# Procuring Firm Growth:

## The Effects of Government Purchases on Firm Dynamics*

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**Abstract**

This paper tests whether demand shocks affect firm dynamics. We examine whether firms that win government procurement contracts grow more compared to firms that compete for these contracts but do not win. We assemble a comprehensive data set combining matched employer-employee data for the universe of formal firms in Brazil with the universe of federal government procurement contracts over the period of 2004 to 2010. Exploiting a quasi-experimental design, we find that a 10 percent increase in the value of a winning contract increases firm growth by 2.51 percent and reduces its probability of exit by 12 percent. We then examine whether the effects of winning a governmental contract differ by certain characteristics of the municipalities from which the firms are located. In particular, we investigate the role of financial frictions, access to markets and transportation costs, and labor regulations. We find evidence that (i) access to credit complements the effects of winning a contract, and (ii) firms located further from a large market grow relatively more given a demand shock.

*Keywords: Demand Shocks, Firm Productivity, Public Procurement*

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# 1 Introduction

Firms in developing countries are smaller and tend to grow less than their counterparts in rich countries. As firm size is correlated with productivity, this explains part of the large productivity gap that exists between rich and poor countries (Bartelsman et al., 2013; Hsieh and Klenow, 2014). But what are the barriers that prevent firms from growing and becoming more productive in less developed countries?

A growing theoretical literature suggests that firm-specific accumulation of organizational, managerial or customer capital can explain heterogeneity in firm dynamics.[1] In these models, firms grow and become more productive as they invest in better technologies and expand their markets. Thus, rising demand for firms'products over time is a key determinant of firm dynamics (Foster et al., 2012). But firms in less developed countries might face fixed-costs to the adoption of inputs or strategies that expand their markets (Banerjee and Duflo, 2005).

There is limited empirical evidence, however, on the importance of demand factors to explain firm dynamics.[2] This is due, in part, to the fact that testing whether demand affect firm growth is challenging because firms can invest to increase their customer base (e.g. marketing, distribution channels) and this investment can occur as a response to unobserved productivity shocks. To separately identify shocks to demand and productivity, the empirical literature has followed two alternative routes. First, some papers have used rich-datasets where firm level prices are available and impose structure on the dynamics of demand to uncover demand and productivity shocks from residuals of regressions (Pozzi and Schivardi, 2012; Foster et al., 2012). Alternatively, in the absence of firm level price data, De Loecker (2011) suggests a method that imposes functional form assumptions on a demand system and isolates physical productivity from confounding demand factors.

This paper proposes an alternative approach to test whether changes in demand affect firm dynamics. We examine whether firms that win government procurement contracts through auctions, by a small margin, grow more compared to firms that compete for these contracts but do not win. To do so, we assemble one of the most comprehensive data sets to date that combine matched employer-employee data for the universe of formal firms in Brazil with the universe of federal government procurement contracts over the period of 2004 to 2010. From the procurement data, we observe not only the winning firm's bids, but also the bids of all the losing firms that participated in the auction. Combining these two datasets allows us to

[1] See for example Cabral and Mata (2003), Atkeson and Kehoe (2005), Fishman and Rob (2005), Arkolakis (2010), Dinlersoz and Yorukoglu (2010), Gourio and Rudanko (2011), Luttmer (2011), Drozd and Nosal (2012), Perla (2013), Holmes and Stevens (2012), Akcigit, Alp, and Peters (2014).

[2] Syverson (2011) suggests that in order to understand how productivity disparities persist over time, it is important to understand firm demand.

estimate the effects of winning a government contract on firm growth for over 65,000 firms that participated in over 6.5 million lots auctioned off by Brazil's federal government during this period.

To estimate these effects, we introduce a novel research design that exploits the fact that we observe the entire distribution of firms' bids in electronic procurement auctions. This allows us to identify those auctions in which the difference between the winning bid and the second-place bid is only a tiny fraction of the contract amount (e.g. in many auctions the difference is less than 0.001 percent). Given some the institutional features of the auction, which we discuss below, winning these types of close auctions can be considered as good as random, and thus represents an exogenous demand shock to the firm.[3] Exploiting this quasi-experimental design, we find that winning a government contract increases firm growth and reduces its likelihood of exit. Our results show that winning a close auction increases firm growth by 2.68 percentage points (over an average of 4.3 percent per quarter) and reduces its probability of exit by 12 percent. We then use the richness of our employer-employee data-set to map whether new workers come from unemployment or the informal sector or are hired from other firms. We find that the growth of firms induced by winning a government contract come mostly from workers being hired from unemployment or from the informal sector.

Given the various potential barriers to firm growth described in the literature, we go on to examine whether the effects of winning a governmental contract differ by certain characteristics of the municipalities from which the firms are located. In particular, we test three hypotheses that have been put out in the theoretical literature: financial frictions, access to markets and transportation costs, and labor regulations.[4]

First, we investigate whether credit constraints play a role that either substitutes or complements the effects of winning a contract. On the one hand, firms might need liquidity in order to respond to this positive demand shocks. Thus, firms that have access to credit might be able to grow more. On the other hand, a government demand shocks might allow firms to use a governmental contract as collateral so it may bootstrap their way into more growth.[5]

Second, we examine whether the effect of a demand shock varies according to a firms access to larger markets. Our hypothesis is that firms who are more distant from larger markets will benefit relatively more from winning a governmental contract and increasing their market size.[6]

[3]Our research design resembles the empirical strategy used by Greenstone and Moretti (2003) where they compare cities that win and lose the location of large industrial plants.

[4]Models that suggest that these wedges affect the misallocation of resources include Hsieh and Klenow (2014), Restuccia and Rogerson (2008), Guner et al. (2008), Buera et al. (2011), Peters (2013), Midrigan and Xu (2014), and Bhattacharya et al. (2013).

[5]See for example Levine (2006), Guiso, Sapienza and Zingales. (2004), Beck et al (2004). See also Manova 2012 for the case of exporting firms.

[6]Syverson (2004) and Campbell and Hugo A. Hopenhayn (2005) document a positive relationship between

Finally, we explore whether the effects of winning a governmental contract vary based on the level of expected enforcement of labor regulations. Because labor regulations are typically seen as an impediment to firm growth, we expect the effects of winning a government contract to be smaller in places where the enforcement of labor regulations is more stringent as proxied by the share of firms that are inspected by the Ministry of Labor in a given municipality.[7]

We find evidence that access to credit complements the effects of winning a contract. In places with more access to credit, as proxied by the ratio of lending to municipal GDP, winning a contract leads to an increase in firm growth compared to places with less access to credit. We also find that firms that are further from a large market (measured as being 1,000 km away from a municipality with a population of at least 100,000 inhabitants) grow relatively more given a demand shock. Finally, we do not find evidence that the effects of the demand shock vary depending on the probability of being inspected, the proxy we use for whether the firm faces a high risk of labor regulation.

Our study relates to three broad literatures. First, we contribute to a new empirical literature that examines the role of demand to explain firm growth. Most of this literature introduces structure in the empirical estimation in order to disentangle demand shocks from productivity through instrumental variables (Pozzi and Schivardi (2012) and Foster et al. (2012). We complement their analysis using quasi-experimental variation on demand shocks that affect firms and are orthogonal to productivity shocks. Our novel quasi-experimental design of comparing winners and losers in close-auctions is similar in spirit to Greenstone and Moretti (2003), but uses close-auctions. As far as we can tell, we are the first to use this research design to estimate the causal effects of winning procurement contracts on firm dynamics.[8]

Our paper is also related to a growing literature that study the barriers faced by small and medium firms in developing countries. The existing explanations for this phenomenon focus on market failures that constrain the ability of firms to grow: credit constraints, difficulties in accessing large markets due to reputation constrains, and policies and regulations that punish large firms compared to smaller firms. Differentiating between these alternative explanations is

the size of the market, firm size, and productivity. Holmes and Stevens (2012) document that large plants tend to ship farther distances even to domestic locations compared with small plants. Combes et al. (2012) find that firms located in large cities are more productive. For a theoretical model linking productivity to market size see Desmet and Parente (2010).

