How Costly Is Affirmative Action? Government Contracting and California's Proposition 209*

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Abstract

Despite the magnitude and controversial nature of affirmative action programs in contracting, surprisingly little is known about the cost they may impose on the government. This paper uses California's Proposition 209, which prohibited the consideration of race or gender in state-funded contracts, to investigate the effect of disadvantaged business enterprise subcontractor participation goals on the winning bids for highway construction contracts. After Proposition 209, the prices on state funded contracts fell by 5.6 percent relative to federally funded projects, for which preferences still applied. While the subcontractor requirements are found to distort the contractor's make-versus-buy decision, most of the decline in costs after Proposition 209 results from the productivity of subcontractors employed. This seems to arise not from productivity differences between minority and non-minority firms in the same location, but from the higher costs of firms located in high-minority areas. Lastly, I provide evidence that short-run barriers to entry and expansion for minority- and women-owned firms may increase the cost of affirmative action.

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1 Introduction

Beginning in the late 1970s and early 1980s, state and local governments began implementing preferential practices in procurement with the aim of fostering minority entrepreneurship and employment. The importance of public purchases in the government budget, along with the widespread use of affirmative action in contracting, have combined to make these programs significant. Government procurement of goods and services at all levels of government is typically estimated to represent nearly 10 percent of GDP, and the practice of giving preferential treatment to disadvantaged business enterprise (DBE) contractors and subcontractors has become widespread. In 2002, 6.75 percent of federal procurement dollars was awarded to DBEs through the Small Business Administration, and according to LaNoue (1993), in 1989, affirmative action was used by 234 states, counties, and cities in the awarding of contracts.

Despite the magnitude and controversial nature of affirmative action programs in contracting, surprisingly little is known about what cost they may impose on the government, a fact pointed out by Holzer and Neumark (2000) in a review of the affirmative action literature.[1] The small literature investigating the cost of interventions in government procurement markets to favor certain firms has thus far focused on small business programs. Denes (1997) examines federal dredging contracts and estimates the effect on the winning bid of setting aside some contracts for small businesses, and Marion (2007a) looks at the procurement cost effect of bid preferences for small businesses in California highway auctions. In principal the predicted effects of asymmetric treatment of small businesses share similarities with affirmative action for firms owned by minorities or women. However, issues particular to programs for minorities and women in contracting suggest these interventions deserve special attention. For instance, discrimination by contractors, or the vulnerability of these programs to fraud through the formation of non-minority "front companies," could weaken or reverse the predicted effect on procurement costs. Blanchflower and Wainwright (2005), for instance, find little impact of affirmative action programs on minority self employment, and they suggest the existence of front companies as a possible reason.

[1]Some work has considered the efficiency effect of affirmative action in employment. Leonard (1984b) argues that affirmative action in employment has had little impact on firm productivity, while Griffin (1992) estimates that affirmative action places significantly constraints on firms' production functions. Holzer and Neumark (1999) examine the qualifications of affirmative action hires. McCrary (2007) is an example of a sector specific study, looking at police hiring quotas and finding no adverse effect on crime prevention. Much of the remaining focus in the literature to date has been on the potential benefits to minority entrepreneurship and employment that accrue as a result of affirmative action. Examples related to contracting include Chay and Fairlie (1998) and Bates and Williams (1995,1996). Examples related to employment include Leonard (1984a), who examines the employment effects of affirmative action requirements placed on federal contractors.

This paper examines the affirmative action program of the California Department of Transportation (Caltrans), where a goal is set for each construction contract mandating the participation of minority and women owned subcontractors. Variation caused by California's implementation of Proposition 209 in March 1998, which eliminated preferential treatment based on race or sex in public employment, contracting, and school admissions, is used to identify the impact of affirmative action on the winning bids for highway construction contracts. Proposition 209 applied only to contracts not using federal funds, so federal-aid status provides comparable treatment and control groups.

Several related issues have contributed to impede research in this area. While there is considerable variation in affirmative action programs across contracts and government entities, much of this variation is likely endogenous to factors that affect costs. First, selection could result in an endogenous relationship between cost and contracting preferences. If the effect of affirmative action on cost varies by locale, then low-cost areas would be more likely to adopt preference programs. Second, common factors could be correlated with both the adoption of preferences as well as with firm costs. For instance, the population density of an area could be related to firm costs on a construction project through higher project complexity as well as the probability of the adoption of contracting preferences through a higher minority population. Similar unobserved factors could drive variation in the application of affirmative action across contracts within a government entity.

Variation over time induced by policy changes lends the possibility of plausibly exogenous variation in affirmative action. However, as Chay and Fairlie (1998) point out, even the dates of adoption of a particular affirmative action program are often difficult to identify. Furthermore, programs in different jurisdictions are not necessarily comparable, and the differences between programs could lead to different predictions about affirmative action's impact on costs.[2]

The elimination of preferences for only state-funded California road construction contracts, and not for contracts using federal aid, provides a quasi-experimental setting to overcome these difficulties. If the assignment of federal aid to a particular project after the implementation of Proposition 209 is unrelated to the cost of using DBE participation constraints on that contract, and if Proposition 209 is uncorrelated with unobserved factors that affect state-funded projects differentially, then Proposition 209 interacted with state funding status will be a valid instrument

[2]For instance, an affirmative action program similar to that in California that mandates DBE subcontractor participation could increase a firm's costs, and therefore its bid, through a constraint on the contractor's production function. On the other hand, McAfee and McMillan (1989) and Corns and Schotter (1999) suggest that an affirmative action program that uses bid preferences for disadvantaged firms could, in fact, lower the equilibrium winning bid if it forces non-disadvantaged firms to bid more aggressively.

for the participation goal on a particular project. Second, detailed data from bid letting on major highway construction projects in California will allow for particularly thorough controls for project heterogeneity. Finally, the program parameters of the affirmative action program in California are observed, and the date of the implementation of Proposition 209 is known with certainty. The results indicate that after affirmative action was eliminated, the average price of items on state-funded contracts fell by 5.6 percent relative to the same items on federal-aid contracts. A graphical analysis suggests that the timing of this decline corresponds to Proposition 209's implementation.

Two explanations of this cost change are ruled out. First, the elimination of participation goals did not result in more able contractors winning bids, as the effect is as great within firms as it is across firms. Second, the elimination of affirmative action did not have a significant effect on the competitive environment, as the average number and quality of bidders is unchanged after Proposition 209.

The paper then investigates the effect of the DBE subcontractor goals on the contractor's make-versus-buy decision. Participation goals could increase the intensity with which subcontractors are employed by the contractor, which could increase contractor costs if the firm could more cheaply produce the goods in house or if coordinating more suppliers is costly. This distortion of the make-versus-buy margin is empirically important. Post Proposition 209, 8.9 percent fewer subcontractors were used per project.

Most of the decline in bids after Proposition 209 can be explained by the subcontractors used. Including subcontractor dummy variables reduces the estimated effect of Proposition 209 by more than half to a cost reduction of 2.5 percent. This indicates that factors aside from the quality of subcontractors, such as distortions to the make-versus-buy decision, can only account for an estimated 45 percent of the decline in bids after Proposition 209. Examining the subcontractor fixed effects from this estimation in more detail reveals that the effects of affirmative action may arise not from a difference in productivity between minority and non-minority firms in the same location, but from forcing contractors to hire subcontractors from higher cost areas. Finally, I find evidence that short-run barriers to entry and/or expansion for minority firms increase the cost of affirmative action.[3]

[3]One other potential component of the effect of eliminating affirmative action on costs is discrimination. Without affirmative action, discrimination raises the contractor's cost as the contractor would hire white subcontractors even when more efficient minority firms are available. Eliminating affirmative action may therefore increase costs by removing a constraint on firms' discriminatory practices. However, I find that costs fall and more efficient subcontractors are used after affirmative action is eliminated. Discrimination can not be ruled out, however, as its effects on costs may be small enough to be overwhelmed by other factors.

This paper proceeds as follows. Section II presents a simple descriptive model that formalizes some of the factors that might impact the winning bid on a contract. Section III discusses the background of affirmative action in government contracting, and lays the groundwork for the empirical tests by describing highway construction and the affirmative action program in California. Section IV describes the bid data that will be used, as well as two empirical approaches to account for project heterogeneity. Section V concludes.

2 A Model of the Subcontracting Decision

Suppose a contract to be awarded has a continuum of tasks defined on the interval $[0, K]$ that the contractor can either produce herself or subcontract to someone else. For each task, j, the firm receives a cost draw, $c(j)$, from the distribution $G(c)$ prior to bidding. This cost determines the contractor's cost of completing the task herself. Instead, the firm may choose to purchase the task either from a market firm, $m \in M$, or from a DBE, $d \in D$, where $D \subset M$. The two firms charge p_m and p_d respectively to perform a task, where in the absence of discrimination $p_d \geq p_m$ since the set of DBEs is a subset of the market firms.

Without any restrictions on its choice of subcontractors, the firm will choose to subcontract out those tasks for which $c(j) > p_m$. After ordering the tasks based on cost from lowest to highest and defining κ such that $c(\kappa) = p_m$, the total cost of the firm to complete the project is therefore

$$C_0 = \int_0^{\kappa} c(j)dj + (K - \kappa)p_m. \tag{1}$$

Suppose the government imposes a requirement that the firm subcontract out a certain dollar amount, X, to DBEs so that $\delta p_d = X$, where δ is the number of tasks to be subcontracted to DBEs. There are two cases to consider. In the first scenario, the firm was already planning to subcontract out at least δ tasks: $K - \kappa \geq \delta$. For a firm in this case, total costs will be given by

$$C_1 = \int_0^{k} c(j)dj + \delta p_d + (K - \kappa - \delta)p_m. \tag{2}$$

Here, the firm merely switches some tasks to DBEs that it would have otherwise subcontracted out using the market firm.

The second scenario is one where the firm would have chosen to subcontract out fewer than δ tasks in the absence of the DBE restriction: $K - \kappa \leq \delta$. In this case, the firm subcontracts out δ tasks, all to DBEs. Total firm cost in this scenario is given by

$$C_2 = \int_0^{K-\delta} c(j)dj + \delta p_d. \tag{3}$$

This model suggests several ways in which affirmative action can affect the winning bid for a contract. The most obvious is through differences in average productivity between DBEs and market firms - that is, if $p_d > p_m$. It is easy to see that $C_1 > C_0$ if $p_d > p_m$. All of the bidders for a contract will see their cost rise, regardless the extent to which they would have subcontracted out. The second avenue through which affirmative action can affect the winning bid is through the distortion in the make-versus-buy decision. For firms that find themselves in the second scenario where $\delta > K - \kappa$, C_2 will be strictly greater than both C_1 and C_0, even if $p_m = p_d$.

