing wage was endogenous. The OLS models found that PWLs increased the costs of affordable housing projects by 9-11% while the IV models estimated a 19-37% increase in costs (DQR 2005).[7] [8]

Two more recent studies, Littlehale (2017) and Palm and Niemeier (2018) use OLS to examine the affordable housing issue. Using the most recent version of the California affordable housing study, Littlehale (2017) examined 321 affordable housing projects in California built from 2001 to 2011. Using a more fully specified OLS model, he reports a PW effect of 5-7%, statistically significant but smaller than DQR. The most recent study (Palm and Niemeier 2018) examined housing projects built between 2008 and 2016 in California's four largest metropolitan areas. The authors report statistically significant cost effects of 15-16%.[9]

In sum, while PWLs have been shown to not increase costs of school construction and highway maintenance projects, they apparently increase costs of building affordable housing in California. These findings seem plausible, both because California has one of the strictest PWLs (Duncan and Ormiston 2018; Belman, Ormiston, Petty, and Hinkel 2020) and because residential contractors have fewer opportunities to offset the effects of PWLs. Improving worker productivity, quality of work, safety outcomes or speed of completion is more difficult, given the less educated and skilled workforce available to residential contractors and their lesser use of sophisticated capital (Blankenau and Cassou 2011). The gains available via PWLs are more readily available to school and highway construction contractors, and PWLs are more likely to increase labor and total project costs in affordable housing. Affordable housing provides a strong test of the cost effects of the prevailing wage under unfavorable conditions.

Research which reconciles these varying PWL cost effects can aid policy decisions about affordable housing programs.[10] The magnitude by which PW requirements raise the costs of affordable housing will affect governments' abilities to build additional affordable housing units, a step central to resolving the affordable housing shortage. Robust estimates are needed to determine how much affordable housing is sacrificed to PW requirements. In addition, residential construction is growing rapidly, and with it, employment. Employment rose each year from 2011 to 2016, with 125,000 more workers employed in residential construction in 2016 than 2011 (Quarterly Census of Employment and Wages). Policies that directly affect this industry, such as prevailing wages, now affect a larger number of workers.

PWLs are unlikely to affect affordable housing construction in a fashion like other sectors of construction. The affordable housing workforce (and that of all residential construction) is less skilled, less trained, has lesser access to advanced equipment and technology and is less unionized than school construction or highway maintenance (Duncan and Ormiston 2018). It cannot be assumed that estimates from these industries generalize to affordable housing.

Further, issues with the structure of the residential construction industry make assessing the impact of PWLs on affordable housing project costs complex. Illegal, low-road labor practices (e.g., cash-only payments, wage theft, worker misclassification, workers' compensation, and tax fraud) are rampant in residential construction; large proportions of employees are misclassified as independent contractors or are paid off-the-books. These profitable illegal practices are institutionalized in the residential sector. Research finds that drywall contractors who misclassify employees as independent contractors or employ them off-the-books reduce their labor costs by over 30% (see Ormiston et al. 2020). The prevalence of these practices in residential construction has both economic and legal sources. Economically, the residential sector closely resembles a highly competitive market, with small, labor intensive firms all competing to complete limited-duration construction projects with the lowest possible cost, key to getting their offer accepted. On the legal side, the lack of communication and coordination between agencies responsible for regulating the industry, the dwindling enforcement resources available to them, and the development of institutions including labor brokers, check cashing stores, and shell companies allow these practices to continue (Ormiston et al. 2020).

It is far more difficult to engage in this kind of egregious behavior on PW projects. Under Davis-Bacon, employers are required, under penalty of law, to file a weekly certified payroll which lists all employees' names, Social Security numbers, work classification, daily hours worked, rates of pay, payments of Social Security and tax withholdings, with deductions for benefit programs, total deductions, and net wages for the week and are not permitted to "hire' individuals as independent contractors (Wage and Hour Division). The penalties for violating prevailing wage standards include make whole remedies, fines, and incarceration. Although some payroll fraud takes place on prevailing wage sites, expert opinion indicates it is neither as extensive as in segments of residential construction nor as disadvantageous to employees or governments. At least part of the cost increases attributed to PWLs laws in affordable housing construction may be associated with employers being less able to evade labor and employment law[11].

The current study also provides insight into the controversies over the purpose and channels through which PWLs act. As discussed in the introduction, opponents view these laws as a raid on the public treasury by special interests. Supporters argue that it corrects a distortion in the public bidding process that compels the public body to deviate from private sector practices in construction markets. Going back to Boss Tweed and Tammany Hall and before, there have been issues with corruption on public works projects. Public officials can arrange overly generous payments to contractors in return for kickbacks and other shameful practices. Since the progressive era, federal, state, and local laws have countered this by requiring public bodies accept the lowest qualified bid[12]. This requirement contrasts with the private sector, where owners consider contractors' reputation, experience, and the quality of the offered materials and designs along with the bid price in determining the winning bid. The low bid requirement places great pressure on contractors to develop methods, techniques and, for those who dare, the gaming of laws to reduce their bid price. Although better engineering techniques and a better-trained workforce lower costs, the most straightforward approach, particularly for less able contractors, is to pay labor less. Such contractors are motivated to search for pools of the least expensive labor they believe can complete the work. PWLs restrict these practices by standardizing wages at the rate paid for similarly skilled workers on similar projects in the private sector. In the presence of low bid requirements, PWLs compel contractors to compete on engineering, on project management, and on the skills of their labor force, rather than labor.

4. Empirical Contribution

As mentioned in the introduction, the current study advances DQR (2005) and Littlehale (2017) with three contributions. First, DQR introduced the use of instrumental variables into the affordable housing literature. We build on their work by applying contemporary methods and systematically testing to determine whether their IV estimates are reliable; whether their instruments are valid and whether PWLs are endogenous. Second, we develop robust estimates of the effect of PWLs on the costs of building affordable housing. The difference between DQR's OLS and IV estimates are very large and imply different policy responses. Third, we examine whether any estimated increases in the costs of affordable housing can be reasonably attributed to "theft" by special interests or are a cost of following labor and employment laws.