[7] Hsieh and Klenow (2014) suggest that labor regulations for larger firms can explain why firms decide to stay small in developing countries. Levy (2008) argues that payroll taxes in Mexico are more stringently enforced on large plants. Busso et al. (2012) provide evidence that in Mexico most firms are formally registered but remain small because they can evade taxes by remaining small. Evidence from firm surveys suggest that there is significant discretionary policy differences for firms such as start-up costs, or enforcement of regulations and taxes, faced by different firms (Pierre and Scarpetta 2006; World Bank (2004); Aterido, Hallward-Driemeier, and Pags 2007). This Peter-Pan syndrome (The Economist, Mcenzie report). Fisman and Svensson (2007) show that taxation and bribery are negatively correlated with firm growth.

[8] Our strategy also relates to Kneller and McGowan (2014) who analyze how demand shocks affect agricultural productivity.

crucial for the design of policies that can increase the productivity of firms in emerging markets. Our paper sheds light on these mechanisms by showing that increasing the demand for firms' products increase firm growth, but that demand effects interact with the local characteristics.[9]

Finally, our work also contributes to the evidence on the role of government in fostering economic activity. While there is a large macro literature on measuring the fiscal multiplier, there is little micro evidence on how government spending affect firm decisions.[10]

# 2 Background

In this section, we provide a brief description of public procurement auctions in Brazil. We then highlight two features of the auction process that are central to our empirical strategy – the absence of proxy bidding and the random ending of auctions.

## 2.1 Public Procurement Auctions in Brazil

The Brazilian public administration has used reverse auctions as a procurement method for off-the-shelf goods – from pharmaceuticals to cleaning services – since 2001.[11] As of 2005, it is mandatory for federal agencies to procure off-the-shelf goods through these auctions, and to conduct them online on ComprasNet, the one-stop internet portal for the federal government's procurement. Around 2200 public bodies scattered across the country list around 1 million lots every year on ComprasNet; in 2012, 0.76 percent of Brazil's GDP – or R$ 33.6 billion worth of contracts accounting for 46 percent of the federal government's procurement spending – were awarded through ComprasNet auctions. In short, these auctions represent a large share of federal tenders and a substantial amount is contracted through them every year.

Over 65,000 firms have placed bids in the ComprasNet platform for contracts to supply the government with various goods and services. To participate in an auction, firms must first register in a registry for vendors. To encourage participation, especially among small firms,

[9] This discussion is not new. See Tendler and Amorin (1996) for a discussion of the importance of fostering demand rather than supply-driven policies to improve the performance of small and medium enterprises.

[10] For a survey of the macro literature see Ramey (2011) and Nakamura and Steinsson (2014) for estimates that use variation from military procurement.

[11] Off-the-shelf goods are goods that have precise and concise enough specifications, so that bids can be compared solely based on price. IT equipment for instance qualify as off-the-shelf, whereas engineering projects do not. Although the legislation does not provide a clear-cut definition of an "engineering project", it is known, for example, to include entire road resurfacing works. On the other hand, reverse auction are sometimes used to procure small demolition work. Federal Law 8666/93 regulates public procurement in Brazil, and Federal Law 10520/2002 are specific to procurement auctions. For a detailed description of public procurement in Brazil, see World Bank (2004).

the registration process, which is done online, is fairly streamlined and simple. And while participation in some specific auctions may involve additional requirements – for example, in the case of services contracts, a public body may ask firms to provide proof that they have the capacity to delivered the same type of service at a similar scale – most of the documents supporting a firm's bid are submitted *after* winning an auction, which again lowers the cost of participating.

A typical ComprasNet auction starts with a public body defining lots it needs to procure. A lot consists of some indivisible quantity of an off-the-shelf good or service.[12] Several lots can be procured at the same session. Next, the public body must provide a reservation price for each lot. The reservation price is calculated as the average of at least three quotes obtained through market research, and is meant to capture the retail price of the lot. Finally, the public body advertises the tender at least 8 days before the session and publishes a tender document on ComprasNet. The tender document is free to download anonymously and contains a detailed description of each lot, the date of the letting session, reservation prices and the contract's terms and conditions.

## 2.2 The Auction Mechanism

Two features of ComprasNet auctions are central to our empirical strategy. First, within time limits, these auctions end at random. To explain how this random ending works, Figure 1 depicts the bidding timeline of a typical auction. Interested firms must submit a sealed bid before a pre-specified deadline $t_0$, after which no firm may enter the auction. At $t_0$ sealed bids are open, and bidders learn the low bid. Firms now engage in a descending auction, and can place as many new bids as they wish.[13] At a point $t_1$, the auctioneer announces $t_2$, the start of the ending (random) phase. Bidding ends at a point $t_3$ up to 30 minutes after $t_2$, but firms, as well as the auctioneer, only learn $t_3$ once it has passed. The low bidder at $t_3$ wins and is paid her bid.[14]

[12] In principle, auctioneers may allow bidders to bid for fractions of the lot. In practice, this is very rarely done. In the data, we noted 724 lots (out of more than 6 million) in which two or more bidders were awarded fractions of the lot.

[13] A bidder can only place bids strictly lower than her own previous bids. Bidders can, however, submit bids higher than other bidders' previous bids. This is to avoid a situation in which typos (unintentional or otherwise) prevent bidders from placing new bids. The platform software uses an algorithm to spot this sort of typos.

[14] After bidding closes, the auctioneer checks if the best bid is below the reservation price. If it is, the best bidder is requested to submit supporting documentation. Required documents vary across lots, but are detailed in the tender announcement. Documents typically concern firms' tax duties, but may include, for example, a cost breakdown when the lot is a service, or sample items if the lot is a good. If the documentation is accepted, the lot is adjudicated. Otherwise, the bid is disqualified and the auctioneer may request the documentation of the second-best bidder, and proceed that way until a valid bid is found. The auctioneer may, at any point, cancel the auction. If the best bid is above the reserve price, the auctioneer tries to negotiate a better price. If the bidder is unwilling to meet the reservation price, the auctioneer has three options. First, she can declare the bid invalid and

To illustrate that auctions indeed end at random, Figure 2 shows the distribution of the final (random) phase duration, for two periods. Panel (a) depicts the distribution of random phases from 2004 to April 2006. In this period, the end phase duration clearly followed a uniform distribution on the $[0, 30]$ minutes interval, as mandated by the ComprasNet rules. Following complains by firms claiming that this rule did not give them enough time to place their best bids, ComprasNet changed the rules. The distribution of random phases after this change is depicted in Panel (b). This distribution results from the sum of a uniform [5,30] plus one random draw from a uniform [0,2] for each bid placed in the auction, but it remains capped at 30 minutes. Effectively, firms had more time to place their bids, but remained ex-ante ignorant of the exact time the auction ended.

A second important feature of these auctions is the absence of a proxy bidding system. Proxy bidding, available in platforms such as eBay, allows bidders to submit their reservation prices and have the system automatically place new bids on their behalf as soon as they are outbid (see, for example, Roth and Ockenfels (2002)). In contrast, every time firms wish to lower their bids in ComprasNet, they must enter it manually on the auction page. Note also that there is no minimum bid decrement[15], and throughout the auction firms (and the auctioneer) only learn the currently low bid, but neither the identity of the firms nor the history of bids.

# 3 Research Design

We are interested in estimating the effect of winning a government contract on firm growth. Let the growth rate of firm $i$ in period $t$ be given by $g_{it}$. We can write the growth of firm $i$ as:

$$g_{it} = f(X_i, U_i, S_{it}, \epsilon_{it}) \tag{1}$$

where $X_i$ represent firm observable characteristics, $U_i$ represent firm unobservable characteristics, $S_{it}$ represents the demand for the firm products, firm sales, or purchased orders received in period $t$ and $\varepsilon_{it}$ represents shocks to firm growth in period $t$ that are not observed to the econometrician (e.g. changes in firm productivity).

If we assume an additive and linear model, we could estimate a reduced form equation for the growth of firms as:

$$g_{it} = \beta_0 + \beta_1 S_{it} + \delta X_i + \epsilon_{it} \tag{2}$$

proceed to negotiate with the second-best bidder, and so on. Second, she may cancel the auction. Finally, she may adjudicate the lot at a price higher than the reservation price. This is rarely done, and when it is, the tender has a higher chance of being externally audited and the auctioneer must justify her decision–e.g., reservation prices were calculated with dated market research.