Allowing for heterogeneity among firms in the hiring cost of DBEs, p_d, suggests two additional sources of costs. Suppose there are two types of firms, A and B, that face different effective prices in hiring DBEs, where $p_d^A > p_d^B$. This may arise, for instance, if type A firms are located in areas with low concentrations of DBEs, and this leads to different coordination costs or reduced market power.[4] After the cost draw, firm A may have a strict cost advantage in terms of its own production, where $c^A(j) \leq c^B(j)$ for all j, yet it could still lose the bidding because of its disadvantages in terms of hiring DBEs if $\int (c^B(j) - c^A(j))dj < (p_d^A - p_d^B)$. Finally, if there are fixed costs to submitting a bid, then firms of type A may be less likely to enter the bidding when affirmative action is in place, thereby reducing the competitiveness of the auction.

One potential source of cost difference between the affirmative action regime and the non-affirmative regime is that in the absence of discrimination the contractor's choice from the set of DBE firms will charge a price at least as high as a firm chosen from the encompassing set of market firms. Two factors could drive a wedge between the price of the average DBE and that of the average firm in the market. First, certain factors may lead to higher marginal costs for DBE firms. Second, barriers to entry may allow the marginal DBE incumbent to earn excess profits in the affirmative action regime.[5]

On the other hand, allowing for discrimination in the model could reverse the predictions on the cost of affirmative action. Taste-based discrimination could affect efficiency if less qualified non-minority firms are hired while more productive minority firms are passed over. An affirmative action program could therefore promote efficiency by forcing the productive minority firms to be hired.

[4]Firms could choose their location taking this into account, however they may be trading off the benefit of locating close to DBEs with other locational considerations. Also, in the setting that will be examined in the empirical work, affirmative action was eliminated only for some contracts. Since affirmative action still exists, the incentive to adjust location in response will be lessened.

[5]One factor that could make both expansion by incumbent firms difficult as well as provide a barrier to entry for potential DBE entrants is poor access to credit markets. Evidence that black-owned enterprises receive asymmetric treatment in capital markets is given by Cavalluzzo and Cavalluzzo (1998), Blanchflower, Levine, and Zimmerman (2003), and Bates (1991). A second factor that has traditionally proved to be a barrier to entry into government procurement markets are prequalification procedures. Attanasi and Johnson (1975) note that because prequalification depends in part on past firm performance, large scale entry may be precluded to some degree. This problem could be particularly acute for smaller DBEs who might have sparser work histories.

3 Contracting and Affirmative Action in California

3.1 Federal aid for highway projects

The U.S. Department of Transportation provides funds to states for the maintenance and construction of interstate and national highways, bridge projects, air quality and congestion management efforts, and other local projects. Federal aid for highway projects is funded through user related taxes, including gasoline taxes. A federal apportionment formula determines the grant to be given to the state under each federal aid program in a given year. A state's grant prior to 2000 was determined by long range estimates of that state's contributions to the Highway Trust Fund. After 1999, there was a substantial increase in the amount of federal funding allocated to California as a result of the Revenue Aligned Budget Authority implemented in 2000. The RABA tied disbursements to Highway Transportation Fund money actually available. That is, it tied it to tax revenue, which increased dramatically during the late nineties. As a result of this increase, the average federal-aid project increased dramatically in size. For this reason, I will focus on the period prior to 2000.

There is a complicated multi-layered process by which projects are selected and funding sources chosen. Project planning occurs at both the regional and state level. Regional planning agencies identify long-term transportation needs within the region and formulate these into a long-run transportation plan. Caltrans also formulates a long-term plan for inter-regional transportation needs, often in consultation with the regional planning agencies. A subset of the projects in the long-run plans are then formulated into the Federal Transportation Improvement Program (FTIP), a document laying out four years of projects. It is at this stage that all sources of funding must be identified, so the decision regarding whether to apply federal funds to a project is made with a long lead time. The decision regarding which projects receive federal funds is made either by the relevant regional planning agency or by Caltrans depending on the transportation program the project falls under.[6] There are eighteen regional planning agencies making funding decisions for their own projects, and the criteria for selecting projects for federal funds may differ across agencies. One of the primary concerns in the funding allocation decision is exhausting federal funds before they expire, and as a result projects with higher priority are often more likely to be allocated federal funds.

[6]The regional agencies manage the Congestion Mitigation and Air Quality (CMAQ) program, the Regional Surface Transportation Program (RSTP), and the Highway Bridge Program (HBP). Caltrans planning arm, the California Transportation Commission, manages the State Transportation Improvement Program (STIP) and the State Highway Operation Protection Program (SHOPP). The STIP is funded using entirely state sources, while the SHOPP utilizes federal sources. Each of the programs managed by the regional agencies are funded using a combination of state and federal funds. There is considerable overlap across programs regarding the types of projects funded.

3.2 Bidding on contracts

Caltrans awards contracts through a sealed-bid, first price auction system, where the lowest qualified bid wins the contract. Potential bidders are solicited through a newsletter that details the bid letting date and the details of the project. A firm can bid on any project for which it has been pre-qualified to do the specified category of work, based on the firm's equipment, training, licensing, and past work history. A firm specifies in its bid which subcontractors it will use, its anticipated DBE subcontractor utilization, and a unit price of each item the engineer has specified. In general, the lowest bidder is awarded the contract. However, for projects using only state funds, small businesses receive a bid preference that is the minimum of 5% of the lowest large firm bid or $50,000, a program examined by Marion (2007a). This allows qualified small businesses to win some contracts where they do not submit the lowest bid. Since the empirical specification will leverage the change in affirmative action for state funded contracts, care will be taken to account for the effect of bid preferences on the winning bid.

3.3 Affirmative action and Proposition 209

Leonard (1990) points out that affirmative action at the federal level was weakened significantly during the 1980s, first by the Reagan administration and subsequently by Supreme Court decisions in 1989. This period of waning federal affirmative action employment laws coincides with a period of growth in affirmative action programs in public procurement, particularly at the state and local level.

Beginning in 1982, the Federal Highway Administration required states to implement affirmative action programs for minorities in the awarding of road construction contracts that are funded with federal aid, and in 1987 this requirement was extended to include women-owned firms. States are required to set goals of at least 10 percent for the combined participation of minority and women business enterprises (MBEs and WBEs, respectively). While a state could petition to have its goal be less than the 10 percent minimum, this is rare. Between when WBEs were included in 1988 and 2002, only eight percent of state-years had a goal below 10 percent, and none before 2000. As with the affirmative action goals described in Leonard (1985)[7], these goals seem to be more than empty promises. From 1988 to 1999, states met their participation goals 68 percent of the time.

As a result of a state statute applying to all state procurement, Caltrans also implemented an affirmative action plan applying to roadway projects using only state funds, so that participation

[7]While they fall short of strictly enforced quotas, Leonard (1985) finds that employment goals set by firms as part of affirmative action programs seem to be strongly related to future firm employment of minority workers.

goals in the total volume of contracts applied to both state and federally funded projects during this time. California sets a statewide goal for the participation of DBEs on state highway construction. To meet this goal, Caltrans sets a DBE subcontractor participation goal on a project-by-project basis. The participation goals vary across contracts depending on the supply of available DBE firms in the project's region and on the the nature of the work to be performed. Participation goals based on firm availability likely reduces the impact of the affirmative action program on procurement costs but could also reduce the effectiveness of the program in fostering minority entrepreneurship. To qualify as an MBE, WBE, or DVBE, a firm must meet two requirements: an ownership requirement that at least 51 percent of a business must be owned by the group for which the goal applies, and an operations requirement that the minority, female, or disabled veteran owners be involved in the day-to-day operation of the business.

Bidders must supply a list of the subcontractors to be used in the completion of the project. A qualifying bid either meets the participation goal stipulated in the contract, or documents a good faith effort to locate and/or assist DBEs in the event that the participation goal is not met. Bids are often rejected for failing one of these two tests. From May 1996 until the end of 2002, 36 low bids were rejected on this basis. Also, prior to a rule change in 2000, even if the contractor was a DBE, it still needed to meet the subcontractor participation goal.

Voters in California passed a statewide referendum, Proposition 209, in June 1996, that was intended to eliminate the consideration of race and gender in state contracting, education, and employment. Two factors delayed the application of Proposition 209 to many state programs. First, the California constitution states that local agencies will continue to enforce state statutes until they are repealed by the legislature or ruled unconstitutional by the courts. Second, certain forms of affirmative action were not explicitly ruled out by Proposition 209. As a result, affirmative action continued to be used in part over ambiguities regarding what programs Proposition 209 actually covered.

Despite the fact that a federal appeals court in 1997 upheld Proposition 209, participation goals continued to be used by Caltrans throughout 1997 and into 1998. Two relevant legal decisions were delivered in early 1998, both coming down against the use of participation goals in contracting. In Hi-Voltage Wire Works v. City of San Jose, which was decided in February of 1998, the courts found that a San Jose program similar to the one used by Caltrans was in violation of Proposition 209. Subsequently in March of 1998, a federal court ruling in Monterey Mechanical v. Wilson was finalized that stated that the use of subcontractor goals, or requiring evidence of firms' efforts to meet these goals, violated the equal protection clause of the U.S. Constitution. Following these

court rulings, in March of 1998 California Governor Pete Wilson issued an executive order stating that all state programs utilizing gender and race based participation goals in the awarding of state contracts were to be immediately suspended. Importantly, this executive order applied only to contracts that did not use federal funds, for which preferences still applied.

4 Data and Empirical Results

4.1 Data

The data in this study consist of information for 2,569 highway construction auctions conducted by the California Department of Transportation between May 1996 and December 1999. For each contract up for bid, a set of information describing the project is given, including the road and county where the work will take place; a short description of the nature of work to be completed; the estimated number of working days to complete the project; and an engineer's estimate of the cost of completing the project. The engineer's estimate is formulated by Caltrans, and reflects project-specific factors incorporating past bids on similar projects. The federal-aid status of the contract is given as well as the DBE participation goal that applies to that project. For every general contractor submitting a bid, the value of the bid and a list of first tier subcontractors is given.[8] A unique identifier is assigned to each firm, so it is possible to track firms across contracts.

Table 1 describes the basic contract level characteristics of the data on state versus federally funded contracts before and after Proposition 209. Contracts using federal aid are larger than those using state funds, though this difference shrinks somewhat in the post-Proposition 209 period. The pre-209 average winning bid is $1.29 million for state funded contracts compared with $2.87 million for those using federal aid. Much of the difference seems to be accounted for by factors such as the number of estimated work days and the number of items to be provided on the contract. The difference in complexity is also reflected in the higher number of subcontractors utilized by the bidding firm.

The differences in scale do not allow a direct evaluation of Proposition 209 from inspection of the average winning bid. However, preliminary results regarding the effects of Proposition 209 can be provided by considering the winning bid relative to the engineer's estimate. Relative to the engineer's estimate, the winning bid on state funded contracts fell by 4.5 percent, while federal aid projects rose by 1.7 percent. The resulting difference-in-difference estimate suggests that Proposition 209 reduced the winning bid on state-funded contracts relative to federal aid contracts by 6.2 percent.