If, as contended by DQR, the prevailing wage is endogenous, OLS estimates of prevailing wage effects will be biased. If the prevailing wage variable incorporates observed and unobserved variables that are correlated with the dependent variable in the cost equation, there will be omitted variable bias in the estimate of the prevailing wage on construction costs. DQR's estimates suggest that correcting for omitted variable bias with IV methods results in the estimated effect of the prevailing wage to increase from 10% (OLS) to 38% (IV), a factor of four.

As Littlehale (2017) pointed out, the IV models employed by DQR (2005) suffer from methodological issues. DQR's instruments were not strong. Of their 17 instruments, only 2 instruments (the fraction of yes votes on California Propositions 160 and 167 in 1992) were significantly related to the requirement that projects require PWLs; these barely cleared a 10% significance test. The relevance requirement for IV estimation (i.e., that each instrument is statistically significant, *and* the instruments are sufficiently jointly significant) was not met.[13]

Likewise, the exclusion restriction for instruments was not adequately addressed by DQR (2005). All first-stage instruments are required not to have a direct causal effect on the dependent variable, project costs. The instruments can only impact project costs via the explanatory variable of interest, prevailing wages. DQR assert, but do not explain, that their instruments have no direct effect on construction costs (DQR 2005, p. 150). The authors also do not test for PW endogeneity, providing no evidence that their IV estimates are improvements over OLS or are needed. The instruments are then weak, possibly causing large inconsistencies and bias in IV estimates (Wooldridge 2013). Greater confidence should then be placed in the DQR OLS estimates of a statistically significant 9-11% effect.

Given the omission of two-stage methods and exploration of prevailing wage endogeneity by Littlehale (2017) and Palm and Niemeier (2018), the methodological defects of DQR's IV estimates, the availability of newer data, and the persistent shortage of affordable housing, we reconsider the effect of PWLs on the costs of building affordable housing and examine whether PWLs are endogenous.

5. Methods

Data and Sample

Building on DQR's work, we estimate both OLS and IV models with the survey of affordable housing construction commissioned by the State of California. (CAAHCS; State of California 2014). This survey was used by Littlehale (2017); a prior version was used by DQR. It includes 356 affordable housing projects built between 2001 and 2011. 233 of these projects were built under PW requirements; 133 were not. Including project built in 153 cities, it captures regional variation in construction methods and conditions.[14]

DQR (2005) recognized the possible endogeneity of the prevailing wage:

> "If projects located in higher-cost areas (for example, in highly urbanized areas) were more likely to be required to pay prevailing wages…then simple ordinary least squares regression models would falsely attribute these higher costs to the payment of prevailing wages" (DQR 2005, p. 149; Littlehale 2017, p. 124).

If the prevailing wage is endogenous, if it is significantly correlated with an error term which includes observable or unobservable omitted variables, estimates of cost effects associated with those omitted variables would be incorrectly attributed to the prevailing wage. A statistically significant OLS correlation between PWLs and project costs would not be indicative of a *causal* effect; OLS estimates would be a biased estimator of causality (Wooldridge 2013). To ensure that our estimates isolate this "true" effect on project costs, we follow DQR and explore potential endogeneity.

Measures

Our variables, their definitions, means and standard deviations are in Table 1. Following prior work, the dependent variable, log project cost, is the natural log of total affordable housing project development costs exclusive of land costs. The explanatory variable of central interest is prevailing wage, an indicator with a value of one if a project was subject to state PW requirements, zero otherwise.

[[Table 1 near here]]

Our OLS model is

(1) $log\ y_i = \beta_0 + \beta_1 PW_{iry} + \boldsymbol{\beta_2 V_{iry}} + \boldsymbol{\beta_3 F_{iry}} + \boldsymbol{\beta_4 X_{iry}} + \mu_{iry},$

where y_i is project cost, PW_{iry} is the prevailing wage indicator variable, and V_{iry}, F_{iry} and X_{iry} are groups of cost drivers. Variables are indexed by construction project (i), region (r), and year (y). Project specific drivers, $\boldsymbol{V_{iry}}$, include developer characteristics, fees associated with state permitting and impact fees, and project characteristics. Developer type and log developer employees capture whether the developer is the government, nonprofit, or another, and the number of workers employed by the developer[15]. Meetings 4 plus, permit and impact fees, and log permit and impact fees per square foot control for effects of state regulations such as obtaining building permits and requirements for community meetings; these are expected to increase total costs. For example, higher fees for obtaining building permits, all else equal, will raise construction costs (Littlehale 2017). Site and structure variables include log building area, parking-to-rentable building, square feet non-residential and non-parking, stories 4 Ppus, and residential square feet per unit. These capture cost effects specifically associated with the project.

The second group of controls involves drivers of affordable housing construction costs common across adjacent projects ($\boldsymbol{F_{iry}}$): average specialty contractor pay and project snow[16]. Construction projects share the specialty contractor workforce and share these common cost elements;[17] snow depths influence costs though their effect on project design and on windows of time for completion of various stages of construction (Littlehale 2017). Additional controls include: log lenders, as a project's costs are affected by the number of loans that finance it; duration 24 plus*,* as longer durations are associated with greater costs; and log architect and engineer (A&E) cost per square foot. This measure is a benchmark A&E estimate of project cost per square foot, is derived from the engineering costs of the project and does *not* include the effects of state regulations or PW requirements. Projects costs rise with A&E costs because more complex projects are more costly and require more time from architects and engineers.

