



## ABSTRACT

Government purchases of goods and services represent approximately 10 percent of the U.S. economy, and policy is commonly used to direct some of those purchases toward specific groups. Bid preferences in procurement auctions, which allow firms from an identifiable group an advantage in bidding against unfavored firms, and subcontractor participation goals that require participation of minority and women owned subcontractors, are two tools commonly used to achieve a particular allocation.

The first chapter of the thesis considers the effects of bid preferences on procurement costs, firm competition, and economic efficiency. While economic efficiency is expected to fall as a result of bid preferences, government procurement costs may either increase or decrease depending on the competitive response of favored and unfavored firms. Using data from California auctions for road construction contracts, where small businesses receive a five percent bid preference in auctions for projects using only state funds and no preferential treatment on projects using federal aid, I show that procurement costs are 3.5 percent higher on auctions using preferences. This increase cannot be explained by the bidding behavior of firms. Large firms bid 1.4 percent lower on auctions using bid preferences, while the lowest cost small firms increase their bid on preference auctions by 1.4 percent. The higher procurement cost in preference auctions is instead attributed to reduced participation by lower cost large firms.

Structural estimates of latent firm costs are then used to evaluate how efficiency and the division of surplus between firms and the government is impacted by the use of preferences. Firm profits are 9.8 percent lower on preference auctions, implying significant losses in economic efficiency. The efficiency loss associated with changing some auction winners from large firms to small firms is estimated to represent 0.7 percent of overall procurement costs; however, including the adverse effect of preferences on the participation of large firms increases the estimated efficiency loss to 6.5 percent.

The second chapter 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 winning bid on state funded contracts fell by 4-6 percent relative to federally funded projects, for which preferences still applied. The savings are not explained by compositional changes in bid winners or changes in the number and quality of bidders. The subcontractor goals are found to distort the contractor's make-versus-buy decision, which may explain some of the decline.

# Costs and Benefits of Affirmative Action in California Government Contracting\*

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## 1 Summary

- Government procurement represents approximately ten percent of the economy
- Affirmative action programs meant to increase purchases from minorities, women, and small businesses are common (eg., represent 10 percent of federal purchases)
- These programs encouraging entrepreneurship among disadvantaged groups are significant, yet little known about either their costs or benefits
- My thesis studies two forms of affirmative action
- Bid preferences for small businesses
  - Theoretically, awarding bid preferences for small businesses could reduce government costs due to their effect on the competitive behavior of large firms
  - I find that winning bids are actually 3.5 percent higher in California highway auctions using 5 percent bid preferences.
  - Bid preferences lead large firms to bid more aggressively, yet they tend to discourage large firm participation
  - Bid preferences are successful at redistributing public purchases, increasing purchases from small firms by 7 percent, indicating a cost of 50 cents for every dollar of increased purchases
- Subcontracting requirements for minority- and women-owned businesses (DBEs)
  - Contractors in California required to subcontract portion of contract to DBEs
  - The voter initiative Proposition 209 eliminated consideration of race or gender in the awarding of contracts
  - To preserve funding, Proposition 209 was not applied to federally funded projects
  - After Proposition 209, winning bids on state funded highway contracts fell by 4-6 percent
  - This change not explained by shifts in competitive environment
  - Subcontracting requirements result in fewer tasks completed by the contractor, which may explain some of the cost effect

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\*This is an executive summary of "Essays on Efficiency and Government Expenditures in Redistributive Public Procurement Programs."

## 2 Introduction

What are the effects of affirmative action in government contracting on business formation and the employment of minorities, and at what costs are these gains achieved? My current research agenda seeks to examine the impact of affirmative action in government contracting, and to understand how more effective affirmative action policies might be designed. In the two papers comprising my thesis, I first estimate the degree to which affirmative action in California highway construction auctions increases purchases from minority firms and small businesses. Second, I estimate the impact of these programs on the procurement cost to the state and which types of affirmative action programs might prove more cost effective at redistributing purchases across firms. This work suggests that affirmative action does in fact increase the costs of procurement. However, it leads to the conclusion that some forms of affirmative action are more cost effective than others. In fact, if a program could be designed that did not discourage the entry of non-favored firms, then government costs may actually be *lower* under an affirmative action program that uses bid preferences.

