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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 labour standards. Historically, issues with labour 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 article, we re-examine whether this trade-off exists and, if so, its implications. We estimate that prevailing wage requirements add, at most, 6 per cent to the costs of affordable housing construction.

1 | INTRODUCTION

Policy makers often face tough trade-offs when designing policies that work at cross purposes. The potential tension between providing affordable housing to low-income families and regulating construction labour 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 article, we analyse whether this trade-off exists and, if so, its implications.

Affordable housing units are residential housing that, through tax subsidies, vouchers, or other programs, are available at a lower rental cost than for comparable unsubsidized units. Affordable housing can be single-family houses or units in multi-family buildings, apartment buildings or mixed-use developments. The availability of affordable housing for US low-income families is in crisis, as low-income families near or below the poverty line face a burdensome shortage of affordable housing (Aurand et al., 2018).[1] Through tenant-based rental assistance, public housing,

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project-based rental assistance and homeless assistance grants, federal and state programs seek to alleviate this shortage. Success in expanding the stock of affordable housing stems, in part, from keeping the cost of new projects low while maintaining quality.

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

The construction labour market crisis is characterized by low-wage segments (particularly residential construction), payroll fraud (particularly in the non-union segment), workplace accidents (particularly among Hispanics and immigrants) and skilled labour 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 labour standards, promoting training and collective bargaining and mitigating workplace dangers rooted in inexperience, casual labour relations and inadequate safety and skills training. The question arises whether affordable housing policy and public construction labour standards work at cross purposes by increasing the cost of public construction.

The effect of prevailing wage laws (PWLs) 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 (Belman & Philips, 2005). PWLs require that employees on public works receive the same hourly compensation paid for similar work on similar private projects. The federal prevailing wage for construction is determined by the Wage and Hour Division (WHD) of the US Department of Labor by trade, type of project and location. 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 six 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 low-bid requirements on public works. PWLs level the playing field in terms of worker compensation and compel contractors to compete on engineering, project management and the skills of their labour force, rather than labour costs.

The body of peer-reviewed empirical literature finds that PWLs are associated with increased training of the construction labour force and better safety performance, but do not increase the costs of constructing schools or road maintenance (e.g. Azari-Rad et al., 2002, 2003; Bilginsoy, 2005; Duncan, 2015; Duncan et al., 2014). In contrast, evidence on the effect of PWLs on affordable housing broadly support the view that PWLs increase costs; however, estimates of the magnitude of their effects vary widely between studies, with estimates ranging from 5 to 37 per cent (Dunn et al., 2005; Littlehale, 2017; Palm & Niemeier, 2018). Research that reconciles these varying cost effects will aid policy decisions about affordable housing programs. The magnitude by which PWLs raise affordable housing construction costs affects governments' ability to build additional affordable housing units, a step central to resolving the affordable housing shortage.

The current study advances Dunn, Quigley, & Rosenthal (2005) and Littlehale (2017) with two contributions. First, DQR introduced the use of instrumental variables (IVs) 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, however, suggests that their instruments did not meet contemporary relevance requirements for unbiased IV estimates.

Second, we use this exploration of endogeneity to obtain robust estimates of the effects of PWLs on the costs of affordable housing construction. Using data from a state of 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. We use this same data to examine whether DQR's specification meets these criteria.

Using data collected by a California state survey of new affordable housing construction in 2001–2011, we find 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.[4] Whether ordinary least squares (OLS) or IV estimation is appropriate depends on specific exclusion restrictions, restrictions not subject to direct statistical testing. We also replicate DQR's specification and preferred instruments using our more recent data and demonstrate their instruments were too weak to reliably estimate the second-stage cost model. We conclude that the weakness of these instruments is likely the cause of their very large prevailing wage cost estimates.

We estimate both OLS and IV models of the prevailing wage cost effects. Our OLS models indicate the PW raises costs by 5 to 6 per cent. The PW is endogenous in our preferred IV model; it has a negative, non-statistically significant cost effect of –6.3 per cent, and our instruments pass a test for relevance and the endogeneity of the prevailing wage. It is, however, estimated with limited precision; a 95 per cent confidence interval includes our OLS estimates. There is then evidence that PWLs increase affordable housing construction costs by 0 to 6 per cent.