Our IV model is:

(2) $PW_{iry} = \beta_0 + \beta_1 CDBG\ Funding_{iry} + \beta_2 Density\ Bonus_{iry} + \boldsymbol{\beta_3 V_{iry}} + \boldsymbol{\beta_4 F_{iry}} + \boldsymbol{\beta_5 X_{iry}} + \mu_{iry},$

(3) $log\ y_{iry} = \beta_0 + \beta_1 \widehat{PW_{iry}} + \boldsymbol{\beta_2 V_{iry}} + \boldsymbol{\beta_3 F_{iry}} + \boldsymbol{\beta_4 X_{iry}} + \mu_{iry},$

where equation (2) is the first stage prediction of the PW variable and equation (3) predicts the cost of affordable housing projects using the instrumented $\widehat{PW}$. Variables in equation (3) follow our discussion of the OLS model (equation 1), except for the use of the instrumented PW. Equation (2) predicts the use of prevailing wage requirements on a project with CDBG funding and density bonus serving as instruments; $\boldsymbol{V_{iry}}$, $\boldsymbol{F_{iry}}$, and $\boldsymbol{X_{iry}}$ included as in the OLS model.

Our instruments, community development block grant (CDBG) funding and density bonus*,* meet the exclusion restriction (that an instrument does not affect costs except through the prevailing wage) and the relevance requirements (that an instrument must be partially correlated with the prevailing wage). The CDBG program is a state of California and federal grant program that, among other purposes, is designed to partially fund the construction of affordable housing units. Any non-entitlement jurisdiction is eligible for CDBG funding,[18] but double dipping is not allowed; a jurisdiction is only eligible for California CDBG funding if it does *not* also participate in the equivalent federal CDBG program. Funding is geared toward smaller and more rural communities that otherwise may lack access to other resources, and the likelihood of receiving funding is independent of the expected costs of a project. Consistent with the exclusion restriction, California CDBG grants are not more likely to be awarded to large projects with higher costs.[19] Consistent with the relevance requirement, projects making use of CDBG funds are, under the terms of the program, subject to prevailing wage requirements (California Department of Housing and Community Development 2018)[20]. CDBG funds should then only impact costs via the explanatory variable of interest, prevailing wage*,* making it a valid instrument.

California's density bonus law, like the CDBG program, is designed to spur the development of a range of projects, including affordable housing. It allows housing developers to obtain more favorable development regulations in exchange for offering housing for specific groups on a site or donating land for that purpose. It allows for up to a 35% increase in housing unit densities on a given site. The relevance criterion is met, as the relaxation of prevailing wage requirements is *not* among the regulations that developers can negotiate (Goetz and Sakai 2017).

The exclusion restriction should also be met, as eligibility is independent of project size and costs. Eligibility is based on how housing units are utilized and the specific vulnerable populations they are geared toward. Further, density bonuses are inherently exogenous; as Goetz and Sakai (2017) point out, developers who meet the requirements of the density bonus law are "entitled to receive the density bonus and other benefits as a matter of right" (Goetz & Sakai 2017, p. 2). California cities and counties are *required* by law to grant density bonuses to projects which meet *at least* one of the following guidelines: (1) at least 5% of units are reserved for very low-income residents, (2) at least 10% of units are reserved for low-income residents, and (3) at least 10% of units are geared toward foster youth, disabled veterans, or homeless persons, with subsidized monthly rents that reflect very low-income levels (Goetz and Sakai 2017). The cost impacts of density bonuses will occur only via the prevailing wage requirement, making it a second valid instrument.[21]

We initially replicate Littlehale's OLS model and then estimate the parsimonious model, given by equation (1), where we eliminate control variables that are highly collinear. Next, we conduct the first-stage regression of prevailing wage on the proposed instruments, including all controls. This is given by equation (2). If the two instruments are sufficiently jointly significant, based on recommended thresholds from prior literature ($F > 10$, Stock and Yogo 2005; Wooldridge 2013), we estimate the second stage regression, equation (3). We regress log project cost on all proposed controls, instrumenting for prevailing wage. Lastly, following this IV estimation, we test for endogeneity.

6. Results

Our results are provided in Tables 2, 3 and 4. Table 2 provides variants on the OLS model, Table 3 provides our preferred IV estimates, and Table 4 investigates sources of the differences between our work and that of DQR (2005). Our OLS estimates indicate that PW requirements increase affordable housing project costs by 5-6%. The IV estimate in Table 3 indicates that the prevailing wage is endogenous but does not have a statistically significant causal effect on construction costs. This estimate is imprecise, its 95% confidence interval includes the OLS estimates. The reconciliation of our estimates with DQR suggest their very large estimates of the cost effects of PW result from their invalid instruments as well as their specification.

Model 1 of Table 2 replicates Littlehale's 5 percent effect. Model 2 is a more parsimonious version dropping highly collinear controls. Our estimates are again like Littlehale:

PWLs are associated with a statically significant 5.8% increase in affordable housing project costs.

[[Table 2 near here]]

Table 3 provides our IV estimate. The left-hand column presents the first-stage regression given by equation (2), which includes the OLS controls from Model 2 of Table 2. Both instruments are both statistically significant at the 1% level; their joint F statistic is 14.80, above the required threshold (Stock and Yogo 2005). The relevance requirement is also met.

[[Table 3 near here]]

The right-hand column of Table 3 presents the results of the second-stage regression, with CDBG funding and density bonus instrumenting prevailing wage. A χ^2 test for endogeneity weakly rejects the null of no effect; this estimate is consistent and asymptotically more efficient than OLS (χ^2 =2.847; p = 0.092). With two excluded variables, the system is overidentified; a test for overidentification rejects the hypothesis that the additional instrument is invalid (χ^2 = 0.309, p = 0.579). The IV estimate of PW (β = -.063) is opposite signed to the OLS estimates and is not statistically significant. The IV estimate is, however, imprecise, with a 95 percent confidence interval reaching from 9.6 to – 22.7 percent; OLS estimates of 5-6% are within this interval. Our tests indicate the non-statistically significant IV estimate is unbiased and therefore preferred.