Beginning in the late 1970s and early 1980s, federal, state, and local governments began implementing preferential practices in procurement and contracting, with the aim of fostering minority entrepreneurship and employment. These programs became an important mechanism to encourage self-employment among disadvantaged groups. For instance, Chay and Fairlie (1998) describe these programs as “arguably...the most substantive pieces of antidiscrimination legislation passed since the 1964 Civil Rights Act and Executive Order 11246 in 1965.” 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.

Despite the magnitude and importance of affirmative action in public procurement, surprisingly little is known about the costs it may impose on the government, a fact pointed out by Holzer and Neumark (2000) in a review of the affirmative action literature. The only previous empirical work addressing this gap is Denes (1997), who considers contract set-asides for small businesses. Denes finds that set-asides have little effect on procurement costs, so my findings of a significant procurement cost effect represent an important finding in this literature. Only slightly more is known about what benefits accrue to minority- and women-owned firms, and even here the evidence is mixed. Myers and Chan (1996) find that minority set-asides in New Jersey had little effect on the number of contracts accruing to minority firms. Furthermore, Bates and Williams (1995,1996) find that minority firms selling to the government are not more likely to survive than minority firms not selling to the government. On the other hand, Chay and Fairlie (1998) find that self-employment rates for minorities grew fastest in those cities that adopted affirmative action policies.

This summary describes the two chapters of my thesis, which address the procurement cost and economic efficiency effects of affirmative action. In section 2, I describe the chapter of my thesis that examines requirements that contractors purchase from minority- and women-owned subcontractors. In section 3, I describe the chapter that looks at bid preferences for small businesses. Finally, section 4 concludes.

## 3 Minority- and Women-Owned Subcontractor Requirements

In March 1998, the CDOT implemented Proposition 209, which eliminated the consideration of race and gender in the award of government contracts. Prior to the implementation of Proposition 209, CDOT required all contractors to award a stated portion of each contract to minority- and women-owned subcontractors. The amount to be purchased from the Disadvantaged Business Enterprises

(DBE) was required to exceed a fraction of the value of the contract. This fraction, or “goal”, varied by contract depending on the supply of local DBEs and the type of work to be provided. Proposition 209 eliminated this goal, but only for projects entirely state funded. Projects using federal funds were required to retain the affirmative action program since its elimination would put those funds in jeopardy. This variation will provide a quasi-experimental setting to identify the effects of affirmative action.

### 3.1 Methodology

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:

$$\ln(B_{it}) = \alpha G_{it} + \beta X_{it} + \gamma_t + \eta_{it}, \quad (1)$$

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

A problem could arise in estimating (1) if unobserved factors contained in  $\eta_{it}$  are correlated with the government’s choice of  $G_{it}$ . In other words, since the goal is related to local conditions potentially correlated with project costs, variation in this goal is likely endogenous. To circumvent this problem, the passage of Proposition 209, interacted with federal aid status, could be used to instrument for the total goal on a project. The approach in this paper will be to estimate the associated reduced form equation

$$\ln(B_{it}) = \pi_{21}D_{it} + \pi_{22}D_{it}1(t \geq t_0) + \pi'_{23}X_{it} + \varphi_t + \varepsilon_{it}, \quad (2)$$

a difference-in-difference (DD) specification that compares the winning bid before and after Proposition 209 on state-funded versus federal-aid contracts, where  $D_{it}$  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  $\phi_t$ , and  $X_{it}$  represents a vector of project characteristics.

### 3.2 Data and Results

The data in this study consists of information for 2,555 highway construction contracts let by the California Department of Transportation between May 1996 and December 1999. For each contract being let, 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 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 its bid is given, as well as the location of the contractor and a list of subcontractors to be used.