[8] A first tier subcontractor performs at least $10,000 or half of a percent of the contract, whichever is greater.

There is considerable variation in the DBE participation goal within the two types of contracts. The value-weighted goal for DBE participation prior to Proposition 209 is 13.2 percent on state-funded contracts and 11.8 percent on federal-aid contracts, and the standard deviations of these variables represent 55 and 32 percent of their means, respectively. Proposition 209 lowers the participation goal on state-funded projects to 3 percent, the goal for firms owned by disabled veterans that is applied to all state-funded contracts. The variation of goals across projects is described graphically in Figure 1. The distribution of goals across federal aid projects in the pre-209 period was similar to the post-209 period. Compared to federal aid projects, more state funded projects used a low goal of between zero and three percent during the pre-209 period. Given that the weighted average DBE goal was slightly higher on state funded projects pre-209, state funded contracts were more prone to have higher goals on larger projects.

Figure 2 displays the decline in DBE goals after Prop. 209. In the pre-Proposition 209 period, the average minority participation goal was more volatile on state funded than federal aid contracts, yet on average was similar. In the post-Proposition 209 period, the average goal fell permanently to 3 percent on state funded projects, while remaining fairly constant on federal-aid projects. The average goal weighted by the winning bid, shown in Panel B, is higher for both state funded and federal aid contracts than the unweighted average goal displayed in Panel A. This indicates that the goal is set higher on larger contracts.

In the pre-Proposition 209 period, there is a pattern where the average goal on state funded contracts is initially lower than that on federal aid contracts, and this reverses after the first quarter of 1997. Only part of this pattern can be explained by differing project characteristics. In Panel C of figure 2, I show the residuals by quarter from a regression of the DBE goal on project characteristics. Project characteristics are able to explain the differences between goals on state and federally funded contracts only from 1996 quarter 2 until the first quarter of 1997.

Caltrans specifies each item that will be required to complete a project and the quantity of that item to be used. The bidder places a unit price for each item, and the sum of the unit prices multiplied by their quantities gives the total bid: $\sum_j p_{ij} q_{ij} = B_i$.[9] Appendix I lists common items specified in contracts. Caltrans attempts to completely specify ex ante the details of the contract. However, the quantities are subject to change as the project progresses and uncertainty is resolved. For each item, Caltrans provides a list of preapproved specific brands and models of the items

[9]The unit prices are used in the event that more of a particular item is required to complete the project, in which case the contractor is allowed extra compensation given by the unit price multiplied by the unexpected quantity. Also, the engineer's office uses the item prices to generate highway construction cost indexes for common categories of items.

that can be used by the contractor to fulfill the contract. In addition, Caltrans dictates specific tolerances and specifications that the final product must meet. Should changes in specifications occur that require different amounts of certain goods than predicted, the contractor is compensated by the unit price placed on that item.

4.2 Empirical approach: Contract Level Variation

One empirical approach to estimating the impact of affirmative action would utilize the variation in DBE participation goals across contracts to identify the effect of affirmative action on the cost of procurement. In this case the log of the winning bid on a project, $ln(B_{it})$, can be modelled as follows:

$$ln(B_{it}) = \alpha G_{it} + \beta X_{it} + \gamma_t + \eta_{it}, \tag{4}$$

where G_{it} is the participation goal on a project; X_{it} is a vector of project specific characteristics; and γ_t represents unobserved time specific shocks.

A problem could arise in estimating (4) if unobserved factors contained in η_{it} are correlated with the government's choice of G_{it}. For instance, Caltrans sets goals higher when the project is located in an area with many DBEs, or when the type of work to be completed is in an industry with more DBEs.

To circumvent this problem, the passage of Proposition 209, interacted with state-funded status, could be used to instrument for the total goal on a project. The first stage of this specification is given by

$$G_{it} = \pi_{11} D_{it} + \pi_{12} D_{it} 1(t \geq t_0) + \pi'_{13} X_{it} + \phi_t + \nu_{it}. \tag{5}$$

Here, D_{it} takes on a value of one if the contract is state-funded, and $1(t \geq t_0)$ indicates that it is awarded after the implementation of Proposition 209. Time effects are indicated by ϕ_t, and X_{it} represents a vector of project characteristics. The approach in this paper will be to estimate the associated reduced form equation

$$ln(B_{it}) = \pi_{21} D_{it} + \pi_{22} D_{it} 1(t \geq t_0) + \pi'_{23} X_{it} + \varphi_t + \varepsilon_{it}, \tag{6}$$

a difference-in-difference (DD) specification that compares the winning bid before and after Proposition 209 on state-funded versus federal-aid contracts.[10]

[10]Note that the effects of bid preferences, which are employed on state funded contracts throughout the time period under consideration, are absorbed by the state funded dummy variable.

Let $\widehat{\pi}_{12}$ and $\widehat{\pi}_{22}$ denote the OLS estimates of π_{12} and π_{22} respectively. If $cov[D_{it}1(t \geq t_0), \eta_{it}|X_{it}] = 0$, then instrumental variables - using $D_{it}1(t \geq t_0)$ as an instrument, conditional on D_{it},time dummies, and the control variables X_{it} - will estimate α well. This will hold if, first, the decision to use federal funds on a project is exogenous, and second, if X_{it} captures all remaining variation in project characteristics that may be correlated with both the passage of Proposition 209 and the winning bid, $ln(B_{it})$.

The considerable heterogeneity across projects could cause this to be violated if project characteristics happen to be changing in a manner correlated with the treatment variable, $D_{it}1(t \geq t_0)$. One particularly intuitive approach to account for project differences is to employ an independent estimate of the cost of completing a project, which would presumably incorporate the real cost factors on a project but would be independent of the contract form being studied.

For example, Ashenfelter, Ashmore, and Filer (1997), examine city building projects in New York and employ an independent agent to provide an assessment given the characteristics of each project. Similarly, Denes (1997), studies how setting aside certain contracts for bidding only by small businesses affects the winning bid for federal dredging projects, using the engineer's estimate of project cost to account for differences across contracts.

The estimation method described in this section takes this approach, controlling for the engineer's estimate provided in the project detail. Table 2 displays estimates of (6) controlling for this estimate. Including the engineer's estimate accounts for 97% of the variation in the winning bid. With no other controls, the estimate of π_{22} is -0.014, but statistically insignificant. After including controls for the log number of workdays, log number of items, year*quarter dummies, and county and road effects, the coefficient becomes -0.031 and marginally statistically significant, suggesting that the winning bid on state funded contracts fell by 3.1 percent after the elimination of affirmative action.

For a point of comparison, the specification displayed in column 3 instead uses variation in the DBE participation goal, G_i, to assess the impact of affirmative action. These results suggest that an increase of ten percentage points in the DBE requirement increases the winning bid by 3.1 percent. The difference-in-difference specification was motivated by the potential endogeneity of the DBE goal and the cost of completing a given project. In column 4, I present estimates of the coefficient on the DBE goal, using the State funded*Post-209 interaction as an instrument. The IV coefficient is 0.622, suggesting that the OLS estimates may understate the effects of the DBE goal. It is important to note, however, that using variation across projects of the DBE goal will be inappropriate if there are fixed costs to hiring subcontractors, or DBEs in particular.

Meeting the affirmative action rules may entail a compliance cost that is incurred regardless of the relative intensity of DBE utilization. The estimated marginal effect of changing the DBE goal in this case will understate the effect of eliminating affirmative action, as Proposition 209 did. Conversely, using the elimination of affirmative action as an instrument to identify the marginal effect of changing affirmative action intensity will overstate this marginal effect as it will imbed the associated reduction in fixed costs. For this reason, I present both the reduced form and IV results.

The model presented in section 2 suggested that if firms vary in their cost of hiring DBE subcontractors, then DBE participation requirements could result in firms with low values of p_d winning more construction contracts even if their own productivity was lower. Column 5 of Table 2 presents estimates of the difference-in-difference specification including firm effects. This is meant to uncover how much of Proposition 209's impact is due to within firm effects (i.e. lowering a particular firm's bid), and how much is due to compositional effects (i.e. changing who wins the bid). If eliminating affirmative action results in more productive prime contractors winning bids, then including firm fixed effects should lessen the estimated effect of Proposition 209.

The coefficient on the Post-209*State funded interaction term, controlling for firm effects, is -0.041, which is slightly larger than the estimated effect without controlling for firm effects. The reduction in project costs induced by eliminating preferences is therefore due entirely to the within firm effect. This result suggests that the mechanism for how the winning bid is affected by preferences is likely to come from differences in average productivity for DBE versus non-DBE firms, changes in coordination costs, or distortions in the make versus buy decision on the part of the contractor. It is unlikely that the source of the cost of an affirmative action program results from less productive firms winning bids simply because they have a comparative advantage in hiring or organizing DBE firms.

4.3 Empirical Approach: Item level variation

One concern with the specification of the winning bid is that the engineer's estimate could take into account the effect of the subcontractor requirements, either explicitly or implicitly through its use of past winning bids. The approach taken in this section treats the prices placed on individual items within a contract as observations. The same items are then compared across state and federally funded contracts. This provides a different way to account for project complexity while eliminating the need to control for the potentially endogenously determined engineers estimate.

One advantage of this method is that items that are not comparable across contracts are not included. Unique elements of a project may be one source of unobserved heterogeneity, and dropping

those unique elements may eliminate a potential source of bias. Items are described in detail in the contract[11], and only those that are comparable across contracts are considered in the empirical analysis. These include all items described in comparable units such as meters, square feet, or liters. Excluded items include those that are designated as "lump sum," where quantity is not measurable in comparable units. An example of such an item is the construction of a temporary building. No details are given regarding the building or the materials used in its construction, making it impossible to compare with other temporary buildings on other projects. To ensure that the bidder does not place high prices on items that it expects to exceed the estimated quantity, Caltrans examines each bid to check for bid balance and has the authority to reject bids that it suspects are strategically unbalanced.

Let p_{ijt} be the price of item j from the low bidder on contract i awarded in period t. The equation analagous to (6) to be estimated is then

$$ln(p_{ijt}) = \pi_{21} D_{it} + \pi_{22} D_{it} 1(t \geq t_0) + \pi_{23}' X_{ijt} + \varphi_t + \gamma_j + \varepsilon_{ijt}, \tag{7}$$

where γ_j is an item specific dummy. The coefficient π_{22} can then be described as the average deviation from the item mean price induced by the elimination of affirmative action. The log specification is desirable, as (7) is comparing across items with large differences in mean price. The experiment is to compare the price on the same good before and after the implementation of Proposition 209 on federal-aid versus state-funded contracts.