This result is complicated because the finding of endogeneity is affected by the choice of instruments. Following a reviewer's suggestion, we estimate a model in which the density bonus variable is treated as a control and is used in both equations; CBDG funding is the only instrument. Adding density bonus to the cost equation has little effect on the first stage. The CBDG variable remains significant, rejecting the null in better than a 1% test in the prevailing wage equation. The point estimate for the $\widehat{PW}$ is -3.15 and is again non-significant. The F-test for endogeneity, however, does not reject the null. Because the PW is no longer estimated to be endogenous, our OLS estimates of a prevailing wage cost effect of 5% to 6% are unbiased and reflect the impact of PW on affordable housing costs.

Our analyses have produced two key findings. First, PW requirements are associated with OLS estimates of a 5-6% increase in affordable housing construction costs. These findings, as expected, are consistent with Littlehale (2017). Second, when we apply a two-stage regression framework, PW requirements have no significant effect on affordable housing construction costs. Although this estimate is imprecise, and subject to some doubts about using density bonus as an instrument, this paper is the first in the literature find the PW may have no causal effect. To this point, we find that prevailing wages have modest to no effect on costs of building affordable housing.

7. Reconciling Current and Prior Research

What are the sources of the differences between DQR's estimates and ours? Are these associated with differences in the data, in the specification, the samples or estimation techniques? We investigate this by supplementing our data with variables needed to reproduce DQR's model and systematically move from their preferred specification to ours.[22] Most notably, we replicate DQR's measures of the outcomes of ballot propositions with similar measures for fraction of yes votes for eight California ballot propositions from 2002-2010.[23] Although not all DQR's controls could be reproduced, our version is reasonably similar and produces similar, if slightly larger estimates of the PW effect.[24] Our OLS replication of DQR's finds a prevailing wage effect of 17.8%, twice DQR's 2005 estimate of 9.7%, and three times found in our preferred estimates (Model 2, Table 2).

Table 4 summarizes the essential elements of our replication and exploration of DQR's IV estimates, providing PW estimates and standard errors, estimates of instruments and their standard errors, F-tests of the significance of the instruments and tests of PW endogeneity and significance.[25] Model 1 replicates DQR with their preferred instruments and regional controls; Model 2 is similar to Model 1, except that it shifts to our preferred geographic controls; Model 3 adds year indicators; Model 4 adds our preferred instruments; Model 5, our preferred model, drops DQR's instruments.[26]

[[Table 4 near here]]

In Model 1, the replication of DQR, the second-stage PW estimate is larger in magnitude than DQR (β = 0.463) and is statistically significant, but the endogeneity of PW is rejected.[27] The instruments do not meet the relevance criteria. Only two of the eight instruments are statistically significant; their joint F-statistic is far from significant. Rejection of the relevance criteria is sufficient to reject the accuracy of the IV estimate; Model 1's results are consistent with our concerns about DQR's original work.[28]

Model 2 replaces DQR's regional variables with ours. The estimate of the PW effect is even larger (β = 0.564) and statistically significant. Model 2 continues to fail the relevance criteria, as only three first stage instruments are significant; a group F-test on the instruments does not reject the null. This may be the source of the large PW coefficient in the second stage estimates.

Model 3 adds year effects. The PW coefficient is smaller (β = 0.379) but remains highly significant. The measure of endogeneity is likewise highly significant. The model continues to fail the relevance criteria, as only three of the instruments are statistically significant and the instruments fail the F-test of group significance.

Model 4 adds CDBG funding and density bonus, the instruments in our preferred model. Both instruments are highly statistically significant, a group test of the significance for the instruments rejects the null and the PW is significant in a test of endogeneity. The PW coefficient is smaller in magnitude than in prior models, but remains large, positive, and statistically significant (β = 0.261)[29] .

Finally, Model 5 summarizes the results from Table 3 for our two-stage model, the model with only our preferred instruments. This model meets each of the criteria for assessing a two-stage model: both instruments are individually significant and reject a joint test of the null; PW is endogenous. The PW variable is, however, not statistically significant in the second-stage equation (β = -0.063). Our estimates, supported by consistent application of appropriate statistical tests, are notably smaller than those reported by DQR. Further, the only intermediate version of the model that meets the test standards is the model including our instruments. Table 4 estimates suggest that, using the contemporary Blue-Sky data, omission of project year fixed effects and weak instruments inflated DQR's estimate of effects of prevailing wages on affordable housing construction costs.

8. Discussion

There is a dual crisis of (a) a lack of affordable housing in many parts of the United States and (b) poor conditions of work and life for segments of the construction labor force. The latter might be alleviated by the application of prevailing wage laws to publicly supported affordable housing construction, but would this come at the price of raising the cost and reducing the supply of new affordable housing?

We posed three purposes for this research. The first (and narrowest) was to systematically apply contemporary instrumental variable (IV) techniques to determine whether the prevailing wage is endogenous to the costs of affordable housing and determine whether DQR's oft cited IV estimates were reliable. To this point, we have determined that whether prevailing wage laws are endogenous in this case is sensitive to the instruments used in the model. We have also determined that DQR's IV methods, applied to current data, produce unreliable estimates of the effect of the prevailing wage. Our current work does not provide the last word on the endogeneity of the prevailing wage but does emphasize the need for thoughtful work in the specification and testing of models in which PW is treated as endogenous.

The second purpose was to obtain reliable, robust estimates of the magnitude of the effect of prevailing wage laws on the costs of constructing affordable housing. Building on our IV estimate, which is negative but not statistically significant, we find that the prevailing wage does not affect the cost of affordable housing. Our IV estimate is, however, estimated with limited precision, as the 95% confidence interval for the effect of the prevailing wage on costs ranges from - 22% to + 9.6%. Littlehale's (2017) and our OLS estimates of 5 to 6% are within this interval. Despite the non-significant point estimate, we cannot rule out that the prevailing wage might raise the costs of affordable housing, albeit more modestly than estimated in some prior research. Given some evidence that the prevailing wage is not endogenous, a range from the IV estimate of 0% and the OLS estimates of 5% to 6% is reasonable.