First, to what extent does affirmative action lead to increased purchases from minority firms? For a subset of contracts, I observe the actual amount purchased from minority-owned subcontractors. Unfortunately this subset only includes federal-aid projects, so the quasi-experiment described in the methodology section is not available for this data. I find that participation goals increase the amount purchased from DBEs - a 10 percentage point increase in the DBE goal increases purchases by 6.8 percent.

At what cost does this increase come at? Table 1 displays estimates of (2). After including controls for the number of workdays, number of items, year and county and road effects, the coefficient becomes -0.039 and statistically significant, suggesting that the winning bid on state funded contracts fell by nearly 4 percent after the elimination of affirmative action.

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

Table 1: Proposition 209 and the Winning Bid

	(1)	(2)	(3)	(4)
Post-209*State funded	-0.018 (0.018)	-0.039 (0.019)**		-0.057 (0.022)***
DBE Participation Goal			0.424 (0.116)***	
Post-Proposition 209	0.007 (0.013)	0.116 (0.034)***	0.108 (0.033)***	0.108 (0.031)***
State funded	0.002 (0.013)	0.016 (0.014)	0.000 (0.011)	0.023 (0.016)
Constant	0.031 (0.050)	0.247 (0.246)	0.287 (0.245)	0.343 (0.179)*
Observations	2547	2546	2546	2546
R-squared	0.97	0.98	0.98	0.99

All columns control for the engineer's estimate, while columns 2 and 3 also control for type of work dummies, number of working days, number of items, as well as road, county, and year effects.

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 -0.057. 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.

Finally, the paper continues on to show that the reduction in the winning bid after Proposition 209's elimination is not due to a change in the competitive environment—the number of bidders and the quality of bidders are unchanged after Proposition 209. These results indicate that the cost of the bidders must be lower after the implementation of Proposition 209 since the ability of firms to markup over costs is unchanged. However, this fact does not necessarily lead to the conclusion that there are productivity differences between DBEs and non-DBEs. Even if the two types of firms are equally productive, DBE goals could increase procurement costs if they distort the contractor's decision of which projects to do itself and which to contract out. I find support for this hypothesis, as DBE goals lead almost dollar-for-dollar to more subcontracting overall. Furthermore, the use of subcontractors declined significantly after Proposition 209's implementation. Both of these results lend support to the notion that DBE goals potentially lead to a significant distortion of the contractor's make-versus-buy decision.

## 4 Are Bid Preferences a Benign Alternative?

Often in procurement auctions, a good or service is purchased from the firm who offers to provide it at the lowest cost. In California highway procurement auctions, preferential treatment is given to small businesses so that they need not submit the low bid in order to win the auction. When the state compares the bids of the small firms with those of the large firms in an auction, it adjusts the bids of the small firms downward. Auction theory indicates that this could have surprising implications for the average winning bid. By adjusting their bids downward, bid preferences make small firms

seem like stronger competition from the perspective of a large firm. This should result in large firms bidding lower than they would if bid preferences were not used. As a result, this form of affirmative action could lead to lower procurement costs while at the same time increasing purchases from small businesses.

If this result holds, this type of program could provide an alternative, more cost-effective means of transferring purchases to minority firms than the subcontractor participation goals discussed earlier. However, three factors could act to increase procurement costs. First, preferences may allow favored firms to increase their bid. Second, preferences transfer some contracts from low cost to high cost firms. Finally, the participation of large firms could be adversely affected, leading to higher cost participants or less competition. In this chapter of my thesis, I assess the effect of bid preferences on the winning bid of California highway auctions, and then divides this effect into the effect of bid preferences on firms' bidding behavior, the firm's participation, and economic efficiency. I find that both economic efficiency and procurement costs are adversely affected; however, this is largely due to the effect of bid preferences on the participation of large firms. Had participation remained unchanged, the average winning bid would have been lower on preference auctions.