2 | BACKGROUND

The federal Davis-Bacon Act of 1931 requires contractors and subcontractors working on federally funded or assisted projects exceeding $2000 to pay their labourers no less than the wages and fringe benefits that prevail for labourers and mechanics performing similar work on similar projects in the same geographic area (United States Department of Labor, n.d.). The WHD of the US Department of Labor determines mandated PW rates by trade, area and type of construction (e.g. residential, building, highway) by surveying private construction employers where federal projects are scheduled and averaging the surveyed wages. PWLs are designed to set the compensation paid on public projects to that paid on private projects for similar work in each locality (United States Department of Labor, 2015). PWLs can then be conceptualized as minimum wages applied to blue-collar construction workers on public projects, determined by occupation, type of construction and locality.

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 labour standards to ensuring a workforce that is safer and supporting apprenticeship training to provide a more skilled workforce (Duncan & Ormiston, 2018).[5] 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 only 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 & Ormiston, 2018). These repeal campaigns have driven the 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 registered apprenticeship programs, the body of the literature finds that PWLs do not raise costs of school construction and highway maintenance projects (see Duncan & Ormiston, 2018 for a thorough literature review).[6]

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 (Dunn, Quigley, & Rosenthal, 2005; Littlehale, 2017; Palm & Niemeier, 2018). California is the only state that covers both public and private affordable housing projects in its state law (Dunn, Quigley, & Rosenthal, 2005).[7] Each find that PWLs result in higher project costs for affordable housing, with estimates ranging from 5 to 37 per cent.

All three studies use detailed California state surveys of affordable housing construction. Dunn, Quigley, & Rosenthal (2005) analysed 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 treated as endogenous. The OLS models found that PWLs increased the costs of affordable housing projects by 9 to 11 per cent while the IV models estimated a 19 to 37 per cent increase in costs (Dunn, Quigley, & Rosenthal, 2005).[8,9]

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 to 7 per cent, statistically significant but smaller than DQR. The most recent study (Palm & 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 to 16 per cent.[10]

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. This is plausible, both because California has one of the strictest PWLs (Belman et al., 2020; Duncan & Ormiston, 2018) and because residential contractors have fewer opportunities to offset the effects of PWLs. PWLs are then unlikely to affect affordable housing construction in a fashion like other sectors of construction. Improving worker productivity, quality of work, safety outcomes or speed of completion is more difficult in affordable housing construction, because of the less educated and less skilled workforce used by residential contractors and their lesser use of sophisticated capital (Blankenau & Cassou, 2011). While the gains available via PWLs are more readily available to school and highway construction contractors, they are more likely to increase labour and total project costs in affordable housing. Affordable housing then provides a strong test of the cost effects of the prevailing wage under unfavourable conditions.

Research that reconciles these varying PWL cost effects can aid policy decisions about affordable housing programs.[11] The magnitude by which PW requirements raise the costs of

affordable housing affects governments' ability 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.

Issues with the structure of the residential construction industry also complicate assessing the impact of PWLs on affordable housing project costs. Illegal, low-road labour practices (e.g. cash-only payments, wage theft, worker misclassification, workers' compensation and tax fraud) are rampant in residential construction; up to one fifth of the national construction workforce is misclassified as independent contractors or paid off-the-books, where workers are paid under the table in cash (Juravich et al., 2021; Ormiston et al., 2020; Ormiston et al., 2020). These profitable illegal practices have become institutionalized in the residential sector. Research finds that drywall contractors who misclassify employees as independent contractors or employ them off-the-books reduce their labour costs at least 30 per cent (Ormiston et al., 2020). These practices affect not only the workers and their families but also the public at large, as medical services that should be covered by workers compensation become burdens for public hospitals. This reduction in public tax receipts is taken on by the public and the evasion of mandated employment programs makes it more difficult for law abiding firms to operate profitably, driving them from those segments of construction where this behaviour is endemic.