This brings us to the third issue: the degree to which PWLs increase the cost of affordable housing beyond what it would cost if built in a manner consistent with labor and employment laws. To the degree that prevailing wage requirements raise costs above that level, prevailing wages would impose excess costs. To the degree these costs are no greater or are less than those needed to follow legal labor standards, prevailing wage requirements are the cost of doing business legally.

We compute the cost reductions associated with violating labor and employment law by multiplying recent estimates of the cost savings realized through payroll fraud by the labor share of net construction costs; we then compare this to our estimates of cost increases associated with the application of prevailing wage laws to affordable housing projects. Estimates of the cost reductions associated with payroll theft are found in Sojourner and Belman (2019), Ruckelshaus's congressional testimony (2010) and Ormiston, Belman and Erlich (2020). The former estimate of 16.8% is a minimum, based on the rigorous assumption that misclassified employees receive the same total compensation as correctly classified employees. Employers only realize savings through not paying the employer share of FICA, unemployment insurance, and workers' compensation. Reflecting arbitrage assumptions about construction labor markets, it is an underestimate of the savings typically realized by employers who engage in payroll fraud. Ruckelshaus (2010) and Ormiston, Belman and Erlich (2020) provide a more realistic estimate of the cost savings realized associated with payroll fraud. Table 5 estimates the savings realized by multiplying these estimates of cost savings by the proportion of net revenue attributable to craft employees and to all employees.[30]

[[Table 5 near here]]

The first numerical row of Table 5 calculates the cost savings associated with payroll fraud using the proportion of net revenue associated with craft labor; the second row uses the proportion associated with all employee compensation. The former ranges from 3.7% to 6.7%, the latter from 5.4% to 9.9%. Our estimates suggest that prevailing wages might increase construction costs by as much as 6%; Littlehale (2017) by 7%. Subtracting the estimated costs of payroll fraud using craft labor from these estimates, between half and the full cost increase is accounted for by the "savings" associated with payroll fraud (3.3% to .3%). Using the costs for all employee compensation, between at least three quarters and the entire estimated cost increase is accounted for by "savings" associated with payroll fraud (1.6% to -2.9%). Even under the least favorable combination of assumptions, costs would not be raised by more than 3.3%.

9. Conclusion

This study has considered several methodologies for estimating the effect of prevailing wage requirements on the cost of affordable housing, has obtained reliable estimates of those effects, and computed the amount prevailing wage requirements add to costs beyond those which are required on a project which observes labor standards. We conclude that California's prevailing wage requirement could, at most, add 3.3% to construction costs of affordable housing. The modest possible increase in cost is certainly balanced by the reduction in social costs including providing medical services to low income construction workers and social gains including increased tax revenues. Pulling together the full literature on the cost effects of prevailing wages, prevailing wage requirements do not meaningfully increase the direct public cost of construction and will, considering externalities, reduce the net public costs.

California is the only state that extends prevailing wage requirements to projects supported by state tax concessions. As such, it is currently the only research setting for examining the effects of prevailing wage requirements on affordable housing construction costs. If additional states follow California's lead, it will provide additional opportunities to study the effect of the prevailing wage on the costs of affordable housing.

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TABLE 1
Definitions and Descriptive Statistics

Variables	Definitions	Means	Standard Deviations
Log project cost	Natural log of total project cost (excluding land)	16.52	0.60
Prevailing wage	=1 if project required payment of prevailing wages, =0 if not	0.63	0.48
CDBG funding	=1 if a project received funding from the Community Development Block Grant program, =0 if not	0.06	0.25
Density bonus	=1 if a project was incentivized by California's density bonus law, =0 if not	0.29	0.45
Nonprofit developer	=1 if a project's developer was nonprofit, =0 otherwise	0.44	0.50
Government developer	=1 if a project's developer was a government developer, =0 otherwise	0.04	0.19
Other developer	=1 if a project's developer was a private, for-profit developer, =0 otherwise	0.02	0.15
Developer general contractor	=1 if the developer was an in-house general contractor, =0 if not	0.46	0.50
Log developer employees	Natural log of each developer's number of employees	3.88	1.33
Meetings 4 plus	=1 if more than 4 community meetings occurred during a project, =0 if not	0.36	0.48
Permit and impact fees	Sum of permit fees and impact fees	0.94	0.23
Log permit and impact Fees/SF	Natural log of the sum of permit and impact fees, per square foot	2.17	0.93
Funding-redevelopment	=1 if a project was a redevelopment project, =0 otherwise	0.33	0.47
9% tax credit	=1 if a project's developer received a 9% tax credit, =0 if not	0.52	0.50
Log lenders	Natural log of the total number of loans that finances a project	1.26	0.54
Log building area	Natural log of gross building area in square feet, excluding parking	11.15	0.62
Structure includes parking	=1 if an affordable housing structure included parking, =0 if not	0.38	0.49
Parking-to-rentable building	Ratio of area of structured parking to gross area of building, minus parking	0.13	0.21
SF non-residential: non-parking	Percentage of total square feet that is non-residential, minus parking	0.11	0.11
Stories 4 plus	=1 if more than 4 stories, =0 otherwise	0.24	0.43