## 4.1 Methodology

### REDUCED FORM

Bid preferences in this program are applied to auctions for contracts using only state funds and are not applied to auctions for contracts using federal funds. In the first portion of the paper, I exploit this distinction to identify the impact of preferences on bidding behavior and procurement costs. Suppose the log of the winning bid,  $\ln(B)$  on auction  $k$  is a function of the preference format used and a set of project specific characteristics:

$$\ln(B_k) = \alpha * PREFAUCTION_k + \beta' X_k + \epsilon_k. \quad (3)$$

The equation (3) will be estimated with and without including the number of bidders in the vector  $X_k$ . Excluding the number of bidders allows the coefficient  $\alpha$  to incorporate the correlation between the preference format used and firm participation. Included in the controls,  $X_k$ , will be the engineer's estimate, number of workdays, number of items to be provided, the minority subcontractor participation goal, indicators for broad work categories, as well as road, county, year, and month effects.

Conditional on auction participation, to what extent are firms responding to the use of bid preferences? Bid preferences can only lead to a fall in procurement costs if they lead large firms to bid more aggressively. Even if large firms bid more aggressively, if small firms respond by bidding more passively then the net effect of preferences on government costs could be positive. I model the log of the firm's bid as a linear function of a small business indicator, a preference auction indicator, and an interaction between these two. The equation to be estimated is as follows:

$$\ln(b_{ik}) = \beta_0 + \beta_1 SB_i * PREF_k + \beta_2 SB_i + \beta_3 PREF_k + B' X_k + \eta_i + \epsilon_{ik} \quad (4)$$

where  $SB_i$  is a small business indicator variable and  $PREF_k$  is an indicator for whether auction  $k$  uses preferences. Each specification will include in  $X_k$  the log of the engineer's estimate,  $\ln(ENGEST)$ , and dummy variables for each interaction of the number of small and large bidders.

Together, the estimates of  $\beta_1$  and  $\beta_3$  can be used to infer the effect of preferences on the behavior of small and large firms. For large firms (where  $SB = 0$ ), the coefficient  $\beta_3$  represents the extent to which large firms lower their bid in response to preferences. For small firms (where  $SB = 1$ ), the coefficient on the preference auction dummy is  $\beta_1 + \beta_3$ .

### STRUCTURAL ESTIMATION

Since they affect both procurement cost and the amount of goods purchased from small firms, bid preferences involve a transfer of economic surplus among small firms, large firms, and the government.



From a policy evaluation standpoint it is important to understand how the size of the surplus to be divided is impacted by preferences. If all firms simply bid their cost, then a regression specification with the winning bid as the dependent variable would provide an estimate of the efficiency loss associated with the use of preferences. Yet preferences affect both markup over cost as well the cost of the winning bidder. For that reason, the reduced form approach is unable to uncover the efficiency loss associated with preferences.

To remedy this shortcoming, I employ a structural model to study how efficiency loss is affected by the use of preferences. In the auction literature, efficiency loss is typically described by the difference between the lowest cost of the auction participants and the cost of the winning bidder. I will extend this definition here to include efficiency loss due to reduced firm participation as well, as this is an additional factor that could be influenced by bid preferences that alters the expected cost of the winning firm.

My thesis describes a model of bid preferences in a first price sealed bid auction setting, and the model is estimated using the nonparametric techniques of Guerre, Perrigne, and Vuong (2000) to obtain the latent costs of firms that are consistent with their bids given that the observed bids represent a Bayes-Nash equilibrium. These estimated costs are used in two ways. First, efficiency loss can be evaluated by comparing the cost of the winning firm with the cost of the low cost firm. Second, the cost distributions can be used to simulate auctions with and without preferences holding participation constant. This can allow us to decompose the loss in efficiency from bid preferences due to participation, and the loss in efficiency due to the direct switching effect where projects that would be awarded to a low cost large firm are instead awarded to a higher cost small firm.

## 4.2 Data and Results

The data in this study are the same as that described in the previous section. The only difference is the sample used. Here, I focus on those projects under \$1 million since the value of the bid preference is the maximum of 5 percent and \$50,000. Focusing on projects smaller than \$1 million ensures that the bid preference is proportionally the same across projects. Furthermore, small firm costs likely rise disproportionately with the scale of the project, while bid preferences fall in importance as the project size increases past \$1 million. This makes drawing inference regarding the effect of bid preferences on these large projects difficult.