The prevalence of these practices in residential construction has economic and legal sources. Economically, the residential sector closely resembles a highly competitive market, with small, labour-intensive firms all competing to complete limited-duration construction projects at the lowest possible cost, key to getting their bid accepted. The easiest way for contractors to reduce costs (and lower bid prices) is to lower labour costs; contractors are therefore incentivized to misclassify their workers or employ them off-the-books. Misclassified and off-the-books workers lose access to unemployment insurance, workers' compensation, minimum wages and overtime payments, allowing firms to avoid these costs and lower their bid prices (Erlich, 2021). 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 such as labour brokers, check cashing stores and shell companies support these practices (Ormiston et al., 2020; Juravich et al., 2021).

It is far more difficult to engage in this kind of egregious behaviour on PW projects. Under Davis-Bacon, employers are required, under penalty of law, to file a weekly certified payroll that 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. Further, under PWLs, contractors are not permitted to 'hire' individuals as independent contractors (WHD). The penalties for violating prevailing wage standards include make whole remedies, fines and incarceration. Although some payroll fraud undoubtedly takes place on prevailing wage sites, Sinyai and Galeas's recent survey of construction in the District of Columbia reports that evidence of wage theft (i.e. payment by personal checks or cash, and the failure to pay overtime) are not reported by those working on public projects (Sinyai & Galeas, 2021). In contrast, 44 to 58 per cent of those employed on private projects report wage theft. 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 labour and employment law.[12]

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 would arrange overly generous payments to contractors in return for kickbacks and other shameful practices. Since the progressive era, legislatures have countered this by requiring public bodies to accept the lowest qualified bid.[13] This low-bid requirement contrasts with the private sector, where owners can consider other factors (e.g. contractors' reputation and experience) along with bid price in determining the winning bid.[14] The low-bid requirement places great pressure on contractors to develop practices, including the gaming of laws, to reduce their bid price; if they do not, they risk losing the bid. Although better engineering techniques and a better trained workforce lower costs, the easiest way to lower bid prices, particularly for less able contractors, is to pay labour less. Such contractors are motivated to search for pools of the least expensive vulnerable labour they believe can complete the work. In the presence of low-bid requirements, PWLs level the playing field in terms of worker compensation and compel contractors to compete on engineering, project management and the skills of their labour force, rather than labour costs.

4 | EMPIRICAL CONTRIBUTION

The current study advances Dunn, Quigley, & Rosenthal (2005) and Littlehale (2017) with two contributions. First, DQR introduced the use of IVs into the affordable housing literature. We build on their work by applying contemporary methods and systematically testing the reliability of their IV estimates, the validity of their instruments and the endogeneity of PWLs. 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.

The issue is which set of estimates, OLS or IV, provides policy makers with the best, least biased, and lowest variance estimates of the effect of PWLs. 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 increases the estimated effect of the prevailing wage from 10 (OLS) to 37 per cent (IV), nearly a factor of four.

The application of IV methods comes with econometric requirements that, if not met, inflate estimated effects. As Littlehale (2017) pointed out, of the 17 instruments used by DQR, only two, the fraction of yes votes on California Propositions 160 and 167 in 1992, were significantly related to the requirement that projects require PWLs; these two barely cleared a 10 per cent 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.[15]

Likewise, the exclusion restriction for instruments was not adequately addressed by Dunn, Quigley, and Rosenthal (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 (Dunn, Quigley, & Rosenthal, 2005,

p. 150). The authors also do not test for PW endogeneity, providing no evidence that their IV estimates are needed or are improvements over OLS. Taken together, their instruments are weak, possibly causing large inconsistencies and bias in IV estimates (Wooldridge, 2013). Thus, DQR's weak instrument problem is likely the main reason why their IV estimates were nearly four times greater than their OLS estimates, as weak instruments can inflate IV estimates to unreasonably high levels.

That DQR's IV estimates of prevailing wage cost effects were unreliable and outside a reasonable range is supported by much of their range (19 to 37 per cent) exceeding typical total labour costs for affordable housing. Using 2007 Economic Census of Construction data, Littlehale (2017) found that total payroll for California contractors specializing in apartment construction work (where most affordable housing work takes place) accounted for 23 per cent of the net value of the work (i.e. exclusive of land costs). That is, in 2007, labour costs were 23 per cent of net project costs—project costs exclusive of land costs—for apartment work in California.[16] DQR found that PWLs increase affordable housing project costs by as much as 37 per cent; the notion that PWLs can impact these costs more than all labour costs combined is implausible.