[15] To be precise, the minimum bid decrement is R$0.01, which is negligible.

where the error term $\epsilon_{it} = U_i + \varepsilon_{it}$, is composed of a fixed firm-level unobservable characteristic and a component that varies over time (e.g. firm TFP).

Our measure of purchase orders or sales $S_{it}$ can be further separated into purchase orders that come from the private sector ($P_{it}$) and orders that come from the government ($G_{it}$): $S_{it} = G_{it} + P_{it}$. Because we only observe purchase orders that come from the government, all purchase orders from the private sector will be part of the unobserved component of firm growth: $\epsilon_{it} = U_i + P_{it} + \varepsilon_{it}$.

In this setting, there two potential sources of bias from estimating equation 2 by OLS. First, because we only observe purchase orders from the government, any correlation between private and government sales will bias our coefficient. If private sector contracts crowd-out government contracts due to perhaps capacity constraints, then we will underestimate the effects of government contracts on firm growth. Similarly, if negative demand shocks in the private sector induce firms to participate more in government auctions, then this too will bias our coefficient downwards. A second source of bias might arise if government contracts are awarded to the most productive firms. In this case, firms who receive positive productivity shocks will not only be more likely to win a government contract, but will also tend grow (independently of winning the contract). This of course will lead us to over-estimate the coefficient of interest.

To overcome these estimation concerns, we propose a novel empirical strategy that exploits the unique design of the procurement auctions to construct an exogenous demand shock. We then use this government-induced demand shock as an instrument to estimate the effects of winning government contracts on firm growth and survival. We describe our approach next.

## 3.1 Close Auctions

Our research design is based on the following idea: conditional on participation in a government procurement auction, winning a close auction can be considered a random event, and thus the share of close auctions that a firm wins in a particular period represents an exogenous demand shock to the firm. We then use this demand shock as an instrument for the total value of contracts that a firm wins over that particular period.

We construct this instrument in two steps. First, we define the set of close auctions. For our preferred set of results, a close auction is one in which two firms issue bids within the last 30 seconds of the auction ending and whose difference in the winning and second-place bids is less than 0.05% of the second place bid. This definition, while somewhat arbitrary, trades off the usual bias versus efficiency concerns that has become common to regression discontinuity designs. Fortunately, our results (as we will document below) are highly robust to both relaxing and restricting this definition. In the second step, we simply compute the amount of contracts a

firm wins in a period as a share of the total value of the auctions in which the firm participated in.

Naturally, the validity of this instrument hinges on whether winning close auctions can be treated as random events. Our implicit assumption is that firms who barely win an auction are similar on average in their productive factors to those that barely lose an auction. Several features of the auction suggest that this likely to be a reasonable assumption. As we discussed in Section 2, the duration of the auction is a random event. Thus firms do not know when the auction will end, and moreover throughout the auction, both firms and the auctioneer only observe the current low bid: neither the identity of the bidding firm nor the history of bids are ever revealed. Also firms do not benefit from a proxy-bidding system, and must enter their bids manually. With these features, firms have a strong incentive to bid their optimal valuation during the last bidding phase. As we restrict the sample to firms who were issuing similar bids just prior to the auction's end, it is likely that these firms are similar in their characteristics.

In Table **??**, we provide evidence that firms who barely lose are in fact similar to firms that barely win for various definitions of closeness. In the top panel, we restrict the sample to auctions with at least 2 active bidders in the last 30 seconds, and where the bid difference between the first and second-place bidders is less than 0.5 percent. Approximately 251,000 auctions satisfy this definition of closeness, and we will use this definition for the rest of analysis. Based on this sample, first and second-place firms are similar along several key characteristics, such as their growth rate in both the previous quarter as well as the previous 12 months, win rates, number of employees, etc. Only the average real wage in the previous quarter is statistically significant at a 10 percent level.

In the remaining two panels of Table **??** we strengthen our definition of closeness along two dimensions. In the middle panel, we reduced the sample used in the top panel to include only auctions with at least 2 active bidders in the last 12 seconds. Whereas in the bottom panel, we restrict the sample used in the top panel to auctions, in which the difference bteween the first and second place bidders is less than 0.1 percent. For the middle panel, we see that the differences between the first and second place firms decrease along some characteristics, but increase along others. For instance, while there is no longer a difference in average real wage in the previous quarter, there are significant differences in number of employees in the previous quarter and whether the bidder is registered as a small-medium enterprise. Our third definition of closeness (presented in the bottom panel) does not necessarily achieve more balance, despite a stricter requirement for differences in the bid amounts. Overall the results suggest that for our definition of closeness the characteristics of first and second-placed firms are balanced.

As another validity check of our research design, we test for any discontinuous breaks in distribution of bids near the threshold. A common concern that arises with such a design is the

potential manipulation of the running variable, or in our case the bids. For instance, if the auctioneer could manipulate the bidding system, then we might expect to observe a concentration of bids that barely win. But as Figure **??** depicts, the distribution of bids is quite continuous. This finding is of course not surprising given that the random-duration feature of the auctions was implemented in part as a safeguard for corruption.

Given our definition of closeness, our demand shock, $Z_{it}$, is simply the total value of close auctions firm $i$ won in period $t$ divided by the total value of auctions that firm participated in that period. Using this as an instrument, we then estimate the following equations using two-stage least squares,

$$g_{it} = \alpha G_{it} + \eta_i + \delta_t + \varepsilon_{it} \quad (3)$$

$$G_{it} = \gamma Z_{it} + \eta_i + \delta_t + \nu_{it} \quad (4)$$

where $g_{it} = E_{it} - E_{it-1}/(0.5 \times E_{it} + 0.5 \times E_{it-1})$ is the growth in employment in period $t$, $G_{it}$ is the total value of government contracts a firm won in the auctions in period $t$, and $\eta_i$ and $\delta_t$ are firm and time fixed-effects. Estimates of the parameter $\alpha$ yield the causal effect of a government-induced demand on firm growth conditional on participation.

## 3.2 Adjusting for Endogenous Participation

As we discuss in Section **??**, our estimation sample only includes firms who have ever participated in a government auction. But even within this restricted sample, in any given period a firm will choose whether or not to participate in a set of auctions, which creates a potential sample selection issue when estimating Equation 3. We account for this endogenous participation decision following the selection procedure suggested by Wooldridge. We proceed in two steps: first, we estimate the probability that a firm participates in a government auction in a particular period. Let $s^*_{it}$ denote the latent variable determining participation, which we model as follows:

$$s^*_{it} = \beta Z_{it-1} + \eta_i + \delta_t + v_{it}.$$

Here $v_{it}$ is an idiosyncratic error term, $Z_{it-1}$ is our demand shock in the previous period. The selection indicator $s_{it}$ can be defined as:

$$s_{it} = 1[s^*_{it} > 0] = 1[\beta Z_{it-1} + \eta_i + \delta_t + v_{it} > 0],$$

where $1[\cdot]$ represents the indicator function. Under the assumption that $v_{it}$ is $Normal(0, 1)$, we can estimate Equation 3.2 as a probit model. The key identifying assumption underlying

this estimation is the exogeneity the demand shock in the previous period, which as we will show below strongly predicts participation in future auctions. Based on the estimation of this selection equation, we then compute an inverse Mills Ratio, $\lambda_{it}$. In the second step, we re-estimate Equation 3 with the addition of the inverse Mills Ratio for the selected sample.

The validity of this approach hinges on two related assumptions: 1) $Z_{it-1}$ is exogenous to the selection equation, and 2) $Z_{it-1}$ does not directly affect growth in period $t$. Both assumptions are quite plausible. Given our research design, $Z_{it}$ is exogenous for all $t$ and as we will document in Section **??** winning a close auction in period $t$ induces firms to participate in auctions in the next period. The plausibility of the second assumption is only slight more subtle. Conditional on our model specification being correct, and in particular the lag structure governing $G_{it}$, $Z_{it-1}$ should not have a direct affect on a firm's growth $g_{it}$. Of course, if the true growth model was a determinant of both $G_{it}$ and $G_{it-1}$, then by not controlling for government sales in the previous period, we would be creating an artificial correlation between $\varepsilon_{it}$ and $Z_{it-1}$ and our exclusion restriction would not hold.

## 3.3 Data

To estimate the effects of winning a procurement contract on firm growth and survival, we assemble an original data set that combines data on the universe of federal procurement auctions from 2004 to 2010 and with data on the universe of formal firms in Brazil. In this section, we describe these data, our final estimation sample.