It is apparent that the prices do not represent independent observations. The disturbances, ε_{ijt}, will be correlated across items within a contract, as there will be contract specific cost shocks that will effect all items. The error term could also be correlated across items if the prices are measured with error. If the bidder generates a bid by determining her overall bid, B_i, and then allocates prices across items such that $\sum_j p_{ij} q_{ij} = B_i$, then positive measurement error that increases p for one item must result in negative measurement error for at least one other good. This will result in the error term in equation (7) to be correlated across items within a contract. To account for this dependence, the variance covariance matrix will be estimated allowing for clustering by contract.

[11] For instance, reflective and non-reflective pavement markers are treated as separate items. Conduits are described both by their width, and whether they are trenched in concrete or soil.

4.3.1 Results

Table 3 contains the results from the estimation of (7). Columns (1) through (3) account for item-level effects, so that the coefficients can be interpreted as the percentage deviation from item means. After controlling for project and item covariates, the coefficient on the difference-in-difference interaction term indicates that the cost of completing state-funded contracts decreased by 5.6 percent relative to contracts using federal-aid in the wake of the passage of Proposition 209.[12] This number is significant, as goals were reduced by an average of 9 percent percentage points.

In column (3), the same specification is shown, however the variable of interest is the DBE participation goal for the contract. The coefficient on this variable is 0.282. In the specification displayed in column (4), the implementation of Proposition 209 is used as an instrument for the DBE goal, yielding a coefficient of 0.826. If Proposition 209 is a valid instrument, then this result implies that the coefficient on the DBE goal is biased downward significantly. As with the contract level specification, care needs to be taken in interpreting this coefficient if there are fixed costs of hiring subcontractors in general or DBEs in particular.

As with the specification with the winning bid as the dependent variable, the effect of Proposition 209 seems to come entirely from the within firm effect. The coefficient on the Post-209*State funded interaction term, controlling for firm effects, is -0.040 and insignificantly different from the value of -0.056 obtained using only item effects. This too suggests that Proposition 209 works primarily through the effect within the firm, rather than by changing the composition of bid winners.

4.4 DBE participation goals and the competitive environment

In a typical model of bidding behavior, a risk-neutral firm, conditional on its own cost draw, marks up its bid above costs by an amount dictated by the number of bidders and by the distribution from which costs are drawn. Eliminating affirmative action could lower the equilibrium bid without having a direct effect on a given firm's cost if doing so results in more bidders or an increase in the average quality of bidders.

Columns (1) and (3) of Table 4 show specifications estimating a regression determining the effect of Proposition 209 on the competitive environment faced by bidders. Column (1) reveals that the passage of Proposition 209 had no effect on the number of bidders on state-funded projects relative

[12] With the log specification, the weight given to items with small means is higher than the fraction of a project's cost that they represent, and the converse is true for items with large mean prices. While the average item price may have decreased by a certain percentage, no conclusion can be reached as to the effect on contracting overall. To correct for this, observations were weighted by $p_j q_{ij}/B_i$. The idea is to weight by the fraction of a project's costs that are accounted for by that particular item.

to federally funded projects. The coefficient on the Post-Proposition 209*State funded interaction term is 0.13, which is both statistically and economically insignificant, as the standard deviation of the number of bidders across auctions is approximately 2.8.

Even if the number of bidders did not change, the average quality of bidders could have increased after Proposition 209's implementation. To address this possibility, average bidder quality on a contract is measured by the number of bidders who have won bids for other contracts at some point during the sample. Column (3) shows the estimates of a regression of the number of winning bidders on the Proposition 209 treatment term. As with the regressions regarding the number of bidders, Proposition 209 seemed to have little impact on the average quality of bidders on a contract. The coefficient on the Proposition 209*State funded interaction term is -0.174, statistically insignificant and small relative to the average of 4 bidders per contract who have won a bid on another contract.

The specifications whose estimates are shown in columns (2) and (4) of Table 4 instead use variation across contracts in the DBE participation goal. The number of bidders is also insignificantly related to the participation goal - every ten percentage point increase in the participation goal results in 0.059 fewer firms submitting bids on a contract. From column (4), we see that this decline is mirrored by the number of auction winners submitting bids.

4.5 Participation goals and the make versus buy decision

As the theoretical discussion in section 2 suggested, California's affirmative action program could be costly if it distorts the decision of whether to complete portions of the contract in-house or subcontract them out. From the 1992 Census of Construction Industries, the average highway and street contractor pays 20.8% of its revenue to subcontractors. DBE subcontractor requirements averaged 12.1% prior to Proposition 209, indicating that if DBE and non-DBE subcontractors are substitutable, then we should expect little response in terms of total subcontracting to the DBE participation requirement. However, if DBEs are imperfect substitutes, for instance due to capital constraints making them unable to develop capabilities in certain specialties that are likely to be contracted out, then subcontractor participation goals are likely to significantly distort the contractor's make versus buy decision.

Table 5 shows estimates of the response of subcontracting to affirmative action. Column (1) of Table 5 shows that relative to federal aid contracts, the number of subcontractors used on state-funded contracts fell by 8.8 percent after Proposition 209. The dependent variable is the log of one plus the number of subcontractors employed. This measure is used since 8.1 percent of firms winning contracts use no subcontractors, and similar results obtain when the dependent variable is

instead $ln(subs)$. Using variation across contracts in the participation goal provides similar results. Increasing the participation goal by ten percentage points is associated with 19.0 percent more subcontractors being used. While it is possible that a decrease in the number of subcontractors could be unrelated to overall subcontractor utilization if a contractor compensates by awarding more to each subcontractor, the data indicates that subcontractor utilization is positively correlated with the number of subcontractors employed on a project. Finally, column (3) displays estimates from a specification where the DBE goal is instrumented using the policy change associated with Proposition 209. This specification yields marginally smaller estimates, indicating that a 10 percentage point increase in the minority goal increases subcontractor utilization by 18 percent.

4.6 Subcontractor Quality

How much of the decline in the winning bid can be explained by the subcontractors used? The model presented in section 2 suggests that one important source of costs with a subcontractor participation requirement is the difference in productivity between the market subcontractor and the restricted set of DBE subcontractors. In the absence of discrimination, restricting the choice set of contractors leads to less efficient subcontractors being chosen.

To investigate to what extent affirmative action affects firm bids through the its effect on the mix of subcontractors employed, I form subcontractor dummy variables by matching subcontractors by name across contracts. I then include these subcontractor fixed effects in the specification of the winning bid and the item level specification.

Table 6 presents the results of this estimation. For comparison purposes, column (1) shows again the full contract level specification that was originally presented in Table 2. The specification presented in column (2) includes controls for subcontractor dummies. With these controls, the coefficient on the Prop. 209*State funded interaction term becomes -0.006 and statistically insignificant. This indicates that the change in the mix of subcontractors after Proposition 209's implementation can explain all of the decline in the winning bid on state funded contracts.

Columns (3) and (4) show the results for a similar exercise with the item level specification, and a similar pattern emerges. Once subcontractor dummies are included in the specification, the estimated effect of Proposition 209 on state funded contracts is cut by more than half to -0.025. This suggests that an estimated 55 percent of the decline in bids on state funded contracts after Proposition 209 can be explained by changes in the subcontractors employed.

In Table 7 I examine the subcontractor fixed effects further. The specifications displayed in this table involve regressing the estimated subcontractor fixed effects on the racial composition of

the firm's zip code. While I do not directly observe whether a particular firm is minority owned, Marion (2007b) shows that minority-owned highway subcontractors are more likely to be located in zip codes with a higher minority population share. The estimates indicate that the minority composition of the firm's zip code is significantly positively related to the subcontractor's fixed effect. An increase in a zip code's minority population share of 10 percentage points is associated with a 4.5 percent higher fixed effect. Since the likelihood a firm in a zip code is minority may increase non-linearly in the minority population share, in column (2) I examine the subcontractor fixed effect for firms located in zip codes with at least 60 percent minority population, finding that these firms have a fixed effect 17.9 percent higher than firms in areas where less than 60 percent of the population consists of minorities.

The higher cost experienced by subcontractors in predominantly minority zip codes seems to be due to the city the firm is located in. The specifications shown in columns (3) and (4) include city fixed effects, and doing so drives the estimated coefficient on minority concentration in the zip code to zero.[13] Much of the effect of affirmative action could therefore derive not from a difference in productivity between minority and non-minority firms in the same location, but from forcing contractors to hire subcontractors from higher cost areas.

4.7 Timing

A reasonable concern of the empirical specifications in the previous sections are that they constrain the coefficient on the state funded indicator to be constant over time, with a shift downward at the time of the implementation of Proposition 209. However, if there are time-varying unobserved factors leading to differences between state and federally funded contracts, then the difference-in-difference model will be misspecified.

For instance, suppose the specification given in (7) were rewritten as follows:

$$p_{ijt} = \pi_{21}' X_{ijt} + \pi_{22t} D_{it} + \varphi_t + \gamma_j + \varepsilon_{ijt}. \tag{8}$$

In the model described in section 4.3, π_{22t} is constant for $t \geq t_0$ and for $t < t_0$. If there is a decline in π_{22t} prior to Proposition 209, or if the decline occurs much later, then it is likely that unobserved differences are driving the estimated shift in the prices of items on state funded contracts relative to federal aid contracts rather than the elimination of subcontractor requirements.

This section takes a graphical approach to examine the timing of the break between state funded and federal aid projects. A permanent decline in the π_{22t} series at the time of Proposition 209's

[13] It is possible to identify subcontractor effects for 770 firms, and these firms are spread across 239 cities.

implementation would be consistent with a decline in the winning bid on state funded projects as a result of Proposition 209. Panel A of Figure 3 plots the time varying coefficients for state funded contracts $\pi_{22t} + \varphi_t$ against that for federally funded projects, φ_t, while Panel B plots the difference in the two series, π_{22t}, along with two standard error confidence bands. This figure shows that prices on state funded contracts shifted permanently downward relative to federal aid contracts near the time of Proposition 209's implementation, though this may occur in the quarter before Proposition 209's implementation. The estimated difference between state funded and federally funded contracts in the quarter prior to Prop. 209 is not statistically significant, which leaves open the possibility that this is merely a statistical anomaly.[14] If this is a real phenomenon, there may be two factors contributing to the early appearance of a difference between the two series. First, state funded contracts using affirmative action that had been auctioned but not yet awarded at the time of Governor Wilson's executive order were postponed. The observed contracts in the first quarter of 1998 are therefore a selected sample. Second, it is conceivable that forward looking bidders may have been able to anticipate when the ruling in the Monterey Mechanical case was to occur, and therefore anticipated being able to replace DBE subcontractors they had previously committed to using.

A similar approach can be taken in examining the pattern of the winning bid, subcontractor hiring, and bidder participation over time. Figure 4 plots the time-varying coefficients for the contract level specification of the winning bid. We see that in the quarter after the implementation of Proposition 209, the winning bids on state funded contracts fell relative to the federal aid contracts. They remained lower for another quarter before increasing to a level that appears on average the same as the federal aid contracts.