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 | METHODOLOGY

5.1 | 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 database was developed from projects that submitted applications to the California Tax Credit Allocation Committee (TCAC), *including* those for which developers sought federal housing tax credits. That is, it is a mix of state and federally funded projects; projects that receive federal funding are excluded from also receiving state funding. This survey was used by Littlehale (2017); a prior version was used by DQR. It includes 356 LIHTC-financed affordable housing projects built between 2001 and 2011. A total of 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. This sample was representative of the larger population of California affordable housing projects. In a comparison of the sample with the universe of the 995 affordable housing projects that begun between 2001 and 2011 across various dimensions (i.e. project type, type of tax credit awarded, project location), the sample was statistically like the larger universe, suggesting a representative sample (CAAHCS; State of California, 2014).[17]

Dunn, Quigley, and Rosenthal (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. (Dunn, Quigley, & Rosenthal, 2005, p. 149; Littlehale, 2017, p. 124)

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

5.2 | 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. It includes both hard construction costs (e.g. labour costs, material costs) and soft construction costs (e.g. fees, financing).[18] The explanatory variable of central interest is prevailing wage, an indicator with a value of 1 if a project was subject to state PW requirements, 0 otherwise.

Our OLS model is

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

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, non-profit or another and the number of workers employed by the developer.[19] 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; should 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 plus 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.[20] Construction projects share the specialty contractor workforce and share these common cost elements;[21] 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. A&E costs are included in the models as a proxy for project complexity; more complex projects are more costly and require more time from architects and engineers. Finally, the vector $\boldsymbol{X_{iry}}$ includes dummies for the (a) the year in which an affordable housing project began and (b) the region in which the project took place.

Our IV model is

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

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
Non-profit developer	= 1 if a project's developer was non-profit, = 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 four 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 four 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

(Continues)

TABLE 1 (Continued)

Variables	Definitions	Means	Standard deviations
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 pays	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 two-bedroom affordable housing unit	6.96	0.31
Project snow	= 1 if a project located in a city with an average snow depth of 1 ft or more, = 0 otherwise	0.01	0.12

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

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, with $\boldsymbol{V_{iry}}$, $\boldsymbol{F_{iry}}$ 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 requirement (that an instrument must be partially correlated with the prevailing wage). The CDBG program is a state of California 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, 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.[22] Of note is that the federal CDBG program does not carry a prevailing wage requirement; federal projects are included in our data. 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.[23] Consistent with the relevance requirement, projects making use of CDBG funds are subject to prevailing wage requirements in most cases (California Department of Housing & Community Development, 2018). CDBG funds should only impact costs via the explanatory variable of interest, prevailing wage, making it a valid instrument.[24]

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 favourable 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 per cent 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 & 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 that meet *at least* one of the following guidelines: (1) at least 5 per cent of units are reserved for very low-income residents, (2) at least 10 per cent of units are reserved for low-income residents and (3) at least 10 per cent of units are geared toward foster youth, disabled veterans or homeless persons, with subsidized monthly rents that reflect very low-income levels (Goetz & Sakai, 2017). The cost impacts of density bonuses will occur only via the prevailing wage requirement, making it a second valid instrument.

We initially replicate Littlehale's OLS model and then estimate the parsimonious model, given by Equation (1) (OLS), 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) (IV). If the two instruments are sufficiently jointly significant, ($F > 10$, Stock & Yogo, 2005; Wooldridge, 2013), we estimate the second-stage regression, Equation (3) (IV). We regress log project cost on all proposed controls, instrumenting for the prevailing wage. Finally, following this IV estimation, we test for endogeneity.

6 | RESULTS

Our results are provided in Tables 2–4. 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 Dunn, Quigley, and Rosenthal (2005). Our OLS estimates indicate that PW requirements increase affordable housing project costs by 5 to 6 per cent. The IV estimate in Table 3 indicates that the prevailing wage is endogenous but does not have a causal effect on construction costs. This estimate is imprecise; its 95 per cent confidence interval includes the OLS estimates. The reconciliation of our estimates with DQR suggest their very large estimates of the cost effects of PW are a product of invalid instruments as well as their specification.