### 3.3.1 ComprasNet Data

We use data on 4,163,599 million lots auctioned off by federal public bodies between 2004 and 2010 through ComprasNet. The data we use come from two administrative sources.

First, we use publicly available data from ComprasNet. For each lot, the ComprasNet platform automatically records the following information: the reservation price; the name and tax revenue number of firms participating in the auction; all bids placed by each firm and their respective time stamps; time stamps for each auction event (as depicted in Figure 1); and the purchasing unit running the auction. All this information is recorded and published in html format at the ComprasNet website. We extract this information from the web pages to construct our data set.

Second, we complement these data with internal data from the Ministry of Planning, Budget and Management. These data contain information on lots, bidders, and purchasing units. On lots, there is a paragraph-long description of the item along with product classification codes

following the United States' Federal Supply Codes (FSC) for materials and United Nations' Central Product Classification for services. These classification schemes define product categories by 2-digit codes, and sub-categories by 4-digit codes[16]. There are also finer 6-digit codes which are created by purchasing units on a rolling basis. On bidders, the data contain information on whether they are registered as a small or micro enterprise (SME). Finally, these data contains the geographical location of purchasing units.

These two sources are combined to form a data set in which each auction is an observation. Our empirical strategy is based on the fact that there is randomness in the allocation of contracts. Since it is unrealistic to expect that all contracts are allocated at random, we narrow our sample to include only auctions for which there was a "close win". We define a "close win" as one in which (i) both the winner and runner up placed bids in the last 30 seconds of the auction, and (ii) the runner-up bid does not exceed the winning bid by more than 0.5%.

Table 2 presents descriptive statistics of our sample of close auctions. For comparison, we also show statistics for all auctions. The reservation value of each lot is on average XX, with an average of XX lots auctioned off per month. The winning bid ends up being around 68 percent of the reservation price, with difference between the winning bid and the second place bid being around 10 percent. On average 7 bidders participating for each lot, and of those 7 bidders only two are from the same city in which the public body is located, which again highlights the important role this procurement system plays in providing firms access to other markets. The auctions are held throughout Brazil, with a slight concentration in Southeast part of the country.

When we restrict the sample to what will be the source of our exogenous variation, we see unsurprisingly that the reservation price is XX percent higher compared to the overall sample and that the winning bid 73 percent of the reservation price. Naturally, these lots also attracted more bidders and interestingly more smaller firms.

Table 1 reports statistics for the 20 most frequent product categories in the sample. As the categories header suggests, various types of goods and services from different industries are procured through ComprasNet auctions. Categories range from books, to pharmaceuticals, to building materials. Moreover, items auctioned are primarily goods; only one service category (Maintenance & Installation Services) makes it into the top 20. Overall, services make up 5 percent of the number of lots (not shown in the table). Columns 1 and 2 give the total and relative frequencies of each category. The top 6 categories account for more than 50 percent of the total number of lots.

Columns 3 and 4 give the number of unique 4-digit and 6-digit codes within each product category. Some product categories are divided in up to 26 subcategories (Electrical and Elec-

[16]The Federal Supply Codes are available at http://www.dlis.dla.mil/H2/search.aspx.

tronic Equipment Components), while other are divided in only 3 subcategories (e.g., Cleaning Equipment and Supplies). Codes at the 6-digit level, which are created on-the-go by purchasing units, display even larger disparities. For example, Medical and Veterinary Equipment and Supplies, a category that includes pharmaceuticals, is divided up in more than 42,000 products at the 6-digit level. Books, Maps and Other Publications, on the other hand, are described by 185 unique products.

### 3.3.2 Firm Data

We use matched employer-employee data from the *Relação Anual de Informações Sociais* (RAIS), a yearly survey conducted by the Brazilian Ministry of Labor. The RAIS is an administrative data set covering all (formal) firms and workers in Brazil. We have information on wages, education, gender, and age of every employee in all firms for 2003-2010. At the end of each year, firms give a monthly breakdown of the status of each of their employees. We construct quarterly measures of firm growth in terms of number of employees. Furthermore, we have firms' geographical locations and industry, as defined by the International Standard Industrial Classification (ISIC). Firms are identified by their tax revenue number, which allows us to match this data with the ComprasNet auction data. Our final estimation sample only includes those firms that appear in the RAIS and have participated in a federal public procurement auction.

Table **??** presents descriptive statistics for the firms in our data, as well as for the entire firm population. As we see from the table, restricting the sample of firms to those who have participated in the public procurement auctions biases the sample towards a sample of much larger firms, with more educated employees. Firms in our sample have an average number of 50.4 employees, compared to 10.7 and 50 percent of the workforce of these firms have at least a high school education, compared with to only 44 percent for the entire sample. Firms in our sample also experienced a quarterly growth of 4 percent during the period, compared to only 2 percent for the sample as a whole.

# 4 Empirical Results

In this section, we begin by documenting the effects of winning a close auction on future contracts and participation in future auctions. This analysis is based on data at the auction level. We then aggregate the data to firm-quarter level to present our results on the effects of winning a government contract on firm growth and the probability of exit. These results are then followed by a series of robustness checks, including using the random variation in winning bids, as well as analysis on the heterogeneity of the impacts.

## 4.1 The Effects of Winning a Close Auction

In Figure X, we plot the effects of winning a close auction on the likelihood that the firms wins another auction within 90 days. The estimation sample is based on auctions in which at least two firms bid within 30 seconds before the end of the auction.[17] The x-axis of the plot denotes the difference between the winning bid and second place bid as a share of the second place bid. The y-axis denotes the proportion of auctions, firms win within the next 90 days. As Figure X depicts, a firm who barely loses an auction has 18 percent probability of winning a future auction within 90 days. This probability increases to almost 20 percent for firms that barely win an auction.

The results in these figures can also be seen in regression format. In Table 5, we estimate the effects of winning a close auction on series of outcomes associated with future auctions. Each regression controls for a third-order polynomial in win margin and auction fixed-effects. In panel A, we examine the effects on outcomes in 90-day window starting the day after the auction, and in Panel B, we examine the effects on outcomes in 30-day window starting 11 months after the auction. The estimation sample is the same as the one used in the figures.

In Table 5, we see that winning a close auction increases the likelihood that a firm participates in the future by YY percentage points. Of those auctions that they participated in, firms that won a close election were 1.2 percentage points more likely to win in the future, which may possibly reflect gains their competitiveness. The financial benefits of winning a close auction are also substantial. For instance, winning a close auction increases the total winnings from government contracts by 26 percent in the next 90 days. In panel B, we explore the effects on these outcomes but over the longer-term. Even after one year, we still find effects that are similar in magnitude.

## 4.2 The Effects of Winning a Government Contract on Firm Growth

In this section, we present our main estimation results for the models of the effects of winning a government contract on firm growth and the probability of survival. We begin in Table 6 with the results for the effects on firm growth. The model in column 1 is estimated for the period of June 2004 to December 2010, with each observation representing a firm-quarter pair. The model is also estimated with firm and time fixed-effects. The OLS estimates show that winning a contract in a particular quarter will increase firm growth by 2.70 percent. The model in column 2 uses as the main independent variable the amount of the contract in logs and here we find that a 10 percent increase in the value of the contract increases firm growth by 2.51

[17] XX percent of all auctions meet this criteria.

percent.

Even after accounting for firm fixed effect, firms that win more government contracts are likely to be quite different than those that win fewer or any contracts. For instance, if government contracts are being won by firms that are becoming more productive over time then these OLS estimates are likely to overestimate the true effects. Conversely, if less productive firms are more likely to win these contracts over time, then the OLS estimates are under-estimates.

In columns 3 and 4, we present the reduced-form effects of winning a close auction. In column 3, we use an indicator for whether or not a firm won a close auction in that period, and in column 4 we use the share of close auctions that a firm won. As we documented in Section 2, winning by a close margin approximates a random event. Using this variation, we find reduced-form estimates that are quite close to the OLS estimates, which given the strength of our first stage estimates (see columns 5 and 6) is perhaps not too surprising. The reduced-form effects in column 4 suggest that a 10 percentage point increase in the share of winnings in close auctions increases firm growth by 0.27 percent.