As mentioned earlier, a concern with this specification is that the engineer's estimate may incorporate the effects of eliminating the DBE goal, perhaps with a lag. If this is so, then the engineer's estimate will become less informative on state funded contracts after the implementation date, yet its accuracy will improve over time to its previous levels. To provide evidence consistent with this, I estimate a regression of the log of the winning bid on the log engineer's estimate separately by quarter and by funding source. I then plot the R-squared of these regressions over time for state funded and federal aid projects. The results are displayed in Figure 5, where we see that the

[14] Due to Wilson's executive order occurring in the first week of March, I include only January and February in defining the first quarter of 1998, while the second quarter of 1998 is extended to include March, the month of implementation. This combined with the fact that fewer contracts are awarded during the winter months limits the sample size for this period. I observe only 55 contracts in the first quarter of 1998 compared with 103 in the last quarter of 1997 and 319 in the second quarter of 1998.

fraction of the variance of the winning bid explained by the engineer's estimate declines noticeably for state funded projects post-Proposition 209, yet recovers over time to its pre-Proposition 209 levels.

Figure 6 plots the time-varying state funded*year coefficients from a specification determining the log number of subcontractors. The gap between state funded and federal-aid contracts widens noticeably and permanently in the second quarter of 1998, which coincides with the implementation of Proposition 209. Unlike with item prices, the break in the subcontractor series occurs in the quarter of Proposition 209's implementation. In reconciling this finding with the time path of item prices, this is consistent with the item price residual either being an anomaly or firms anticipating Proposition 209's implementation. A firm who anticipates the implementation may be able to incorporate this expectation into its bid. However if it does so with respect to its reported hiring of DBE subcontractors, it risks its bid being rejected for failing to meet the DBE goal. With no affirmative action requirements, DBE subcontractors can later be substituted.

Finally, Figure 7 displays the time varying coefficients for state funded projects in the bidder participation specification. Federal aid projects on average have slightly more bidder participation on average, but consistent with the results described in section 4.4, the difference between the two seems uncorrelated with Proposition 209.

4.8 Barriers to Entry and Expansion and the Effect of the DBE goal

Barriers to entry and expansion into the highway procurement market may be significant for DBEs. This could lead to restricted competition and market power in some markets, or an upward sloping DBE supply curve. The pre-qualification process, which requires past experience, and the need for bonding both represent barriers to entry into this market. Furthermore, DBEs may face imperfect access to capital, leading to an inability to enter the procurement market or expand to take advantage of new opportunities. This will interact with affirmative action, which shifts out the demand from DBEs.

In this section, I consider shifts in the short-run demand for DBEs to examine the effect of barriers to entry and expansion on the cost of setting DBE goals. To do so, I measure the value of upcoming opportunities for DBE firms through the affirmative action program. Upcoming projects are advertised with a lead time of between four and ten weeks. Consider an project being auctioned at time t. I measure the total value of upcoming auctions within the project district using the sum of the engineer's estimate across all projects being auctioned between t and $t+6$, $alloppps6_j = \sum_i v_i I(t < s < t+6)$, where $I(.)$ indicates that week s of project i

falls between t and $t+6$, and v_i is the value of the engineer's estimate. The value of upcoming DBE projects sums the value of upcoming auctions in the district multiplied by the DBE goal g_i: $dbeopps6_j = \sum_i g_i v_i I(t < s < t+6)$.

To examine how the interaction between the DBE goal and upcoming opportunities effects the winning bid, I estimate the following specification:

$$ln(B_j) = \beta_0 + \beta_1 G_j * ln(dbeopps6_j) + \beta_2 G_j + \beta_3 ln(dbeopps6_j) + \beta_4 ln(allops6_j) + BX_j + \epsilon_j \quad (9)$$

where B_j is the winning bid on project j. In this specification, the DBE goal, G_j, interacts with upcoming DBE opportunities, and the effect of this interaction is captured by the coefficient β_1. Upcoming opportunities may have an effect on the bidding behavior of firms, as noted by Jofre-Bonet and Pessendorfer (2003), and so these are controlled for directly with the variable $allops6_j$. The vector X_j contains all other observable factors shifting the winning bid.

In the above specification, the effect of the DBE goal on the firm's bid differs depending on the upcoming DBE opportunities within the same district. A positive sign for β_1 can represent one of two factors. When a firm submits a bid, it must list subcontractors it has hired. When negotiating the price with subcontractors, the presence of upcoming DBE opportunities raise the negotiating power of DBEs by improving their outside option. Alternatively, even if subcontractors price at marginal cost when upcoming options are present, capacity constraints could lead the interaction term β_1 to be positive. Serving as the subcontractor on the present project increases future marginal cost, and this represents an opportunity cost that will be reflected in the current price charged to the prime contractor. Both channels require barriers to entry or expansion.

Table 8 presents the results of estimating (9). The specification shown in column 1 only includes in the covariate vector X_j the log of the engineer's estimate, while the specification shown in column 2 includes the full set of controls. In either case, the estimates show that the effect of the DBE goal is greater on a project when the volume of DBE opportunities in the same district within the next six weeks is greater. The coefficient estimate of β_1 is 0.084 without controls and 0.083 with controls. To put this number in perspective, consider that increasing $ln(dbeops6_j)$ 2.18 from its mean, or one standard deviation, would increase the estimated effect of the DBE goal from 0.30 to 0.48.

Due to the large change in the state-funded DBE program surrounding Proposition 209 and the apparent effect this had on contractor costs, it may be desirable to exclude auctions taking place in the first two months of 1998. The specifications shown in columns 3 and 4 estimate the same empirical model excluding these months. When these months are excluded, the estimates of β_1 change little to 0.088 without controls and 0.092 with controls.

5 Conclusion

This paper considers an open question, how affirmative action affects the cost of government contracting. This question is made significant by the widespread use of affirmative action in contracting. The preferred specification employed in this study implies that a road construction project costs the government 5.6 percent less to complete after the elimination of the affirmative action program in California. This is significant given that the variation induced by Proposition 209 reduced participation goals by 9.0 percent on state-funded contracts relative to federally funded contracts. The savings to California from eliminating affirmative action were significant. After Proposition 209 was implemented in early March 1998, California awarded $1.14 billion of state funded contracts in the remainder of 1998 and 1999. This suggests that eliminating affirmative action saved an estimated $64 million in these two years.

Empirical support is found for a significant distortion of firms' make versus buy decision as a result of the requirements, which is not necessarily related to the difference in productivity between DBE and non-DBE subcontractors. However, most of the decline in bids is attributed to an improved mix of subcontractors employed after Proposition 209.

A potential shortcoming of this empirical approach is that only contemporaneous changes in costs are considered, and the current market structure is taken as fixed. The long-run market structure, however, could be sensitive to the affirmative action program, and firms that get a foothold because of it could turn into bidders on contracts in the future. The results here indicate that an additional bidder reduces the winning bid by approximately 2.6 percent. For the California affirmative action program to reduce costs, it would need to produce an average of more than two additional bidders per contract, a high figure relative to the current average of 5.4 bidders.

It seems unlikely, then, that the affirmative action program itself is cost effective. However, the positive externalities that may accrue through increased minority entrepreneurship and employment very well could tip the scales in its favor. The evidence, both theoretical and empirical, is mixed on the extent to which disadvantaged firms benefit from preferential treatment in contracting. Further work in this area will allow for a more complete program evaluation.

APPENDIX 1

Table A1.1: Twenty-five Most Commonly Used Items

	Item Description	Number of contracts	Mean Price	Stand. Dev. of Price
1	THERMOPLASTIC. PAVEMENT MARKING	1667	43.16	17.46
2	ROADWAY EXCAVATION	1653	0.04	0.04
3	PAVEMENT MARKER (REFLECTIVE)	1362	4.53	2.24
4	MINOR CONCRETE (MINOR STRUCTURE)	1174	1.52	0.77
5	TEMPORARY RAILING (TYPE K)	1149	50.04	22.18
6	PAINT TRAFFIC STRIPE (2-COAT)	1130	1.86	2.42
7	CLASS 2 AGGREGATE BASE	1080	0.06	0.04
8	PAVEMENT MARKER (NON-REFLECTIVE)	1072	2.64	1.83
9	PLACE ASPHALT CONCRETE (MISCELLANEOUS AREA)	1030	47.4	49.47
10	PORTABLE CHANGEABLE MESSAGE SIGN	965	6952.21	5652.24
11	TEMPORARY CRASH CUSHION MODULE	926	263.15	81.01
12	MISCELLANEOUS IRON AND STEEL	922	3.66	2.04
13	THERMOPLASTIC TRAFFIC STRIPE (SPRAYABLE)	913	1.38	1.83
14	ASPHALTIC EMULSION (PAINT BINDER)	907	0.35	0.31
15	200 MM THERMOPLASTIC TRAFFIC STRIPE	877	3.02	1.5
16	100 MM THERMOPLASTIC TRAFFIC STRIPE	855	1.93	2.22
17	CHANNELIZER (SURFACE MOUNTED)	840	34.43	9.25
18	REMOVE ASPHALT CONCRETE DIKE	755	10.55	10.61
19	ROADSIDE SIGN - ONE POST	748	215.51	74.9
20	TERMINAL SYSTEM (TYPE SRT)	726	2269.7	409.56
21	IMPORTED MATERIAL (SHOULDER BACKING)	725	0.04	0.03
22	METAL BEAM GUARD RAILING (WOOD POST)	688	95.67	51.6
23	REMOVE PAVEMENT MARKER	669	1.51	1.14
24	ASPHALT CONCRETE (TYPE A)	654	0.08	0.06
25	PAVEMENT MARKER (RETROREFLECTIVE)	654	4.79	2.87

A1.1 How meaningful are item prices?

While the bidder reports unit prices for each item listed on the contract, the contract is won or lost on the basis of the total bid. Evidence has been presented that suggests that the item prices are not strategically placed by the bidder, and Caltrans has indicated that it examines bids to ensure the accuracy of the item prices. However, the concern might still remain that the prices given by the bidders do not contain the information one obtains from observing prices in a market.

Often within broad categories of items, different of items are identical except for their size. For instance, the same type of pipe could come in different diameters. Using items that vary only by size, Table A1.2 estimates the relationship between the log size of an item and the mean price listed across contracts, controlling for the item group (eg, a certain type of pipe). Clearly, the

Table A1.2: Are the Item Prices Meaningful? Compare items that vary only by size

Dependent variable: log of the mean bid of item j	
Ln(size)	0.44
	(0.02)***
Constant	-0.06
	(0.01)***
Item group effects	Yes
Within item R-Square	.36
Observations	820

The given prices of items that vary only by size are compared. The price for an item of a particular size is averaged across all contracts on which it appears. The average price for an item is then regressed on its size, controlling to the size-independent product group to which it belongs.
To account for variance in measuring the item means, observations are weighted by the number of price observations used in calculating the mean.
*,**,*** denote significance at the 90%, 95%, and 99% level, respectively.

relationship between item size and its price will vary greatly depending on the item group. The true price-size gradient may even be negative for some items considering the fact that larger items may be easier to produce. Despite these limitations, the results indicate a very strong relationship between ln(price) and ln(size). A 10 percent increase in size results in a 4.4 percent increase in price, and 36 percent of the within item group variation in mean price can be explained by the size. This provides suggestive evidence that the item prices represent real differences between items.