Residential SF per unit (100s)	Gross area of parking, community, common, and commercial divided by total units (100s of SF)	9.26	2.54
Log site in acres	Natural log of the size of an affordable housing project site, in acres	0.97	0.94
Includes non-residential area	=1 if an affordable housing site included a non-residential area, =0 if not	0.96	0.20
Log A&E cost per SF	Natural log of the sum of architect and engineer fees divided by building area, excluding parking	1.98	0.80
Duration 24 plus	=1 if a project took at least 24 months (2 years) to complete, =0 otherwise	0.37	0.48
Average specialty contractor pay	Average pay for specialty trade contractors, by county, as a percentage of state average in project year	1.00	0.17
Log fair market rent (2-bedroom)	Natural log of the HUD-established going rental rate for a 2-bedroom affordable housing unit	6.96	0.31
Project snow	=1 if a project located in a city with an average snow depth of one foot or more, =0 otherwise	0.01	0.12

TABLE 2
Ordinary Least Squares Estimates (Dependent Variable: Log Project Cost)

Variables	Model 1	Model 2	Model 3
Prevailing wage	**0.050****	**0.058****	**0.178*****
	(0.024)	(0.024)	(0.048)
Log units			**0.775*****
			(0.061)
Nonprofit developer	**0.032**	**0.046****	**0.019**
	(0.022)	(0.022)	(0.037)
Government developer	**0.130***	**0.155*****	**0.066**
	(0.052)	(0.048)	(0.088)
Other developer	**-0.003**	**-0.008**	
	(0.041)	(0.041)	
Log developer employees	**-0.022*****	**-0.025*****	
	(0.006)	(0.006)	
Developer general contractor	**(-0.038) ***		
	(0.021)		
Meetings 4 plus	**0.064*****	**0.071*****	
	(0.019)	(0.019)	
Permit & impact fees	**-0.154*****	**-0.174*****	
	(0.050)	(0.049)	
Log permit & impact fees per SF	**0.042*****	**0.048*****	
	(0.014)	(0.014)	
Funding-redevelopment	**0.041****		
	(0.019)		
9% tax credit	**-0.030**		
	(0.021)		
Log building area	**0.877*****	**0.919*****	
	(0.020)	(0.017)	
Structure includes parking	**-0.014**		
	(0.027)		
Parking-to-rentable building	**0.371*****	**0.372*****	
	(0.062)	(0.050)	
SF non-residential: non-parking	**-0.533*****	**-0.597*****	
	(0.135)	(0.128)	
Stories 4 plus	**0.054**	**0.023**	
	(0.034)	(0.031)	
Residential SF per unit	**-0.029*****	**-0.032*****	
	(0.004)	(0.004)	
Log site in acres	**0.026**		
	(0.021)		
Includes non-residential area	**0.024**		
	(0.039)		
Average specialty contractor pay	**0.245***	**0.421*****	
	(0.130)	(0.111)	

Log fair market rent (2-bedroom)	**0.212***** (0.070)		
Project snow	**0.190***** (0.055)	**0.197***** (0.060)	
Log lenders	**0.026** (0.020)	**0.041**** (0.019)	**0.027***** (0.006)
Duration 24 plus	**0.033*** (0.018)	**0.028** (0.018)	
Log A&E cost per SF	**0.148***** (0.017)	**0.162***** (0.018)	
Housing type: non-targeted			**-0.047** (0.108)
Housing type: senior			**-0.280***** (0.056)
Housing type: SRO			**-0.594***** (0.085)
Housing type: special needs			**-0.234**** (0.088)
Number of bedrooms			**0.000** (0.000)
Mitigation			**0.138***** (0.048)
Structure: townhouse			**0.085** (0.064)
Structure: single family			**0.157** (0.114)
Structure: three stories			**0.101***** (0.040)
Constant	**4.72***** (0.462)	**5.47***** (0.218)	**12.90***** (0.196)
N	321	321	279
R^2	0.958	0.954	0.836
F	246	254	54.50

Estimated coefficients in bold. Robust standard errors in parentheses.
*Statistically significant at the 10% level; ** at the 5% level; *** at the 1% level.

TABLE 3
Two Stage Least Squares Model
Prevailing Wage and Instruments in Italics

Variables	First-Stage Coefficients	Instrumented Coefficients
Prevailing wage		***-0.063***
		(0.084)
CDBG funding	***0.378****	
	(0.073)	
Density bonus	***0.140***	
	(0.055)	
Nonprofit developer	**0.053**	**0.065***
	(0.064)	(0.025)
Government developer	**0.433***	**0.210***
	(0.089)	(0.058)
Other developer	**0.349**	**0.056**
	(0.138)	(0.057)
Log developer employees	**-0.043**	**-0.029***
	(0.019)	(0.008)
Meetings 4 plus	**0.059**	**0.078***
	(0.057)	(0.020)
Permit & impact fees	**0.158**	**-0.136**
	(0.143)	(0.057)
Log permit & impact fees per SF	**-0.053**	**0.041**
	(0.037)	(0.017)
Log building area	**-0.083***	**0.913***
	(0.048)	(0.021)
Parking-to-rentable building	**0.148**	**0.419***
	(0.150)	(0.056)
SF non-residential: non-parking	**-0.470**	**-0.673***
	(0.290)	(0.138)
Stories 4 plus	**0.204***	**0.039**
	(0.069)	(0.037)
Residential SF per unit	**0.022***	**-0.029***
	(0.012)	(0.005)
Average specialty contractor pay	**-0.018**	**0.321**
	(0.442)	(0.130)
Project snow	**0.376**	**0.244***
	(0.175)	(0.066)
Log lenders	**0.166***	**0.059***
	(0.055)	(0.023)
Duration 24 plus	**-0.030**	**0.017**
	(0.055)	(0.020)
Log A&E cost per SF	**0.075**	**0.194***
	(0.054)	(0.018)
Constant	**0.873**	**5.57***
	(0.686)	(0.263)

Project year fixed effects	**Yes**	**Yes**
Project region fixed effects	**Yes**	**Yes**
N	281	281
R^2	0.506	0.944
F	15.42	5869

Estimated coefficients are in bold. Robust standard errors are in parentheses. The joint F statistic for *CDBG Funding* and *Density Bonus* was 14.80, above the required threshold for this number of instruments (Stock & Yogo, 2005).
The values for the robust score χ^2 was 2.847 (p = 0.092); the statistical significance provides evidence of prevailing wage endogeneity.
The value of the χ^2 test of overidentifying restrictions was 0.309 (p = 0.579). A statistically significant value would have indicated that using a second instrument for *Prevailing Wage* was likely invalid.
*Statistically significant at the 10% level; ** at the 5% level; *** at the 1% level.