Model 1 of Table 2 replicates Littlehale's 5 per cent 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 per cent increase in affordable housing project costs. Model 3 is a replication of DQR's work and is discussed in Section 7.

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 per cent level; their joint F-statistic is 14.80, above the required threshold (Stock & Yogo, 2005). The relevance requirement is also met.

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

TABLE 2 Ordinary least squares estimates (dependent variable: log project cost)

Variables	Model 1Littlehale Replication	Model 2Preferred Model	Model 3DQR Replication
Prevailing wage	**0.050****	**0.058****	**0.178*****
	(0.024)	(0.024)	(0.048)
Log units			**0.775*****
			(0.061)
Non-profit 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)		

(Continues)

TABLE 2 (Continued)

Variables	Model 1Littlehale Replication	Model 2Preferred Model	Model 3DQR Replication
Includes non-residential area	**0.024**		
	(0.039)		
Average specialty contractor pays	**0.245***	**0.421*****	
	(0.130)	(0.111)	
Log fair market rent (2-bedroom)	**0.212*****		
	(0.070)		
Project snow	**0.190*****	**0.197*****	
	(0.055)	(0.060)	
Log lenders	**0.026**	**0.041****	**0.027*****
	(0.020)	(0.019)	(0.006)
Duration 24 plus	**0.033***	**0.028**	
	(0.018)	(0.018)	
Log A&E cost per SF	**0.148*****	**0.162*****	
	(0.017)	(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*****	**5.47*****	**12.90*****
	(0.462)	(0.218)	(0.196)
N	321	321	279
R^2	0.958	0.954	0.836
F	246	254	54.50

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

TABLE 3 Two-stage least squares model

Variables	First-stage coefficients ($\widehat{PWL}$)	Instrumented coefficients (project cost)
Prevailing wage		***−0.063***
		(*0.084*)
CDBG funding	***0.378*** ***	
	(*0.073*)	
Density bonus	***0.140*** **	
	(*0.055*)	
Non-profit 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 pays	**−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)

(Continues)

TABLE 3 (Continued)

Variables	First-stage coefficients ($\widehat{PWL}$)	Instrumented coefficients (project cost)
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

Note: Prevailing wage and instruments are in italics. 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 were 2.847 ($p = 0.092$); the statistical significance provides evidence of prevailing wage endogeneity. The value of the χ^2 test of over-identifying 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, **5% level, ***1% level.

rejects the null of no effect; this estimate is then consistent and asymptotically more efficient than OLS ($\chi^2 = 2.847$; $p = 0.092$). With two excluded variables, the system is over-identified; a χ^2 test for over-identification does not reject the validity of the additional instrument ($\chi^2 = 0.309$, $p = 0.579$). We do not find evidence that the over-identified system was problematic, further supporting our model. The IV estimate of PW ($\beta = -0.063$) is opposite signed to the OLS estimates and is not statistically significant. The IV estimate is, however, imprecise, with a 95 per cent confidence interval reaching from 9.6 to −22.7 per cent; OLS estimates of 5 to 6 per cent are within this interval. Our tests of significance, of endogeneity and of over-identification indicate the non-statistically significant IV estimate is unbiased and therefore preferred to the OLS estimate.

Any conclusions are complicated as the finding of endogeneity is a product of the use of both instruments; it is not supported when only the CDBG or Density Bonus are the lone instrument. We test the robustness of our IV results by estimating two single-instrument models: (a) an IV model with CDBG funding as the only instrument and Density Bonus as a control; and (b) a model with Density as the instrument and CDBG funding as a control. In model (a), the CDBG variable remains highly significant as an instrument, with an *F*-statistic of 26.32. The point estimate for the $\widehat{PW}$ is −3.15, which is non-significant and similar to the two-instrument point estimate of −6.3. The χ^2 test for endogeneity, however, does not reject the null ($\chi^2 = 1.056$; $p = 0.30$). In model (b), the Density Bonus is the lone instrument, its *F*-statistic is 6.5, well short of commonly used thresholds. The weakness of this specification is also reflected in the small magnitude of the prevailing wage coefficient (−0.13) in the second-stage estimate and the failure to reject the null of the exogeneity of the prevailing wage ($\chi^2 = 2.459$; $p = 0.12$). In these instances, the prevailing wage is not endogenous. With these specifications, our OLS estimates of 5 to 6 per cent are unbiased and reflect the true impact of PW on affordable housing costs.