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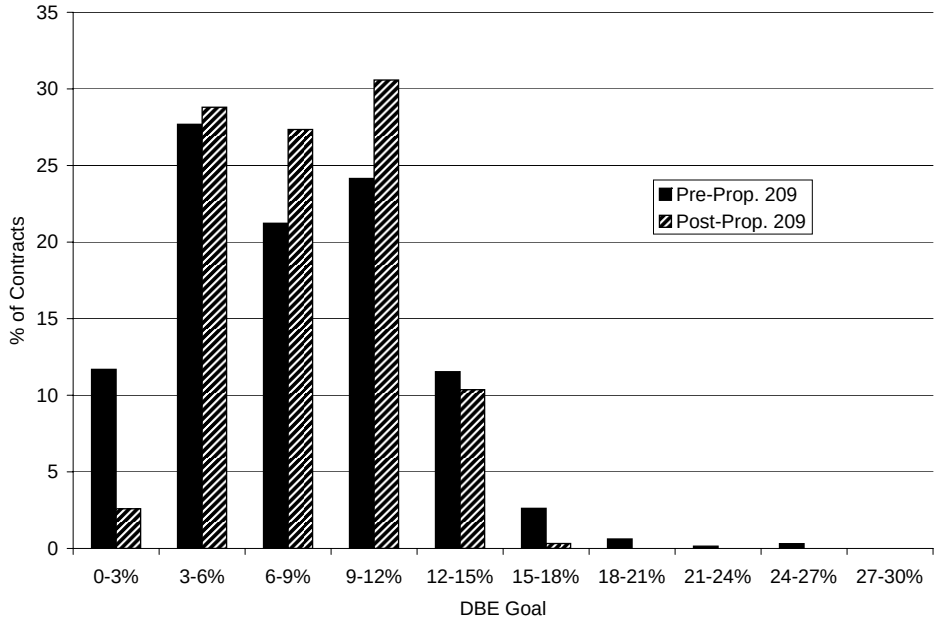
[25] McCrary, Justin. (2007) "The Effect of Court-Ordered Hiring Quotas on the Composition and Quality of Police," *The American Economic Review* 97:1, p. 318-353.

Figure 1: Distribution of DBE Participation Requirement

Panel A: Federal Aid Contracts



Panel B: State Funded Contracts Pre-Prop. 209

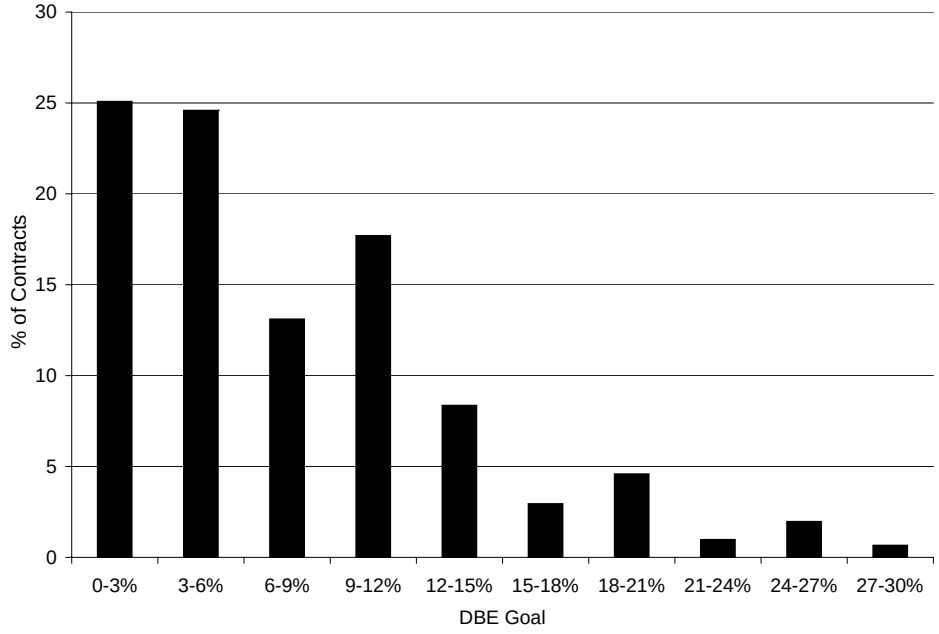
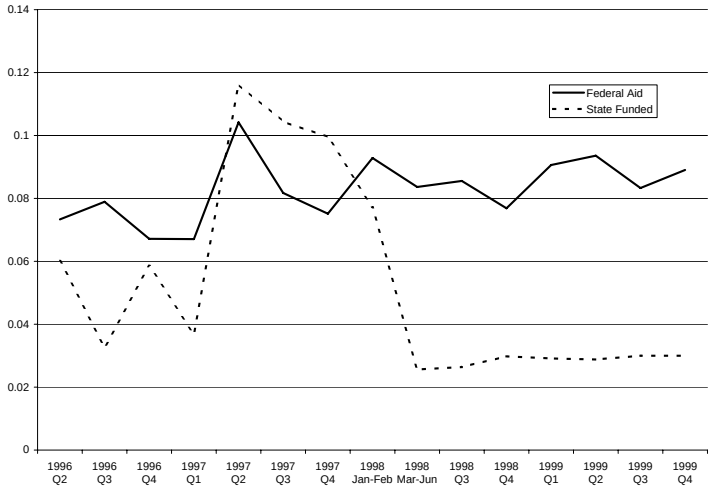
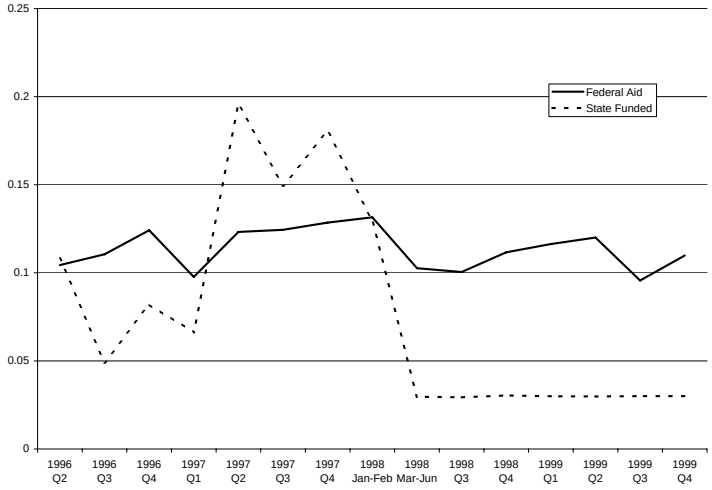


Figure 2: Mean DBE Participation Requirement By Quarter, Weighted by Winning Bid

Panel A: Unweighted Average



Panel B: Average Weighted by Winning Bid



Panel C: Residual DBE Goal

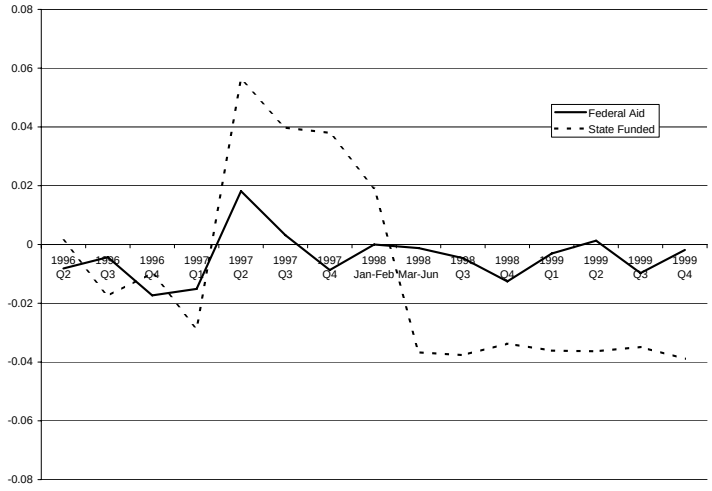
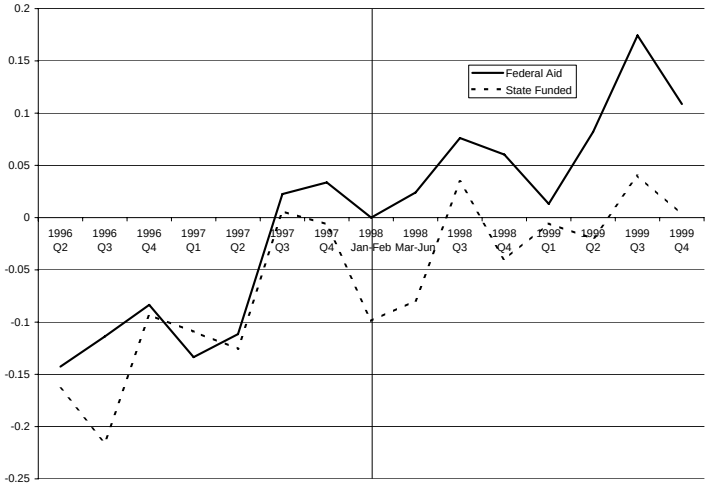


Figure 3: Residual Item Prices by Quarter

Panel A: State versus federally funded



Panel B: Difference

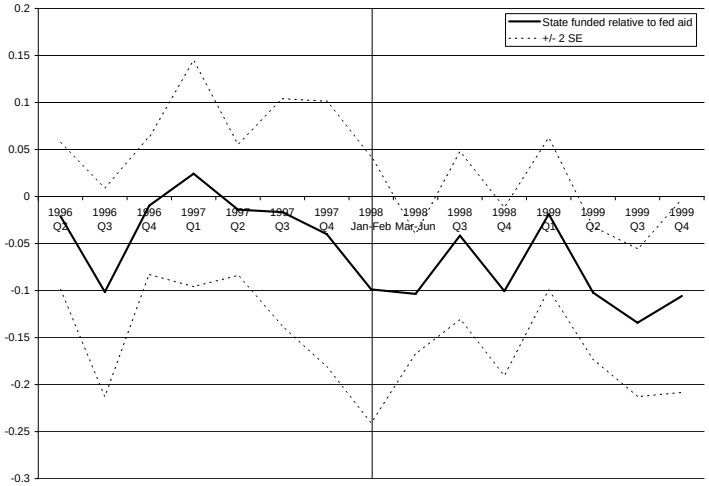
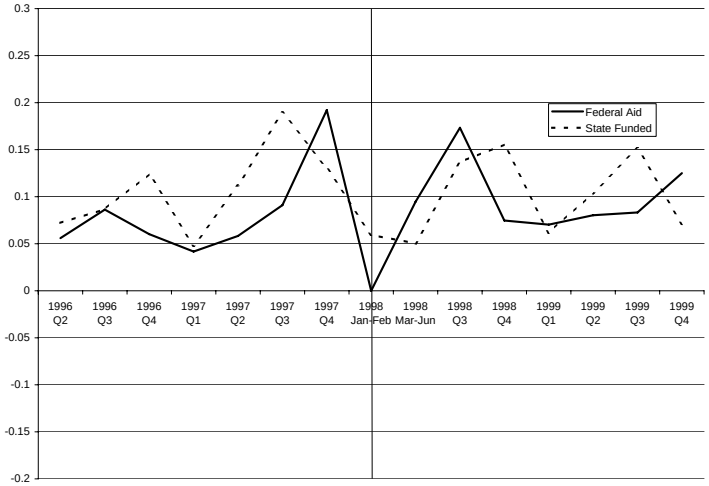