Table 2: Preference auctions and the winning bid

	(1)	(2)	(3)
Preference Auction	0.035 (0.013)***	0.018 (0.013)	-0.005 (0.015)
Constant	-0.004 (0.175)	0.011 (0.160)	-0.783 (0.736)
Bidder Controls?	No	Yes	Yes
Firm Effects?	No	No	Yes
Observations	2685	2685	2685
R-squared	0.89	0.91	0.95

The dependent variable is the log of the winning bid.

Each specification controls for log of the engineer's estimate, the number of workdays and items, the DBE goal, road, county, year, and month effects, as well as dummies indicating the broad category of work.  $LN(\widehat{ENGEST})$  is the log of the engineer's estimate relative to its mean.

The results of estimating equation 3 are shown in Table 2. Column (1) displays the results from estimating (3) without controlling the number of small and large bidders. The winning bid is found to be 3.5 percent higher on preference auctions than on similar non-preference auctions. The specification shown in column (2) controls nonparametrically for the number of bidders by including variables indicating the number of small and large bidders. Including these controls reduces the coefficient on the preference auction dummy to 0.018, suggesting that approximately half of the procurement cost effect of preferences is due to fewer bidders participating on preference auctions. In later results, I find that the participation of large firms is approximately 20 percent lower on preference auctions, while the participation of small firms is largely unaffected.

Finally, column (3) displays results controlling for firm fixed effects, which is meant to control for the composition of winners on preference versus non-preference auctions. Including firm effects reduces the coefficient on the preference auction variable to -0.005 and is indistinguishable from zero. One explanation for the impact of firm effects on the results could be that the set of auction participants have higher costs on average. In the paper, I go on to find support for the latter explanation.

I also find that after controlling for projects size, small businesses are 7 percent more likely to win a preference auction than a non-preference auction. This increased probability includes both the direct effect of bid preferences, and also the indirect effect due to reduced large firm participation. This indicates that it costs 50 cents for each additional dollar being awarded to small firms through the bid preference program.

The estimates of (4), not shown here, suggest that the bidding response of firms to bid preferences largely conforms with expectations. Large firms bid more aggressively, small firms less so, and this effect is greatest for the lowest cost firms. The lowest cost large firms reduce their bids by 1.4 percent, while relative to large firms the bids of small firms are higher by 2.7 percent on preference auctions. These responses largely cancel out, which is consistent with the results regarding the effects of bid preferences on procurement costs.

Finally, in the structural section of the paper, I establish three important facts. First, small firms are at a cost disadvantage on auctions that do not use preferences. This is a necessary condition for preferences to result in a decrease in the winning bid. Second, the cost distributions of small and large firms are virtually identical on preference auctions, meaning that the set of large participants are weaker on preference auctions. Third, I find that the efficiency loss due to bid preferences is large, however, this loss is almost entirely due to preference's effect on firm participation and virtually unrelated to the "switching effect" of transferring projects from low to high cost firms.

## 5 Conclusion

This paper considers an open question, how affirmative action affects the cost of government contracting. This question is made significant by both the importance of government contracting at all levels of government and by the widespread use of affirmative action in contracting.

The results from my thesis imply that a road construction project costs the government 6.1 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. If the only source of the cost difference was through average productivity differences between DBE and non-DBE firms, then this would imply that the DBE firms charge more than twice as much to perform the same work as a non-DBE firm, which seems an unreasonable conclusion. This implies a significant role for affirmative action's effect on the make-versus-buy decision by the contractor. Empirical support is found for this alternative explanation.

Bid preferences do not seem to be a benign alternative. While theory suggests that bid preferences may lower the winning bid in an auction, I find that the winning bid is in fact higher on auctions

using bid preferences. This is due to the effect of bid preferences on the participation of firms.

A potential shortcoming of the empirical approach taken in this thesis 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 2.5 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 results indicate that both forms of affirmative action are successful at redistributing purchases toward minority firms and small businesses. How this affects firm formation and survival remains an open question. The existing evidence in the literature, 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.

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