In columns 7 and 8, we present the corresponding IV estimates to columns 1 and 2 using the exogenous variation in the share of winnings in close auctions as an instrument. In column 4, we see that point estimate on winning a contract increases to 0.036, compared to 0.026 for the OLS, and in column 5 the IV estimates imply a 3 percent increase in firm growth as a result of a 10 percent increase in winnings.

Overall the results in Table 6 suggest that winning a government contract does lead to firm growth in the short run.

## 4.3 Robustness: Using Random Price Variation

In this section, we exploit the exogenous variation in the prices firms paid, due to the random auction duration, to explore the relationship between the size of the contract and firm performance. Of course, using this variation necessitates restricting the sample to firms who win at least one contact in any given period. The model in column 1 estimates firm growth on the log value of all of the contracts that a firm won in a particular quarter, while controlling for both firm and time fixed-effects. The point estimate suggests that a 10 percent increase in value of contracts that a firm wins is associated with a 1.6 percent increase in firm growth. In column 2, we present estimates of the reduced-form effects. Here the independent variable is the predicted value of the contracts based on the random duration of the last bidding phase. Based on this variation, the reduced-form estimates suggest that a 10 percent increase in total amounts of contracts will lead to a 3.5 percent increase in firm growth. Finally in column 3, we present

the IV estimates, and again find consistent results. A 10 percent increase in the total value of the contract increases firm growth by 3.5 percent.

## 4.4 Heterogeneity based on Access to Credit, Remoteness, and Labor Regulations

Thus far, the results suggest that winning a government contract does lead to firm growth and reduces the probability of the firm exiting the formal sector. In this section, we explore how these effects vary according to various characteristics of the marketplace.

Access to financing is widely considered one the major obstacles affecting the profitability, survival and growth of firms. While lack of credit may prohibit firms from making the larger and perhaps riskier investments that are often necessary to grow, it can also have important consequences for the ability of a firm to meet the demands of a government contract. Given that the government only pays the firms upon delivery of the goods and service, once a firm enters into contract with the government, it needs to be able to finance the production of these goods and services. Thus, we might expect that the effects of the winning a government contract to be more pronounced in municipalities with more access to credit.

In Table 10, we test this hypothesis using three different measures of access credit. In columns 1 and 2, we use the amount of private and public lending in municipality during 2005 as a share of municipal GDP. In columns 3 and 4, we use the amount of bank deposits in 2005 as a share of municipal GDP, and columns 5 and 6, we use the number of bank branches in the municipality. For each measure, we distinguish between municipalities that are below median (the odd columns) and municipalities that are above the median (the even columns). The coefficients and their corresponding standard errors reported in cell of the table corresponds to a separate regression, where the dependent variable is firm growth and main dependent variable is either the log of total winnings in a given quarter, or an indicator for whether or not the firm won an auction in that quarter. In Panel A we report the IV estimates, and in Panel B we report the corresponding OLS estimates.

In Panel A of Table we see that the effects of winning a contract are in fact much larger for firms residing in municipalities where credit is more abundant. For instance, winning a government contract increases firm growth by 7.4 percent for firms with high access to credit as measured by the share of lending. In contrast, winning a government contract increases firm growth by only 1.7 percent among firms with low access to credit. As the rest of the table documents, a similar pattern emerges whether we consider alternative measures for access to credit or use the amount of the contract that the firm won as our main dependent variable. In each case, access to credit plays a complementary role in a firm's ability to expand based on the government led

demand shocks.

Another barrier to firm growth that is likely to interact with winning a government contract is access to a large market. For firms who are located in a smaller and more remote market place, these government contracts can represent a sizable demand shock. As a result, we might expect the effects of these contracts to be more pronounced in municipalities that are more distant from a sizeable market.

To test this possibility, we compute the distance of each municipality to a municipality with a population of at least 100,000 which for our sample of municipalities corresponds to the about the $90^{th}$ percentile of the distribution. We then re-estimate our model distinguishing between places that are only 1,000 km away, in between 1,000 and 2,500 km, and further than 2,500 km - these are distances that correspond to the $25^{th}$ and $75^{th}$ percentile of the distribution. We present the results in Table 11. Again, as in Table 10, each cell corresponds to a separate regression, and panels A and B report the IV and OLS estimates, respectively.

Consistent with this hypothesis of remoteness, we find that the effects of winning a government contract are much larger for firms located more than 1,000 km away. In fact, for firms with access to a large market, winning a government contract increases firm growth by only 1.3 percent and we cannot reject that the coefficient is actually zero. In contrast, for firms that are in between 1,000 and 2,500 km away from a large market, winning a contract increases firm growth in the next period by almost 5 percent.

In columns 4 and 5, we also explore whether there is a differential impact based on the probability that a firm gets inspected. An argument that is commonly put forth in the literature is that labor regulations are another source of impediments to firm growth. In column 4, we estimate the model for firm located in municipalities where the probability of having a labor inspection is below the median. In contrast, column 5 explores the effects in places where the probability of being inspected above the median. Along this margin we don't find any evidence of a differential effect of winning a contract and firm growth.

# 5 Conclusion

This paper employs a novel empirical strategy to test whether an exogenous change in the demand for a firm's product affect its growth. We find that firms that win more governmental contracts through procurement auctions grow more and are less likely to exit. But we find that all firms do not benefit the same. Having access to credit is important in allowing the firms to benefit from the exogenous demand shock.

We interpret our results as being consistent with Banerjee and Duflo (2005) model of small and

medium firms facing fixed-costs to use better technologies or managerial capacities. As sales increase, these firms exploit economies of scale to grow. We are still not able to provide evidence, however, on the mechanisms that allow firms to grow. One explanation might be associated with the adoption of better technologies. Another might be that government contracts bring reputation that firms can use to sell in the private sector market.

Our results do not imply, however, that procurement contracts are an effective way to foster growth and employment in developing countries. First, we need to understand what happens to other firms located in the same city of winning firms and whether there are local spillover effects to downstream suppliers. Second, aggregate efficiency depends on the type of products being purchased by the government. Because corruption and mismanagement is widespread in developing countries, governments might purchase goods and services that are easier to diverge. Finally, government purchases might just be substituting for private purchases. if the government acts as a monopolist, this might induce low competition and might affect product quality in the long-run. Given the richness of our data, we plan to investigate some of these questions in future research.

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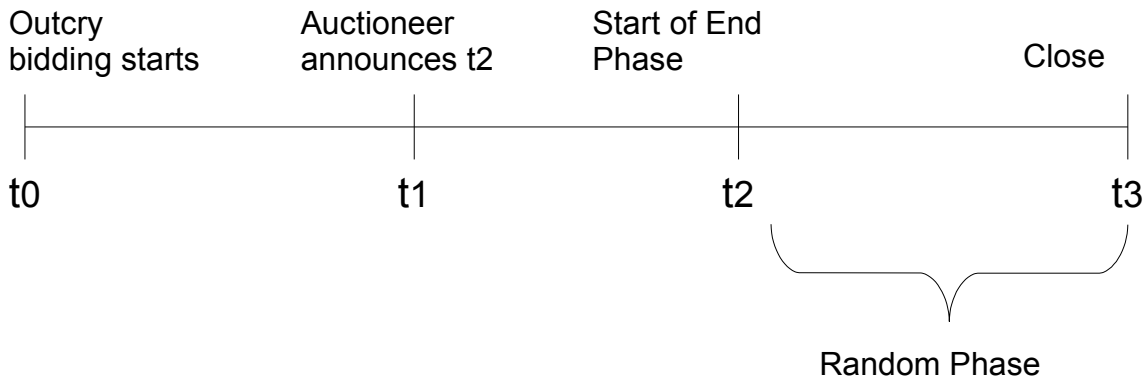


