

# Chapter 1

## Mechanisms

Having established positive and significant treatment effects of experience on outcomes in the market for public construction projects, we seek to investigate how does experience operate in practice to produce improved outcomes in the treated firms. Our objective is to provide evidence of some of the changes that might have taken place within the firm to produce a higher rate of success.

We start presenting the following working hypothesis regarding the effects of experience. Each details one way in which a firm might have experienced improvements that led to increased success in the market. Our analysis will be aimed at testing them with the data we have available.

1. H1: experience produces improvements in cost measures in the firm, keeping constant the type of project. This improvement in cost operates either via economies of scale, since after winning the project the firm is bigger than before; or via adjustments in the production function itself, for example, by changing the relative inputs to produce.
2. H2: experience allows the firm to produce at a higher quality than before, constant the cost of the works. This improvement operates because the firm, having performed certain tasks once, is able to better predict potential problems. Note that in the bidding phase this could be reflected in a better proposals.
3. H3: experience increases the pool of projects that a firm can perform. Experi-

ence can allow the firm to produce either bigger or more complex projects, due to increased human and organizational capital.

We first investigate whether firms are more efficient by examining how do bids change on average with experience as treatment. Then, we study whether increased the technical possibilities of the firm.

## 1.1 Bids and experience

This section investigates whether experience causes improvements in cost measures for treated firms. We do this by examining how do firm's bids evolve after the firm has been treated, i.e. after it has more experience.

The relationship between bids and several firms characteristics has been investigated several times in the construction and economics literature.

The next section details briefly the data, empirical strategy and results, since most of the the empirical strategy and data is analogous to the analysis performed in the previous chapter.

### 1.1.1 Data

Our main data is the same as in the previous chapter, i.e a set of bids submitted by firms in auctions for public construction projects. However, instead of aggregating firm's experience and outcomes in time slices, our observations will be the bids themselves. We still employ aggregation to compute experience at each point in time for every firm.

Furthermore, we filter the first year in the data for our regression sample, since all firms have zero experience at this point and keeping it would introduce noise in the estimates do to treatments set to zero artificially. We do however employ all the available years in the data to compute experience, as in the previous section.

Table ?? shows descriptive statistics of the bids employed in the analysis sample and of acceptance rates by the amount of experience.

### 1.1.2 Empirical Strategy

In this section, our main strategy is perform a regression of the form:

Here, the outcome variable is a binary indicator which is 1 if the firm  $i$  won the project  $j$  at time  $t$  and zero if not. Our treatment variable is experience, either in binary form  $EXP > 0$  or linear form  $EXP$ . We compute experience by summing all won up to  $t$ . Note that each row of our main dataset is an observation in the regression. Similarly as before, we have unobserved cost variables, specific to each firm, which might skew estimates upwards. The same argument employed in the previous chapter, regarding endogeneity of cost measures, can be applied in the case of equation.

We use the same strategy as before to produce consistent estimates, employing closely won bids to produce random variation in total experience. Table shows a comparison of contracts identified as close wins againsts the rest of the sample. Note that there are very small modifications with respect to table ??, given the extra filtering steps employed in this section. The parameters employed in each IV strategy are also the same as the previous section.

We perform four regressions. The first two are OLS regressions and the second two are IV regressions, employing closely won contracts to instrument total experience. For each type, we develop one regression where the treatment is the binary of previous experience and the second is total past experience.

### 1.1.3 Results

Table 1.1 presents our main results.

## 1.2 Quality and Experience

In order to test hypothesis number two, in this section we study if experience treatments causes firms to submit higher quality proposals. We do this by employing a step in the auctioning process aimed at controlling some basic quality conditions of

Table 1.1: Regression of bid amounts to experience

	<i>Dependent variable:</i>			
	Standarized Bid			
	<i>OLS</i>		<i>instrumental variable</i>	
	OLS	OLS	IV	IV
	(1)	(2)	(3)	(4)
exp		−0.001 (0.005)		−0.023* (0.012)
exp >0	−0.034*** (0.003)		−0.362*** (0.135)	
indFirstYear	−0.015*** (0.003)	−0.007 (0.038)	−0.156*** (0.058)	−0.176* (0.091)
Constant	0.887*** (0.013)	0.862*** (0.045)	1.201*** (0.130)	1.054*** (0.105)
Fixed effects By Period and Region	Yes	Yes	Yes	Yes
Observations	25,926	25,926	25,926	25,926
R <sup>2</sup>	0.021	0.019	−0.353	−1.610
Residual Std. Error (df = 25898)	0.210	0.210	0.247	0.343
<i>Note:</i>		*p<0.1; **p<0.05; ***p<0.01		

a proposals, namely, formal requirements and qualifications.