Where does this leave our estimates? Although the endogeneity of the prevailing wage is sensitive to the instruments, this does not invalidate the two-instrument model. That model passes the standard tests for our instruments, for endogeneity and for over-identification. As both instruments measure the impact of California state housing policies, it is not unreasonable to view them as reinforcing one another or measuring an unmeasured latent effect. Although our IV estimate of the effect of prevailing wage on the cost of affordable housing is imprecise and includes the OLS

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 water, air and parks, 2002	**3.560**	**1.570**	**2.210**	**1.530**	
	(2.190)	(1.770)	(1.850)	(1.780)	
% Yes, vote on prop. 45 term limits, 2002	**−6.410****	**−1.130**	**−1.270**	**−0.809**	
	(3.230)	(2.820)	(2.740)	(2.730)	
% Yes, vote on prop. 46 housing/emergency shelter, 2002	**5.370**	**−4.400**	**−3.660**	**−1.750**	
	(4.450)	(3.130)	(3.110)	(3.030)	
% Yes, vote on prop. 77 redistricting, 2005	**−1.510**	**0.401**	**−0.175**	**−0.299**	
	(2.070)	(1.430)	(1.420)	(1.420)	
% yes, vote on prop. 1B highways and air quality, 2006	**−1.940**	**−3.910****	**−3.930****	**−3.830****	
	(2.350)	(1.750)	(1.740)	(1.620)	
% Yes, vote on prop. 1C housing/emer. shelter, 2006	**−5.310**	**7.420***	**6.440**	**4.760**	
	(3.990)	(3.940)	(3.930)	(3.660)	
%Yes, vote on prop. 99 eminent domain, 2008	**0.105**	**−1.610**	**−1.700**	**−1.110**	
	(2.150)	(1.530)	(1.480)	(1.470)	
% Yes, vote on prop. 1A state taxes, 2009	**0.823**	**3.540***	**3.670****	**3.260***	
	(2.220)	(1.850)	(1.770)	(1.750)	
Percentage of voters registered as democrats	**−0.564**	**−4.420****	**−4.760****	**−4.480****	
	(2.150)	(2.220)	(2.230)	(2.240)	
Percentage of population over 40 years old	**−4.160****	**0.067**	**−0.202**	**−0.719**	
	(1.960)	(2.240)	(2.170)	(2.030)	
Percentage of housing units owner-occupied	**1.110**	**−2.190**	**−1.560**	**−1.110**	
	(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

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

estimate within its 95 per cent confidence interval, it meets the fundamental criteria for judging IV models.

Our analyses have produced two key findings. First, PW requirements are associated with OLS estimates of a 5 to 6 per cent increase in affordable housing construction costs. These findings, as expected, are consistent with Littlehale (2017). Second, when we apply a two-stage, two-instrument IV framework, PW requirements have no significant effect on affordable housing construction costs. Although this estimate is imprecise and endogeneity is sensitive to specification, this article is the first in the literature to suggest PWLs may have no causal effect. Taken together, we find that prevailing wages have, at most, a modest 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, specification, 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.[25] 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 to 2010, obtained from the office of the California Secretary of State. 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.[26] Our OLS replication of DQR (Model 3, Table 2) finds a prevailing wage effect of 17.8 per cent, twice DQR's 2005 estimate of 9.7 per cent and three times our preferred estimates.

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.[27] 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.[28]

In Model 1, the replication of DQR, the second-stage PW estimate is larger in magnitude than DQR ($\beta = 0.463$) and is statistically significant, but the endogeneity of PW is rejected.[29] 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.[30]

Model 2 replaces DQR's regional variables with ours. The estimate of the PW effect is even larger ($\beta = 0.564$) 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 is likely the source of the large PW coefficient estimates in the second stage.