Figure 1: Bidding Timeline

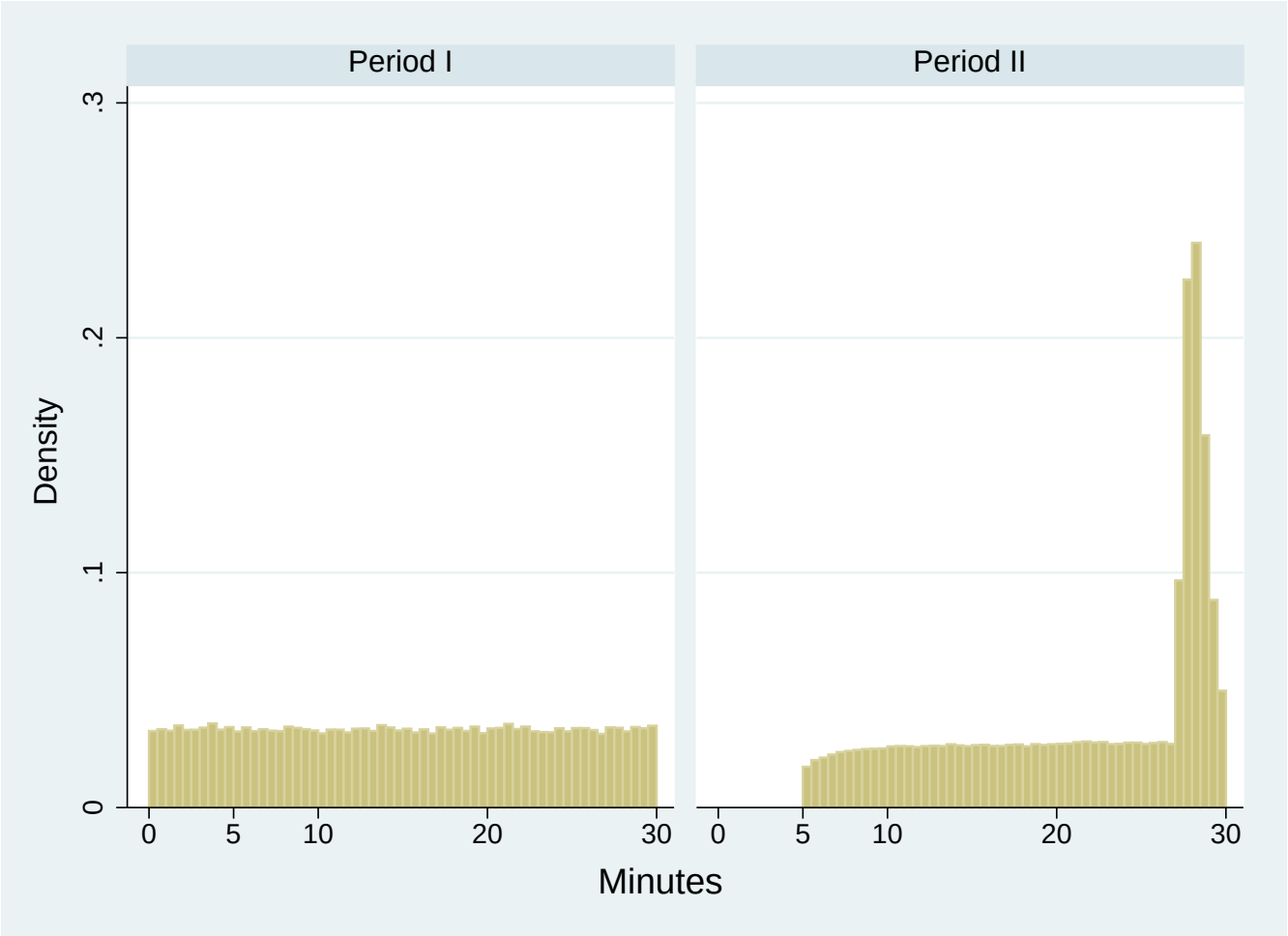


Figure 2: Distribution of Random Duration

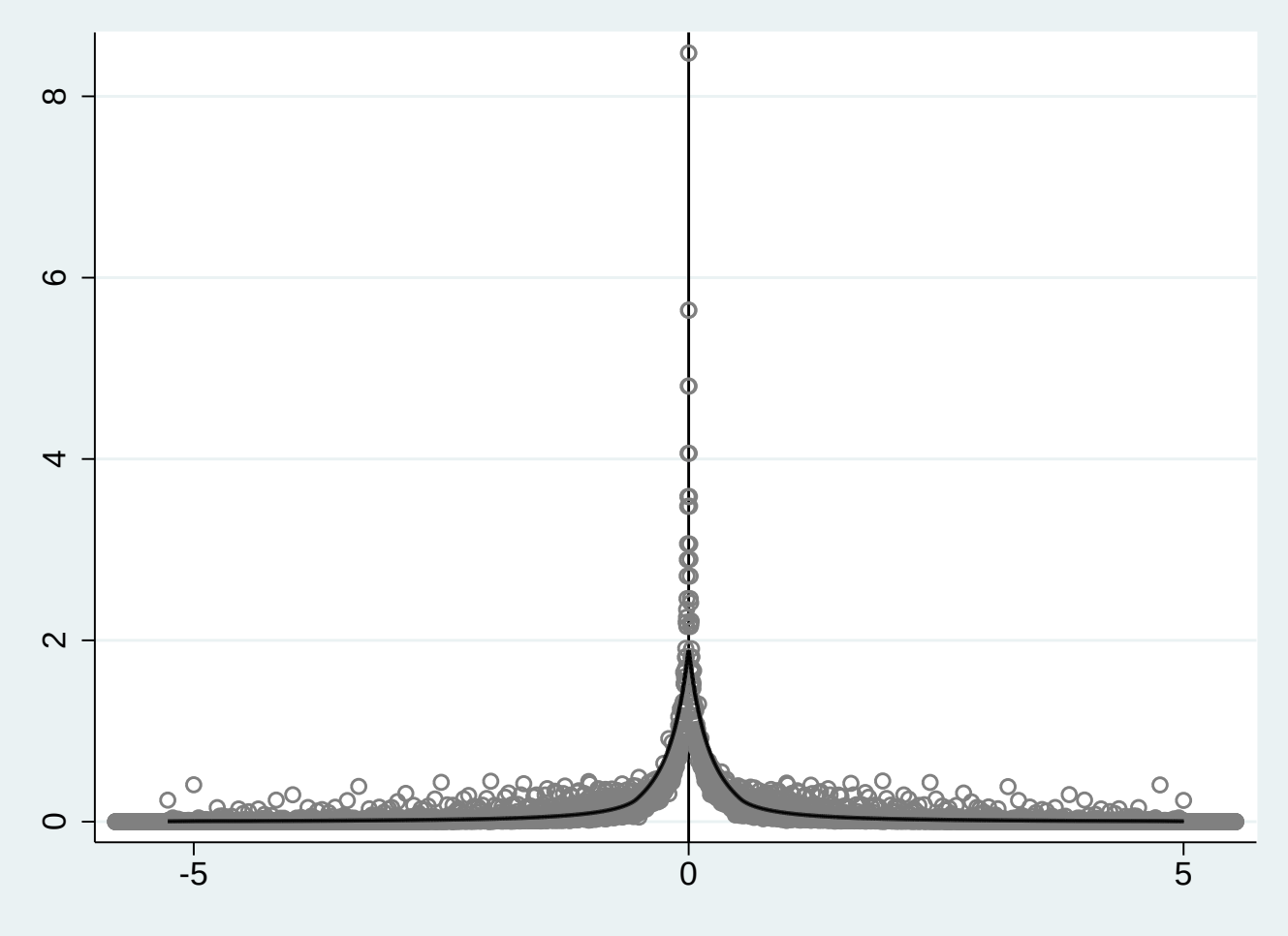


Figure 3: McCrary Plot

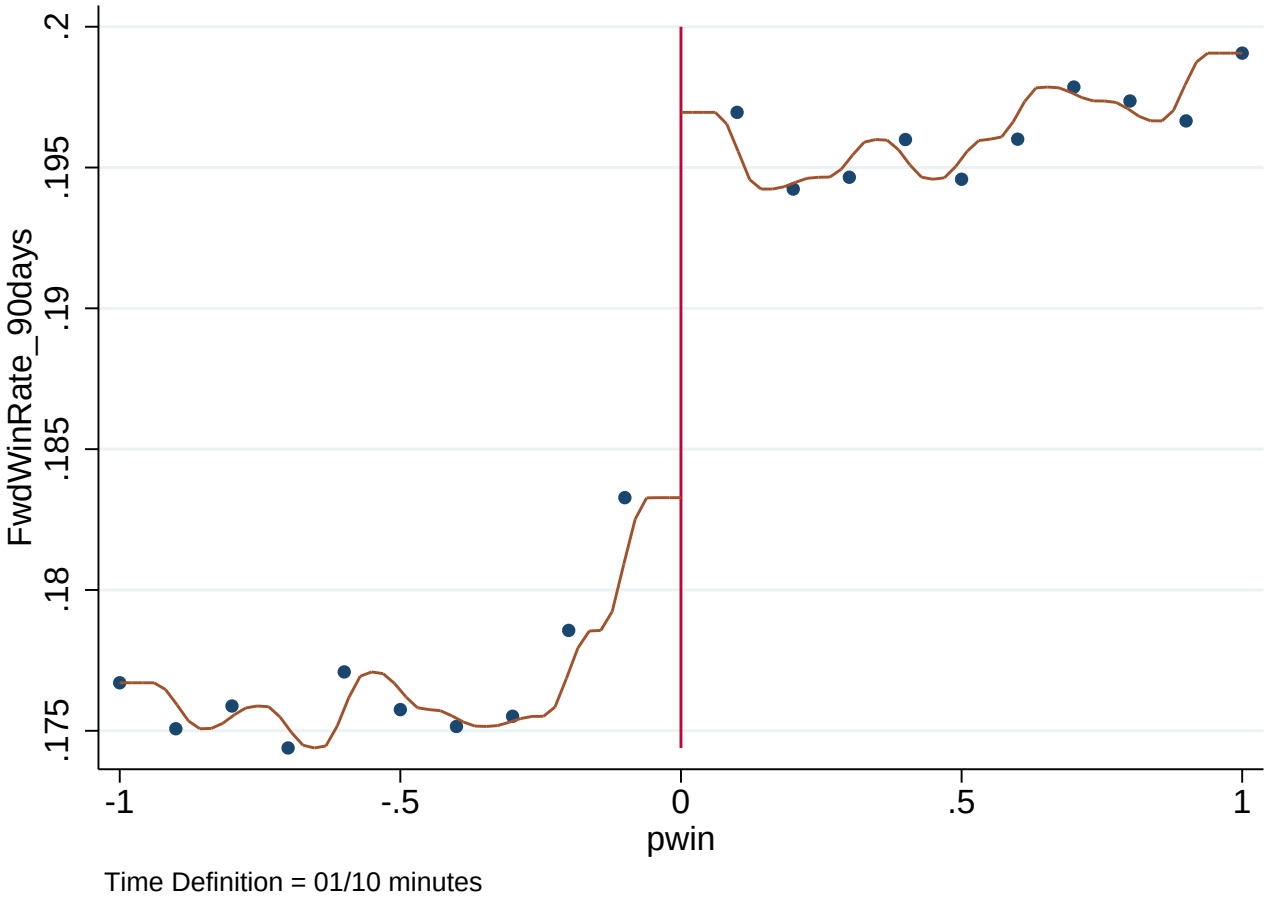


Figure 4: Winning Rate over 90 days Following an Auction: Close Winners vs Close Loosers

Table 1: 20 Most Frequent Product Categories in ComprasNet: 2004-2010

| | (1) # of Lots | (2) % of Total | (3) Median Lot Estimate | (4) % of Total Value Purchased | (5) # of 4-digit | (6) # of 6-digit |
|---|---|---|---|---|---|---|
| Books, Maps, Other Publications | 502,253 | 12 | 149 | .71 | 7 | 134 |
| Medical & Veterinary Equip | 446,508 | 11 | 780 | 12 | 12 | 31,149 |
| Laboratory Equipment | 398,921 | 9.6 | 500 | 4.7 | 19 | 5,009 |
| Office Supplies and Devices | 312,593 | 7.5 | 323 | 1.6 | 4 | 9,754 |
| Subsistence (Food) | 247,975 | 6 | 2,250 | 5 | 14 | 3,383 |
| IT E&S | 238,268 | 5.7 | 1,892 | 9.1 | 11 | 8,010 |
| Vehicular Equipment Components | 234,852 | 5.6 | 400 | 2.3 | 5 | 976 |
| Electrical/Electronic Equip Com | 151,060 | 3.6 | 310 | .75 | 26 | 6,751 |
| Construction & Building Materia | 121,983 | 2.9 | 1,113 | 3.5 | 8 | 1,283 |
| Chemicals and Chemical Products | 91,431 | 2.2 | 339 | 1.3 | 5 | 4,248 |
| Hardware and Abrasives | 85,683 | 2.1 | 240 | .44 | 16 | 3,181 |
| Pipe, Tubing, Hose, Fittings | 85,338 | 2 | 215 | .34 | 3 | 2,830 |
| Hand Tools | 84,036 | 2 | 149 | .16 | 7 | 2,159 |
| Brushes, Paints & Sealers | 80,374 | 1.9 | 560 | .92 | 4 | 1,673 |
| Furniture | 68,960 | 1.7 | 2,925 | 2.1 | 4 | 2,999 |
| Cleaning E&S | 64,253 | 1.5 | 706 | .42 | 3 | 810 |
| Electric Wire & Power Equipment | 60,760 | 1.5 | 900 | .95 | 13 | 3,013 |
| Food Preparation E&S | 55,806 | 1.3 | 872 | .67 | 6 | 2,098 |
| Maintenance & Installation Serv | 53,768 | 1.3 | 3,200 | 6.1 | 16 | 260 |
| Nonmetallic Fabricated Materials | 46,867 | 1.1 | 564 | .58 | 6 | 2,428 |
| Total | 4,163,599 | $1.0e+02$ | 560 | $1.0e+02$ | 704 | 118,819 |