Note that quality is explicitly evaluated in many contracts by including an item in the awarding criteria labeled as "technical specifications" or just "quality of the proposal". Our estimation is that around % include some measure of technical evaluation in the awarding criteria. Ideally, we would test the hypothesis that experience improves the quality of a firm's proposals by employing the score that each firm obtained in the technical or quality item of the evaluation criteria of the project. However, since our data has not this item available by firm, we employ an alternative strategy, which focuses on measuring quality across a different but related dimension: the formal acceptance rate of the proposals.

Recall that, for each auction, firm proposals are analyzed in two steps. The first step only examines if the proposal fulfills all the formal requirements in the process. Formal requirements include the inclusion of legal documents, submitting each of the technical documents asked for in the bidding documents, etc. In essence, the first stage verifies that all proposals can be evaluated at an equal footing and that minimum bidding legal requirements are fulfilled. Clearly, whether a proposal was accepted is a measure of its quality, albeit an imperfect one. Although it leaves out a significant part of the variation that would be expected in proposal's qualities, it is nonetheless an interesting measure of quality because formal acceptance is a necessary condition to win a project.

Our research design, detailed below, will test whether experienced firms have a higher formal acceptance rate than inexperienced firms at the formal revision step of the procurement process. To our knowledge, it has not been studied in the previous literature factors influencing formal acceptance of bid proposals.

### **1.2.1 Data**

We employ our bid dataset similarly as the previous section. Each observation is a bid submitted by a firm to an auction held by the government. Since we are analyzing the formal revision part of the auction, and not scoring itself, we think that on principle we could skip the filtering of contracts that do include experience as an awarding

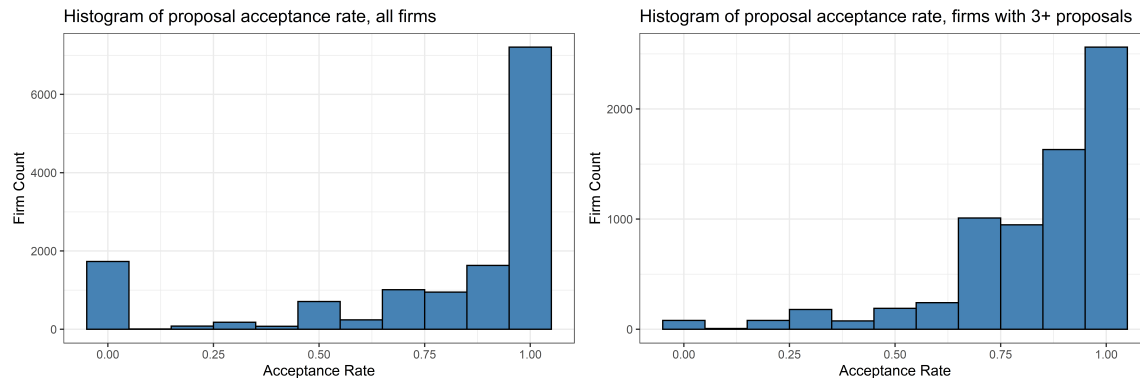


Figure 1-1: Acceptance rate for proposals sent by firms to auctions for public construction project.

factor. However, due to possible self-selection, we will examine both possibilities. We again filter the first year of the data in our analysis sample to prevent confounding effects.

We show some descriptive statistics of acceptance rates in table and Figure 1-1. We can already see that the fraction of firms getting all proposals rejected decreases with more than one proposal, which could be either due to revealed preferences or to the effect of learning about formal requirements after the first completed bidding process.