Model 3 adds year effects. The PW coefficient is smaller ($\beta = 0.379$) 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 ($\beta = 0.261$).[31]

Finally, Model 5 summarizes the results from Table 3 for our two-stage model, the model that drops DQR's instruments and only includes 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; the PW is endogenous. The PW variable is, however, not statistically significant in the second-stage equation ($\beta = -0.063$). 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 the 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 labour force. The latter might be alleviated by the application of PWLs 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 approach this issue by answering two questions. The first (and narrowest) was to systematically apply contemporary IV techniques to determine whether the application of the prevailing wage is endogenous to the costs of affordable housing and determine whether DQR's oft cited IV estimates were reliable. We have determined that whether PWLs are endogenous is sensitive to the instruments adopted for 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. Their IV estimates of 37 per cent are several orders of magnitude greater than those obtained from an IV model that explicitly follows current practices and applies appropriate statistical tests to the IV estimates. 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 PWLs are treated as endogenous.

The second purpose was to obtain reliable, robust estimates of the magnitude of the effect of PWLs on the costs of constructing affordable housing. Building on our IV estimate, which was 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; the 95 per cent confidence interval for the effect of the prevailing wage on costs ranges from –22 to +9.6 per cent. Littlehale's (2017) and our OLS estimates of 5 to 6 per cent are within this interval. Despite the non-significant IV 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 per cent and the OLS estimates of 5 to 6 per cent is reasonable.

Our estimated range suggests that the prevailing wage requirement has a moderate cost effect; even an upper limit of 6 per cent is well below that of most prior research. Our OLS estimates find that, relative to the costs of construction under current industry practices, there may be an efficiency cost associated with the prevailing wage requirement in affordable housing

construction in California. The implicit baseline for this research has been the current practices in the residential construction industry, including the cost advantages realized by contractors engaging in illegal and undesirable practices. An alternative baseline would be the cost of building affordable housing for contractors who abide by labour standards, classify their workers correctly and pay the required amounts in social insurance and taxes. Computation of this baseline, and of its effect on the net costs of prevailing wage requirements for affordable housing construction, awaits additional research.

9 | CONCLUSION

This study has considered several methodologies for estimating the effect of prevailing wage requirements on the cost of affordable housing and has obtained reliable estimates of those effects. We conclude that California's prevailing wage requirement adds as much as 6 per cent to construction costs of affordable housing but possibly less. Although this cost increase might, as suggested by Fenn et al. (2018), be partially balanced by the reduction in social costs including providing medical services to low-income construction workers injured during their work or, as suggested by Juravich, Ormiston, and Belman (2021), social gains including increased tax revenues, this research does not speak to that issue.

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, this will provide additional opportunities to study the effect of the prevailing wage on the costs of affordable housing.

DATA AVAILABILITY STATEMENT

The data used for this study cannot be provided, per the non-disclosure agreement. However, additional results and computer programs used to generate the results presented in this paper are available from the corresponding author.

ENDNOTES

[1] Only 37 available affordable housing units are available per 100 US low-income households. The shortage is especially pronounced in the Western United States (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, poverty rates among the working poor in construction rise faster in economic downturns than in the overall economy. In 2010, the rate of working poor in construction was 90 per cent higher than the overall economy (Bureau of Labor Statistics, US Department of Labor, 2010).

[3] In 2018, construction accounted for 19 per cent of all workplace fatalities (Bureau of Labor Statistics, US Department of Labor 2018). In 2015, Hispanic construction workers accounted for 35 per cent of all construction fatalities (https://www.bls.gov/iif/oshwc/cfoi/hispanic-or-latino-fatal-injuries.htm).

[4] Concern over the validity of our Density Bonus instrument is addressed by estimating a second IV model in which Density Bonus is treated as a control. The remaining instrument remains valid, but the PW fails an endogeneity test.

[5] States' methods of determining a prevailing wage varies considerably. Some use the federal prevailing wage, others use a survey to determine the wage, and others adopt the collectively bargained wage.

[6] 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 Dunn, Quigley, & Rosenthal (2005), and DQR has been cited in these non-peer-reviewed studies. Re-examining DQR's estimates is therefore more important to founding policy decisions on sound research.