Notes: Table reports statistics for the 20 most frequent categories in ComprasNet between June 2004 and December 2010. There are 106 categories, as defined by the U.S. Federal Supply Classification for goods and the U.N. Central Product Classification for services. The last row shows total for all categories, not only the ones showed in the table. Column (1) shows the number of lots that attracted at least 2 bidders, in each category. Column (2) shows the percentage each category represents. Column (3) shows the median reservation price of lots within each category. Column (4) shows the share of each category in total value purchased. Column (5) shows the number of subcategories in each category. Subcategories are defined by 4-digit codes of the aforementioned classification schemes. Column (6) shows the number of 6-digit codes in each category. 6-digit codes are created by procurement officers in ComprasNet.

Table 2: Sample Descriptive Statistics

| | All Auctions | | Close Auctions[a] | |
|---|---|---|---|---|
| | Mean | Std. Dev. | Mean | Std. Dev. |
| Reserve Price[b] | 20,387 | 6.9e+05 | 46,743 | 1.1e+06 |
| Winning Bid[b] | 10,745 | 3.6e+05 | 27,262 | 5.4e+05 |
| $\frac{Ranked2 - Ranked1}{Ranked2} \times 100$ | 10.06 | 18.05 | 0.02 | 0.01 |
| Winbid/Reserve | 0.68 | 0.32 | 0.73 | 0.28 |
| # of Bidders | 6.90 | 4.88 | 8.13 | 5.82 |
| # of Small Bidders | 5.78 | 4.59 | 7.17 | 5.39 |
| # of Bidders in Same City | 1.81 | 2.32 | 1.80 | 2.44 |
| *Geographic Region* | | | | |
| North | 0.12 | 0.33 | 0.10 | 0.30 |
| Northeast | 0.21 | 0.41 | 0.21 | 0.41 |
| Southeast | 0.33 | 0.47 | 0.33 | 0.47 |
| South | 0.18 | 0.38 | 0.18 | 0.39 |
| Central-West | 0.16 | 0.37 | 0.18 | 0.38 |
| # of Lots | 4,163,599 | | 104,928 | |

Notes: Table shows summary statistics for auctions held by federal purchasing units between June 2004 and December 2010 in which at least two firms participate. See data appendix for a detailed description of filters used. (a) We define close auctions as those auctions where (i) both the winner and runnerup placed bids in the last 30 seconds of the auction, and (ii) the runnerup bid does not exceed the winning bid by more than 0.5%. (b) Monetary values are measured in nominal R$.