TABLE 4
Supplemental Analysis

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Prevailing wage	**0.463****	**0.564*****	**0.379*****	**0.261*****	**-0.063**
	(0.191)	(0.137)	(0.114)	(0.071)	(0.084)
First-stage joint F statistic	**1.220**	**1.750**	**1.510**	**4.440*****	**14.800*****
% yes, vote on prop. 40	**3.560**	**1.570**	**2.210**	**1.530**	
water, air and parks, 2002	(2.190)	(1.770)	(1.850)	(1.780)	
% yes, vote on prop. 45	**-6.410****	**-1.130**	**-1.270**	**-0.809**	
term limits, 2002	(3.230)	(2.820)	(2.740)	(2.730)	
% yes, vote on prop. 46	**5.370**	**-4.400**	**-3.660**	**-1.750**	
housing/emergency shelter, 2002	(4.450)	(3.130)	(3.110)	(3.030)	
% yes, vote on prop. 77	**-1.510**	**0.401**	**-0.175**	**-0.299**	
redistricting, 2005	(2.070)	(1.430)	(1.420)	(1.420)	
% yes, vote on prop. 1B	**-1.940**	**-3.910****	**-3.930****	**-3.830****	
highways and air quality, 2006	(2.350)	(1.750)	(1.740)	(1.620)	
% yes, vote on prop. 1C	**-5.310**	**7.420***	**6.440**	**4.760**	
housing/emer. shelter, 2006	(3.990)	(3.940)	(3.930)	(3.660)	
%Yes, vote on prop. 99	**0.105**	**-1.610**	**-1.700**	**-1.110**	
eminent domain, 2008	(2.150)	(1.530)	(1.480)	(1.470)	
% yes, vote on prop. 1A	**0.823**	**3.540***	**3.670****	**3.260***	
state taxes, 2009	(2.220)	(1.850)	(1.770)	(1.750)	
percent of voters registered	**-0.564**	**-4.420****	**-4.760****	**-4.480****	
as democrats	(2.150)	(2.220)	(2.230)	(2.240)	
Percent of population over 40	**-4.160****	**0.067**	**-0.202**	**-0.719**	
years old	(1.960)	(2.240)	(2.170)	(2.030)	
Percent of housing units	**1.110**	**-2.190**	**-1.560**	**-1.110**	
owner-occupied	(1.440)	(1.740)	(1.720)	(1.630)	
CDBG funding				**0.326*****	**0.378*****
				(0.079)	(0.073)
Density bonus				**0.235*****	**0.140****
				(0.059)	(0.055)
Endogeneity statistic	**2.390**	**8.839*****	**6.110****	**3.844***	**2.847***
N	279	279	279	279	281
First-stage R^2	0.508	0.461	0.482	0.523	0.506
Second-stage R^2	0.808	0.781	0.901	0.918	0.944

Estimated coefficients are in bold. Robust standard errors are in parentheses.
*Statistically significant at the 10% level; ** at the 5% level; *** at the 1% level.

Because of missing data, inclusion of the CBDG Funding and Density Bonus variables in Models 4 and 5 reduced the number of observations from 315 to 279 and 281, respectively. As a robustness check, Models 1 – 3 were run with 315 observations. The reduction in the number of observations had little effect on the signs, magnitudes, or significance of the PW results. These results are available from the corresponding author upon request

TABLE 5 Cost of Payroll Fraud NAICS 23 (National Construction Industry)			
	Sojourner-Belman (16.8%)	Ruckelshaus (30.0%)	Ormiston-Belman-Erlich (30.8%)
% craft labor compensation (22%)	3.7%	6.6%	6.7%
% all employee compensation (32%)	5.4%	9.6%	9.9%

Labor cost is the ratio of payroll + benefit costs for all workers to net revenue (sales- land costs – subcontracting costs)
% Craft labor payroll: The ratio of craft total compensation to net revenue
% All compensation: The ratio of compensation of all employees to net revenue