We end up with a dataset where each observation is a bid submitted by a firm to an auction of a public construction project, which includes as variables of interest whether the proposal was formally accepted, the experience of the firm at the time of the auction (both regular, annualized and close wins), and several auxiliary variables that characterize the contract itself.

### 1.2.2 Empirical Strategy

We test whether experience leads to a higher rate of formal proposal acceptance employing the following regression:

Here,  $acc_{it}$  is an indicator variable that equals 1 if the firm's  $i$  proposal for contract  $j$  at time  $t$  was accepted and zero if it was not.  $EXP$  is our treatment variable, both in binary and linear functional forms.  $X_j$  is a set of contract-specific controls, which

### Mean of Proposal Acceptance Indicator by Past Experience

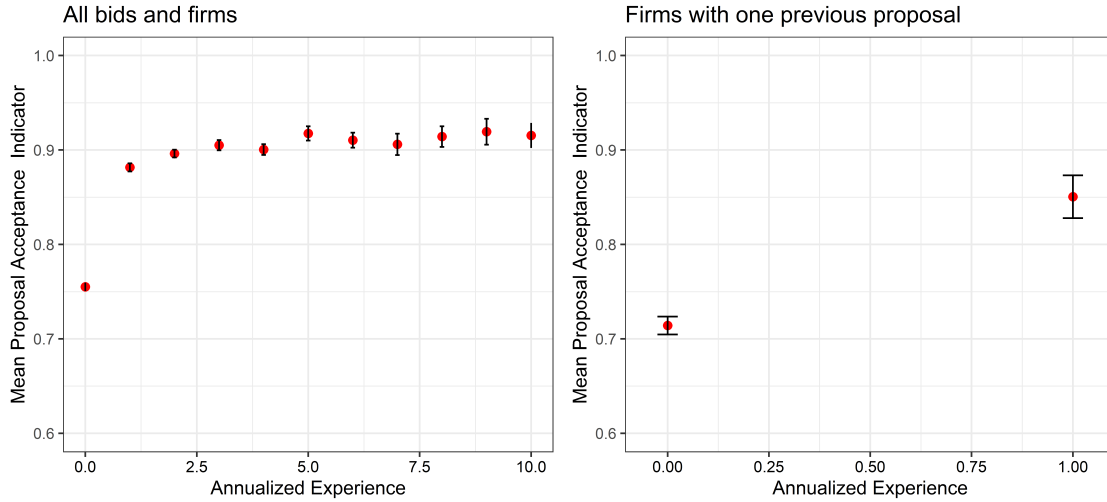


Figure 1-2: Acceptance rate for proposals sent by firms to auctions for public construction project.

include year, region, and the government body in charge of the auction. We include the controls for the possibility that government units in different geographical regions have different levels of stringency when evaluating proposals for similar projects.

We are less worried about endogeneity with unobserved cost factors since formal revision does not relate to economic aspects of the proposal. However, it is possible that there are different levels of baseline levels of proposal-making abilities among firms, so we repeat our usual instrumentation of experience with close wins.

We perform four regressions. The first two are OLS regressions and the second two are IV regressions, employing closely won contracts to instrument total experience. For each type, we develop one regression where the treatment is the binary of previous experience and the second is annualized past experience.

### 1.2.3 Results

Table 1.2: Regression of proposal acceptance on experience

	<i>Dependent variable:</i>			
	Standardized Bid			
	<i>OLS</i>		<i>instrumental</i>	
	OLS (1)	OLS (2)	IV (3)	IV (4)
annualexp >0	0.155*** (0.002)			
annualexp		0.006 (0.025)		0.071*** (0.027)
exp >0			0.441*** (0.101)	
Constant	0.855*** (0.328)	0.955*** (0.192)	0.511*** (0.072)	0.270 (0.207)
Fixed effects By Period, Region	Yes	Yes	Yes	Yes
Fixed effects By Government Body	Yes	Yes	No	No
Observations	137,001	137,001	137,001	137,001
R <sup>2</sup>	0.122	0.100	-0.061	-1.039
Residual Std. Error	0.328 (df = 136078)	0.332 (df = 136078)	0.359 (df = 136973)	0.498 (df = 136973)
<i>Note:</i>			*p<0.1; **p<0.05; ***p<0.01	