Figure 4: Residual Winning Bid by Quarter

Panel A: State versus federally funded



Panel B: Difference

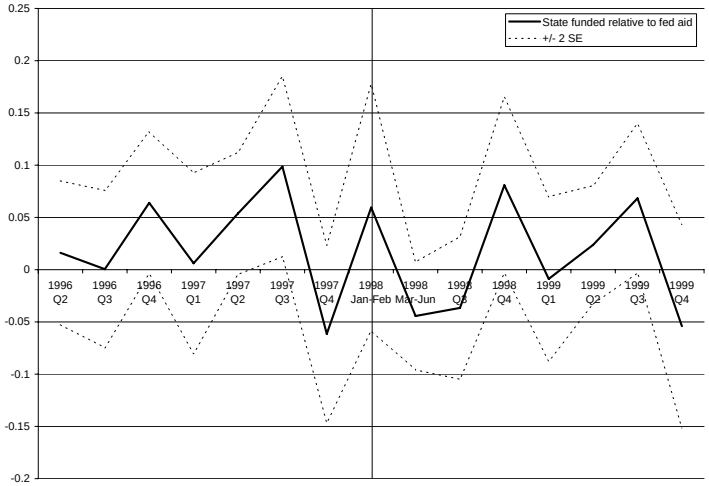
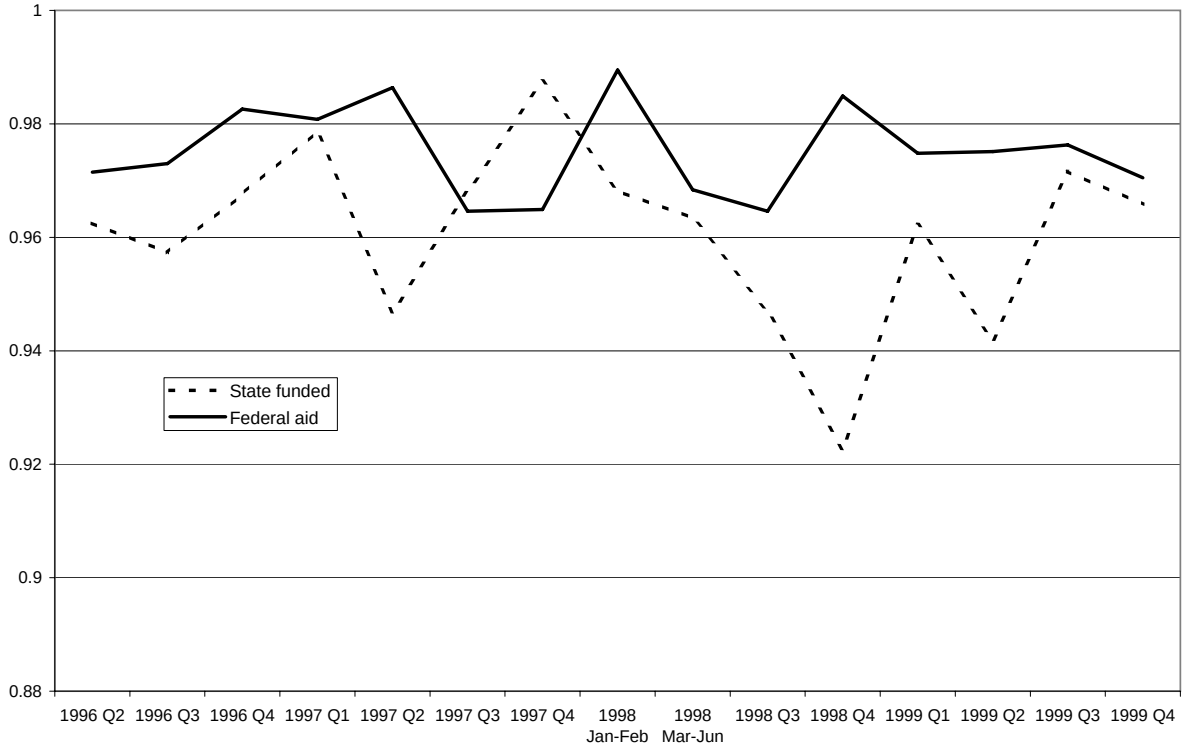


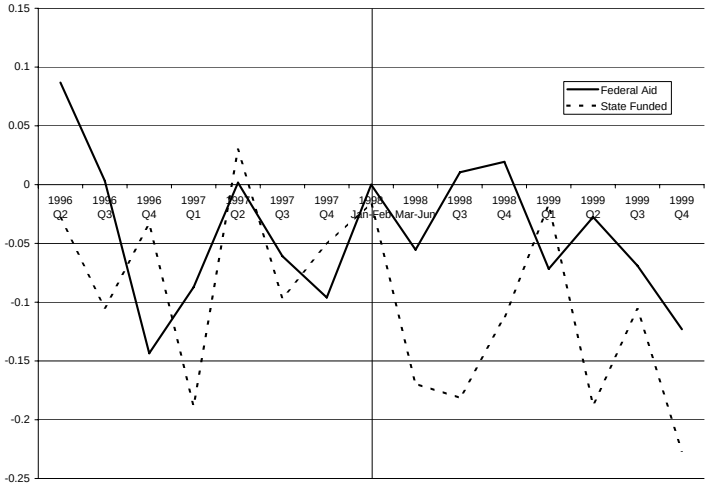
Figure 5: Explanatory Power of Engineer's Estimate by Quarter



Note: This figure plots the R-squared from a regression of the log of the winning bid on the log of the engineer's estimate, which is estimated separately by quarter and by funding source.

Figure 6: Residual Log Number of Subcontractors by Quarter

Panel A: State versus federally funded



Panel B: Difference

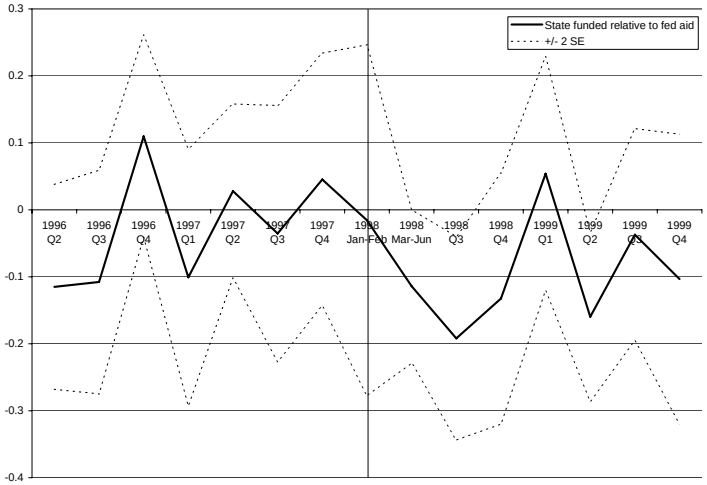
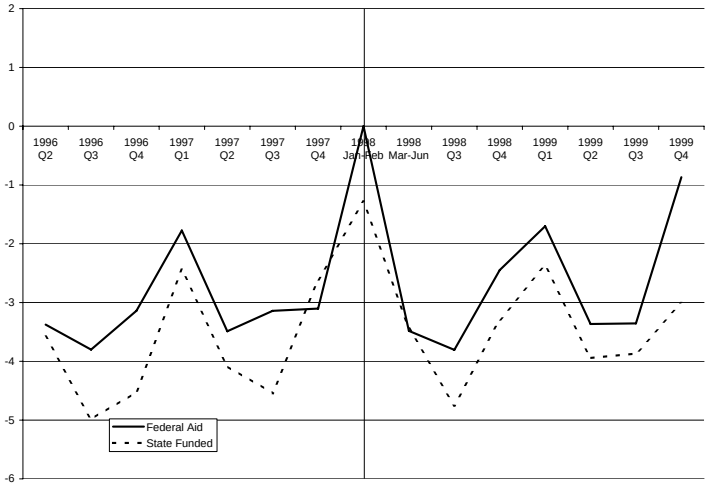


Figure 7: Residual Number of Bidders by Quarter

Panel A: State versus federally funded



Panel B: Difference

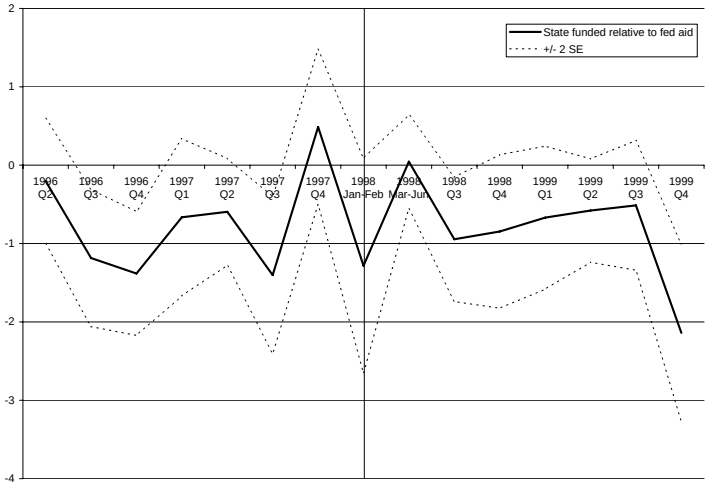


Table 1: Average Contract Characteristics, Pre- and Post-Proposition 209

Winning bid	\$1.29 million	\$1.66 million	\$2.87 million	\$2.94 million
	(5.31)	(9.03)	(7.25)	(5.12)
Engineer's Estimate	\$1.38 million	\$1.86 million	\$3.15 million	\$3.15 million
	(5.15)	(10.9)	(8.03)	(5.45)
Bid/Estimate	0.963	0.918	0.938	0.956
	(0.007)	(0.006)	(0.007)	(0.006)
Difference	-0.045		0.168	
	(0.009)		(0.010)	
Difference-in-difference		-0.062		
		(0.014)		
Total DBE participation goal	13.22%	2.98%	11.83%	10.79%
	(7.29)	(0.28)	(3.73)	(3.20)
Number of subcontractors	3.82	3.32	5.15	5.43
	(3.54)	(3.55)	(3.78)	(3.31)
Number of bidders	5.35	5.24	5.62	5.4
	(2.67)	(2.78)	(2.83)	(2.88)
Number of workdays	135.32	146.86	191.79	163.06
	(205.85)	(245.30)	(253.48)	(212.04)
Number of items	22.97	21.67	44.09	44.1
	(28.61)	(30.29)	(44.37)	(36.85)
N	612	687	650	622

The pre-Proposition 209 period includes all contracts let between May 1996-February 1998. The post period includes March 1998-December 1999. Bid/estimate is the weighted average of the ratio of the winning bid to the engineer's estimate.
Participation goals are weighted by the value of the winning bid in the calculation of the mean.
Standard deviations are given in parenthesis.