[1] Only 37 available affordable housing units are available per 100 U.S. low-income households. The shortage is especially pronounced in the Western U.S. (i.e., Washington, Oregon, California, Nevada, and Arizona), where only 25 affordable housing units are available for every 100 low-income households (The National Low-Income Housing Coalition, Aurand, Emmanuel, Yentel, Errico, & Pang, 2018).
[2] As construction is more volatile than the overall economy, in downturns, poverty rates among the working poor in construction rise faster than in the overall economy. In 2010, the rate of working poor in construction was 90 percent higher than the overall economy (https://www.bls.gov/opub/reports/working-poor/archive/workingpoor_2010.pdf table 4).
[3] In 2018 construction accounted for 19 percent of all workplace fatalities (https://www.bls.gov/iif/oshcfoi1.htm#2018). In 2015, Hispanic construction workers accounted for 35 percent of all construction fatalities (https://www.bls.gov/iif/oshwc/cfoi/hispanic-or-latino-fatal-injuries.htm).
[4] This weakness of these instruments is likely the cause of their very large estimates of the PW effect.
[5] The repeal campaigns have also been accompanied by non-peer reviewed literature on the effects of prevailing wage on construction costs that assert high cost effects. This literature has recently become aware of the large estimates of DQR (2005), and DQR has been cited in these non-peer-reviewed studies. Re-examining these estimates is therefore more important to founding policy decisions on sound research.
[6] California's expanded its PWL to include privately as well as publicly funded affordable housing projects in 2001 (DQR 2005). Private sources are primarily incentivized by the federal Low-Income Housing Tax Credit (LIHTC) (National Housing Law Project 2017).
[7] In DQR (2005), the OLS models regressed the natural log of total project costs on explanatory variables including the number of units in a project, the fraction of units meeting affordability guidelines, the populations targeted by each project, the developer in charge of a project (e.g., for-profit and non-profit), and the structure type (e.g., two-story, townhome, single-family). The authors preferred estimate found that the PW increased costs by 9.7 percent.
[8] In the first stage of their 2SLS model, two models were run: the first model included all project characteristic control variables from the OLS models, except for the number of units in each project. The second model added in the number of units as an additional control. First-stage instruments included the fraction of yes votes on various California propositions in the 1990s, the fraction of voters registered as Democrats, the percentage of the population over 40 years old, the percentage of affordable housing project workers in highly unionized industries and occupations, and the fraction of workers who were unionized (DQR 2005).
[9] Palm and Niemeier (2018) estimate OLS models of affordable housing projects for four large metropolitan areas from 2008 to 2016. They find PWLs increase construction costs by 15 to 16%. Their estimates are not comparable to other estimates, as their sample was limited to San Francisco, San Diego, Sacramento, and Los Angeles and do not incorporate controls for the year in which construction was begun. Later in this paper, we show that the omission of year controls greatly increases the magnitude of the prevailing wage effect.
[10] The importance of this issue is reflected in several non-peer-reviewed studies claiming that PW requirements significantly raise the cost of affordable housing construction. For example, the New York's Empire Center for Public Policy suggested that PW inflates costs by as much as 25% (McMahon & Gardner 2017). A study published by the New York Center for Urban Real Estate suggested PW requirements raise costs by 25-30% (Vitullo-Martin 2012). These studies suffer methodological flaws (see Duncan & Ormiston 2018 and Ormiston, Belman, & Hinkel 2018), but influence public discourse on PW laws.
[11] The state of California's requirements are stricter than those of the federal Davis-Bacon Act, as building trades unions are involved in monitoring projects and informing the state of likely violations (discussion with Littlehale, June 2020).
[12] Bids are considered qualified if the contractor can obtain bond the project, a modest hurdle in most instances.
[13] The joint F statistic for instruments was less than 3, well below the value of 11.5 recommended with more than 15 first-stage instruments (Stock, Wright, & Yogo 2002).
[14] Our data was originally compiled and graciously provided by Blue Sky Consulting Group, with whom we signed a limited non-disclosure agreement.
[15] Developer size, measured by the number of employees, reflects developer capabilities and experience.
[16] Project snow is an indicator variable with a value of one if a project took place in a city with an average snow depth of 1 foot or more, and zero otherwise. Littlehale (2017) used an average city snow depth of one foot in January of 2017 as the threshold. (Littlehale 2017).

[17] Specialty contractors install electrical systems, water systems, prepare land and foundations as well as the carry out the architectural work of carpentry and steel erection including framing and drywall.
[18] Non-entitlement jurisdictions are defined as either (1) cities with populations under 50,000 that are not principal cities of Metropolitan Statistical Areas or (2) counties with populations under 200,000 (California Department of Housing and Urban Development 2018).
[19] Grant awards for housing projects vary widely. In 2017-2018, the city of Pacific Grove, CA was awarded $390,854 in state CDBG funding for a housing rehabilitation project, whereas the city of Arcata, CA was awarded $1,767,442 for a similar, much larger project (California Department of Housing and Community Development 2018).
[20] Although the law allows for exceptions, we are unaware of exceptions to the prevailing wage requirement being granted. This requirement constitutes a causal connection between the use of the grant and the application of prevailing wage to a project.
[21] Reviewers have suggested that the argument for using density bonus as an instrument is less compelling than that for the CDBG. As discussed in the results, treating density bonus as a control rather than an instrument does not fundamentally alter estimates or conclusions.
[22] DQR's original data set has been lost, precluding replication of their work.
[23] This was obtained from the Office of the California Secretary of State.
[24] Our model includes controls for housing type (*Non-Targeted, Senior, SRO, Special Needs*), building characteristics (*Townhouse, Single Family, Three Stories, Number of Bedrooms*), and DQR's preferred regional controls; measures of affordability, the occupancy date, the fraction of financing provided from public sources, and whether the project was built on an inner city infill site could not be included
[25] The complete estimates are available from the corresponding author.
[26] It was not possible to include DQR's measures of union density or the proportion of employment in highly unionized industries and occupations A in the first stage of the model (see DQR footnote 14 and Table 4) as they were highly collinear with other variables. We recreated these variables using current data from Hirsch and MacPherson (2003,) but too collinear to estimate. Even when possible, inclusion resulted in other variables and observations being dropped. When union density was required in our preferred model, five other variables and 43 observations were dropped.
[27] The eight instruments, used to replicate DQR, variables that only enter the first stage model, were the percentage of yes votes on eight California propositions between 2001 and 2010 (Propositions 40, 45, 46, 77, 99, 1A, 1B, and 1C), the percentage of voters registered as Democrats, the percentage of the population over 40 years old, and the percentage of housing units that are owner-occupied. Additional measures were obtained from the supplemental California Secretary of State data.
[28] The larger magnitude of the PW effect in these intermediate estimates may be due to the omission of the union density and highly unionized industry and occupation variables discussed previously.
[29] Robustness tests indicate that the significant DQR instruments are only significant in the presence of the full set of DQR instruments and the CDBG Funding and Density Bonus variables. If the non-significant instruments are dropped, neither the "% Yes on Prop 1B" or %Registered Democrats" remain significant. Therefore, the success of Model 4 of Table 4 is due in main to our instruments.
[30] We use the national ratios as it is difficult to compute meaningful ratios for construction subindustries.