[7] California's expanded its PWL to include privately as well as publicly funded affordable housing projects in 2001 (Dunn, Quigley, & Rosenthal, 2005). Private sources are primarily incentivized by the federal Low-Income Housing Tax Credit (LIHTC; National Housing Law Project 2017). This law does not include a prevailing wage requirement.

[8] In Dunn, Quigley, & Rosenthal (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 and structure type (e.g., two-story, townhome, single-family). The authors preferred estimate found that the PW increased costs by 9.7 per cent.

[9] 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, and the percentage of the population over 40 years old (Dunn, Quigley, & Rosenthal, 2005).

[10] 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 per cent. 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 article, we show that the omission of year controls greatly increases the magnitude of the prevailing wage effect.

[11] 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 per cent (McMahon & Gardner 2017). A study published by the New York Center for Urban Real Estate suggested PW requirements raise costs by 25 to 30 per cent (Vitullo-Martin 2012). These studies suffer methodological flaws (see Duncan & Ormiston 2018; Ormiston, Belman, & Hinkel 2018), but influence public discourse on PW laws.

[12] Enforcement of California's requirements is more comprehensive than the federal Davis-Bacon Act, as building trades unions are directly involved in monitoring projects and informing the state of likely violations (discussion with Littlehale, June 2020).

[13] Bids are considered qualified if the contractor can obtain a bond for the project, a modest hurdle in most instances.

[14] An increasing exception to this low-bid requirement; are responsible bidder ordinance (RBO). RBOs outline sets of criteria a contractor must meet to be awarded contracts for public projects (e.g., past compliance with environmental and safety regulations, prevailing wage compliance, funding of apprenticeship progams). Rather than awarding projects to the lowest bidder, public bodies under RBOs award projects to the lowest *responsible* bidder. These need not be the lowest overall bids, and in many cases, they are not.

[15] 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).

[16] We also did similar calculations using 2017 Economic Census data to see if this result was robust and held over time. In 2017, for both the state of California and the entire United States, labor costs as a percentage of the net value of all construction work (NAICS = 23) was 23 per cent. This is notably identical to the percentage found by Littlehale (2017) for 2007 apartment work, suggesting that the 2007 result has remained stable over time.

[17] Our data were originally compiled and graciously provided by Blue Sky Consulting Group, with whom we signed a limited non-disclosure agreement.

[18] A 2019 study on the cost of residential housing in Northern California (Garcia 2019) suggests that hard costs accounted for approximately two thirds of total development costs, while soft costs (including land costs) accounted for approximately one third. Prevailing wage requirements directly impact hard costs, since they affect labor costs; any impact on soft costs is indirect. As our dependent project cost variable excludes land costs, which are unaffected by prevailing wages, our estimated effect is an *upper bound* estimate of the effect of prevailing wages on total project costs.

[19] Developer size, measured by the number of employees, reflects developer capabilities and experience.

[20] Project snow is an indicator variable with a value of 1 if a project took place in a city with an average snow depth of 1 ft or more, and 0 otherwise. Littlehale (2017) used an average city snow depth of 1 ft in January of 2017 as the threshold (Littlehale 2017).

[21] 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.

[22] 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).

[23] Grant awards for housing projects vary. 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).

[24] Public funds such as the CDBG program do *not* trigger prevailing wage mandates if the grants account for less than 5 per cent of the total project budget. Thus, there are many cases where affordable housing projects can receive CDBG funding and *not* be subject to prevailing wages, as evidenced by a correlation between prevailing wages and CDBG funding of 0.15 found in the data. Thus, while they are positively related, it is not one-to-one.

[25] DQR's original dataset has been lost, precluding replication of their work.

[26] 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.

[27] Complete estimates are available from the corresponding author.

[28] It was not possible to include DQR's measures of union density or the proportion of employment in highly unionized industries and occupations in the first stage of the model (see DQR, footnote 14 and Table 4) as they were highly collinear. We recreated these variables using current data from Hirsch and MacPherson (2003) but too collinear to estimate; 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.

[29] 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.

[30] 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.

[31] 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.

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