Table 2: Proposition 209 and the Winning Bid

	OLS	OLS	OLS	IV	OLS
	(1)	(2)	(3)	(4)	(5)
Post-209*State funded	-0.014	-0.031			-0.041
	(0.017)	(0.019)*			(0.021)*
DBE Part. Goal			0.308	0.622	
			(0.121)**	(0.378)*	
Post-Prop. 209	0.008				
	(0.012)				
State funded	0.003	0.031	0.017	0.020	0.034
	(0.012)	(0.014)**	(0.011)	(0.011)*	(0.016)**
Log(estimate)	0.990	0.954	0.951	0.948	0.952
	(0.003)***	(0.006)***	(0.006)***	(0.007)***	(0.008)***
Log(workdays)		0.033	0.031	0.031	0.018
		(0.008)***	(0.008)***	(0.008)***	(0.011)
Log(# items)		0.048	0.044	0.040	0.060
		(0.008)***	(0.008)***	(0.009)***	(0.010)***
Constant	0.053	0.725	0.663	0.610	0.780
	(0.047)	(0.131)***	(0.120)***	(0.121)***	(0.161)***
Firm Effects	N	N	N	N	Y
Observations	2571	2569	2569	2569	2569
R-squared	0.97	0.98	0.98	0.98	0.99

Robust standard errors are in parentheses.
*,**,*** denote significance at the 90%, 95%, and 99% level, respectively.
The specifications shown in columns 2-5 control for quarter*year dummies, type of work dummies, as well as road and county effects.
The specification shown in column 4 instruments for the DBE participation goal using the post-209*state funded interaction.

Table 3: Item Level Regression

Dependent variable: log of price of item j on contract i

	OLS	OLS	OLS	IV	OLS
	(1)	(2)	(3)	(4)	(5)
Post-209*State funded	-0.032	-0.056			-0.040
	(0.029)	(0.023)**			(0.021)*
DBE Participation Goal			0.282	0.826	
			(0.149)*	(0.382)**	
Post-209	0.111				
	(0.018)***				
State funded	0.063	-0.008	-0.037	-0.029	-0.021
	(0.022)***	(0.019)	(0.014)***	(0.015)*	(0.017)
Log(number of items)		-0.025	-0.028	-0.039	-0.036
		(0.012)**	(0.012)**	(0.014)***	(0.012)***
Log(quantity)		-0.292	-0.290	-0.293	-0.280
		(0.006)***	(0.006)***	(0.006)***	(0.006)***
Specialty item		-0.083	-0.081	-0.085	-0.056
		(0.024)***	(0.024)***	(0.024)***	(0.021)***
Fixed cost item		0.027	0.024	0.025	-0.014
		(0.030)	(0.030)	(0.030)	(0.030)
Log(workdays)		0.150	0.143	0.139	0.152
		(0.014)***	(0.014)***	(0.014)***	(0.014)***
Constant	0.126	3.896	3.651		3.541
	(0.013)***	(0.209)***	(0.197)***		(0.189)***
Observations	69623	69592	69623	69623	69623
R-squared	0.98	0.99	0.99		0.99

The sample includes items within contracts between May 1996 - December 1999. Only the low bidder was considered. Proposition 209 was implemented in March 1998.

Columns 2-5 also include controls for quarter*year, type of work dummies, and county and road effects.

The reported coefficients are from regressions at the item level, where the dependent variable is the log of the unit price place on a particular contract item.

Robust standard errors, corrected for clustering by contract, are in parenthesis.

*,**,*** denote significance at the 90%, 95%, and 99% level, respectively.

Items are weighted by $p_{ij}q_{ij}/B_i$ so that the coefficients can be interpreted as the percentage effect on the cost of contracting.

The specification shown in column 4 instruments for the DBE participation goal using the post-209*state funded interaction.

Table 4: DBE Participation Goals and the Bidding Environment

	Dependent variable:			
	Number of bidders		Number of winning bidders	
	(1)	(2)	(3)	(4)
Post-209*State funded	0.132		0.174	
	(0.221)		(0.197)	
DBE Participation Goal		-0.591		-0.602
		(1.394)		(1.248)
State funded	-0.738	-0.675	-0.692	-0.607
	(0.172)***	(0.129)***	(0.154)***	(0.115)***
Constant	11.831	10.508	6.846	8.046
	(1.372)***	(1.348)***	(1.204)***	(1.231)***
Observations	2568	2568	2569	2569
R-squared	0.31	0.31	0.28	0.28

Sample period is May 1996-Dec 1999.
The dependent variable in columns (3) and (4) are the number of firms bidding on a particular contract who have won at least one bid on a contract between 1996 and 2002.
Other controls include quarter*year dummies, log engineer's estimate, log project workdays, log number of items, category of work, county effects, and road effects.
Robust standard errors are in parentheses.
*,**,*** denote significance at the 90%, 95%, and 99% level, respectively.

Table 5: DBE Participation Goals and Subcontractor Usage

Dependent variable: Log(1+ number of subcontractors)

	OLS	OLS	IV
	(1)	(2)	(3)
Post-209*State funded	-0.088		
	(0.042)**		
DBE Participation Goal		1.871	1.773
		(0.266)***	(0.836)**
State funded	-0.020	-0.048	-0.049
	(0.033)	(0.024)**	(0.025)*
Constant	-0.357	-0.083	-0.092
	(0.347)	(0.330)	(0.338)
Observations	2569	2569	2569
R-squared	0.59	0.59	0.59

Other controls include quarter*year dummies, log engineer's estimate, log project workdays, log number of items, category of work, county effects, and road effects.

Robust standard errors are in parentheses.

*,**,*** denote significance at the 90%, 95%, and 99% level, respectively.

Table 6: Controlling for Subcontractor Effects

	Contract-Level Regression		Item-level Regression	
	(1)	(2)	(3)	(4)
Post-209*State funded	-0.031	-0.006	-0.056	-0.025
	(0.019)*	(0.028)	(0.023)**	(0.026)
Post-Prop. 209	0.031	0.027	-0.008	-0.033
	(0.014)**	(0.021)	(0.019)	(0.022)
Log(estimate)	0.954	0.940		
	(0.006)***	(0.010)***		
Log(workdays)	0.033	0.048	0.151	0.170
	(0.008)***	(0.012)***	(0.014)***	(0.016)***
Log(# items)	0.048	0.062	-0.025	-0.039
	(0.008)***	(0.014)***	(0.012)**	(0.018)**
Log(quantity)			-0.292	-0.316
			(0.006)***	(0.006)***
Specialty item			-0.083	-0.079
			(0.024)***	(0.023)***
Fixed cost item			0.026	0.030
			(0.030)	(0.028)
Constant	0.725	0.618	3.777	4.301
	(0.131)***	(0.251)**	(0.211)***	(0.540)***
Subcontractor dummies	N	Y	N	Y
Observations	2569	2569	69589	69589
R-squared	0.98	0.99	0.99	0.99

The sample includes contracts between May 1996 - December 1999. Proposition 209 was implemented in March 1998. Controls also include quarter*year dummies, and county and road effects.

The dependent variable in columns (1) and (2) is the log of the winning bid on each contract. The dependent variable in columns (3) and (4) is the log of the item price in the contract with the lowest bid.

Robust standard errors, corrected for clustering by contract in the specifications in columns (3) and (4), are in parenthesis.

*,**,*** denote significance at the 90%, 95%, and 99% level, respectively.

In the item-level specifications, items are weighted by $p_{ij}q_{ij}/B_i$ so that the coefficients can be interpreted as the percentage effect on the cost of contracting.

Table 7: Firm location and subcontractor fixed effects

Dependent variable: Subcontractor fixed effect

	(1)	(2)	(3)	(4)
Fraction of firm zipcode minority	0.450		0.004	
	(0.059)***		(0.065)	
Zipcode minority fraction>.6		0.179		-0.013
		(0.033)***		(0.040)
Constant	-0.508	-0.376	-0.331	-0.326
	(0.029)***	(0.020)***	(0.029)***	(0.018)***
City Fixed Effects	N	N	Y	Y
Observations	770	770	770	770
R-squared	0.08	0.03	0.65	0.65

Robust standard errors are in parentheses.

*,**,*** denote significance at the 90%, 95%, and 99% level, respectively.

Dependent variable is the subcontractor effect estimated in the specification displayed in column (6) of Table 6

Table 8: DBE Goals and Upcoming DBE Opportunties

Dependent variable: Log bid

	Full sample		Excluding Jan, Feb 1998	
	(1)	(2)	(3)	(4)
DBE Goal*Log DBE Opportunities	0.084	0.083	0.088	0.092
	(0.037)**	(0.039)**	(0.038)**	(0.041)**
DBE Goal	0.349	0.296	0.363	0.295
	(0.094)***	(0.120)**	(0.095)***	(0.122)**
Log DBE Opportunities	-0.004	-0.003	-0.004	-0.003
	(0.006)	(0.006)	(0.006)	(0.006)
Log Total Upcoming Contracts	-0.001	-0.001	-0.001	-0.001
	(0.006)	(0.006)	(0.006)	(0.006)
Log(Estimate)	0.984	0.953	0.983	0.952
	(0.003)***	(0.006)***	(0.003)***	(0.006)***
Other controls	N	Y	N	Y
Observations	2355	2353	2302	2300
R-squared	0.98	0.98	0.97	0.98

Robust standard errors are in parentheses.

*,**,*** denote significance at the 90%, 95%, and 99% level, respectively.

The observations are at the contract level. DBE opportunities are defined as the sum of the DBE goal multiplied by the engineer's estimate on contracts open for bid within the following six weeks within the same district, and here is taken relative to its mean to make interpreting the coefficient on DBE goal easier. Log total upcoming projects is the log of the sum of the engineer's estimate for similarly defined upcoming projects. Controls are whether the contract uses state funds, log project workdays, log number of items, category of work, county effects, and road effects.