Table 3: Sample Descriptive Statistics: Firms

| | Participating in ComprasNet Auctions | | | All Firms | | |
|---|---|---|---|---|---|---|
| | Mean | Median | Std. Dev | Mean | Median | Std. Dev |
| # of employees | 49.495 | 7.000 | 275.39 | 11.718 | 4.0 | 77.44 |
| # of full time employees | 44.570 | 6.000 | 248.11 | 9.882 | 2.0 | 70.18 |
| # of temporary employees | 0.390 | 0.000 | 24.61 | 0.078 | 0.0 | 7.35 |
| Average monthly wages | 1088.729 | 807.995 | 1093.62 | 864.903 | 672.1 | 853.02 |
| Average hourly wages | 25.747 | 18.717 | 28.13 | 20.951 | 15.6 | 26.08 |
| Average Years of Schooling | 8.595 | 9.688 | 3.83 | 9.339 | 9.5 | 2.35 |
| Quarterly Growth | 0.031 | 0.000 | 0.30 | 0.014 | 0.0 | 0.32 |
| Annual Growth | 0.098 | 0.000 | 0.52 | 0.027 | 0.0 | 0.50 |
| Win Rate | 0.184 | 0.039 | 0.29 | | | |
| # of auctions firm participated | 26.360 | 0.000 | 267.21 | | | |
| # of auctions firm won | 3.803 | 0.000 | 53.04 | | | |
| Number of Firms | | 65,613 | | | 4,369,111 | |
| Number of Observations | | 1,531,276 | | | 78,043,248 | |

Notes:

Table 4: Runnerups and Winners: Sample Balance

| | Runnerups | | Winners | | |
|---|---|---|---|---|---|
| | Mean | Std. Dev | Mean | Std. Dev | p-value |
| Sample: 251,126 auctions with 2 active bidders in last 30 seconds; bid difference <0.005 | | | | | |
| Number of Employees in previous quarter | 12.912 | 113.03 | 10.28 | 94.17 | 0.135 |
| Growth rate in previous quarter | 0.053 | 0.27 | 0.06 | 0.28 | 0.883 |
| Growth rate in previous 12 months | 0.141 | 0.42 | 0.15 | 0.43 | 0.832 |
| Average real wages in previous quarter | 633.922 | 619.90 | 611.83 | 610.97 | 0.086 |
| Employees' Schooling in previous quarter | 7.296 | 4.87 | 7.18 | 4.94 | 0.231 |
| Accumulated win rate | 0.184 | 0.12 | 0.19 | 0.12 | 0.378 |
| Bidder in same city as Auction | 0.210 | 0.41 | 0.18 | 0.39 | 0.894 |
| Bidder registred as SME | 0.903 | 0.30 | 0.94 | 0.24 | 0.107 |
| Sample: 103,648 auctions with 2 active bidders in last 12 seconds; bid difference <0.005 | | | | | |
| Number of Employees in previous quarter | 11.091 | 108.95 | 9.113 | 88.86 | 0.058 |
| Growth rate in previous quarter | 0.058 | 0.28 | 0.062 | 0.28 | 0.423 |
| Growth rate in previous 12 months | 0.149 | 0.43 | 0.156 | 0.43 | 0.525 |
| Average real wages in previous quarter | 619.425 | 595.70 | 597.692 | 585.44 | 0.206 |
| Employees' Schooling in previous quarter | 7.230 | 4.94 | 7.059 | 5.03 | 0.266 |
| Accumulated win rate | 0.177 | 0.12 | 0.185 | 0.12 | 0.237 |
| Bidder in same city as Auction | 0.184 | 0.39 | 0.160 | 0.37 | 0.929 |
| Bidder registred as SME | 0.929 | 0.26 | 0.959 | 0.20 | 0.075 |
| Sample: 135,865 auctions with 2 active bidders in last 30 seconds; bid difference <0.001 | | | | | |
| Number of Employees in previous quarter | 13.794 | 127.47 | 10.222 | 102.14 | 0.096 |
| Growth rate in previous quarter | 0.054 | 0.27 | 0.062 | 0.28 | 0.401 |
| Growth rate in previous 12 months | 0.141 | 0.42 | 0.150 | 0.42 | 0.392 |
| Average real wages in previous quarter | 644.620 | 630.54 | 600.354 | 616.53 | 0.042 |
| Employees' Schooling in previous quarter | 7.313 | 4.87 | 7.025 | 4.99 | 0.089 |
| Accumulated win rate | 0.186 | 0.12 | 0.195 | 0.12 | 0.210 |
| Bidder in same city as Auction | 0.203 | 0.40 | 0.173 | 0.38 | 0.795 |
| Bidder registred as SME | 0.890 | 0.31 | 0.935 | 0.25 | 0.054 |

Notes:

Table 5: The Effects of Winning a Government Contract on Future Auctions Outcomes

| | (1) Participation | (2) Win Rate | (3) Any Winnings | (4) Value of Winnings |
|---|---|---|---|---|
| Panel A: Outcomes within a 30-day window starting the day after the auction | | | | |
| winner | 366.4 | .0167 | .0213 | .4235 |
| | [95.46] | [.0038] | [.0015] | [.0417] |
| $R^2$ | 0.643 | 0.549 | 0.545 | 0.608 |
| # of Obs. | 499,024 | 466,542 | 466,542 | 424,856 |
| Mean dep. var. | 1,192 | .195 | .952 | 11.7 |
| Panel B: Outcomes within a 30-day window centered around 12 months after the auction | | | | |
| winner | 218.6 | .0057 | .0139 | .2446 |
| | [77.14] | [.0027] | [.0032] | [.0336] |
| $R^2$ | 0.582 | 0.546 | 0.528 | 0.566 |
| # of Obs. | 380,044 | 216,004 | 216,004 | 168,866 |
| Mean dep. var. | 838 | .165 | .881 | 11.4 |

Notes: All specifications include auction fixed-effects and a cubic polynomial on the percentage difference between the runnerup's and winner's bid. Standard errors are clustered at the firm level. Sample is restricted to auctions in which (i) the runnerup and the winner placed bids in the final 30 seconds, and (ii) the runnerup's bid does not exceed the winner's bid by more than 0.5%. In Panel A, dependent variables are measured in the 30 days following the auction. In Panel B, dependent variables are measured during the 30-day period between centered at 360 days after the auction. The dependent variable in column 1 is the number of auctions the firm enters. The dependent variable in column 2 is the number of auctions the firm wins divided by the number of auction the firm enters. The dependent variable in column 3 is an indicator equal to 1 if the firm wins an auction, and it is missing if the firm does not enter any auctions. The dependent variable in column 4 is the log of the total amount won by the firm, and it is missing if the firm did not win any auctions.

Table 6: The Effects of Winning a Government Contract on Firm Growth

| Dependent variable | Firm Growth | | | | Won | Amount Won | Firm Growth | |
|---|---|---|---|---|---|---|---|---|
| | (1) OLS | (2) OLS | (3) OLS | (4) OLS | (5) OLS | (6) OLS | (7) IV | (8) IV |
| Won | 0.0219 | | | | | | 0.0415 | |
| | [0.0014] | | | | | | [0.0040] | |
| Amount Won (logs) | | 0.0022 | | | | | | 0.0036 |
| | | [0.0001] | | | | | | [0.0004] |
| Won a close auction | | | 0.0268 | | 0.6471 | | | |
| | | | [0.0025] | | [0.0015] | | | |
| Share of close auctions won | | | | 0.0303 | | 8.5334 | | |
| | | | | [0.0031] | | [0.0213] | | |
| $R^2$ | 0.060 | 0.060 | 0.060 | 0.060 | 0.455 | 0.467 | | |
| # of Obs. | 1,227,437 | 1,227,437 | 1,227,437 | 1,227,437 | 1,257,904 | 1,257,904 | 1,227,437 | 1,227,437 |
| Mean dep. var. | 0.0429 | 0.0429 | 0.0429 | 0.0429 | 0.1511 | 1.6230 | 0.0429 | 0.0429 |

Notes: All specifications include bidder fixed effects and quarter dummies. Robust standard errors are reported in brackets. The dependent variable in columns (1)-(4) and (7)-(8) is the firm's growth in terms of number of employees during the quarter.

Table 7: The Effects of Winning a Government Contract on Hires

| | Dependent Variable: # of hires | | | | |
|---|---|---|---|---|---|
| | (1) Total | (2) from Unemployment | (3) from Other Firms | (4) First Job | (5) Within-firm |
| | Panel A: IV Estimates | | | | |
| Won | 1.4184 | 0.3827 | 0.6927 | 0.3034 | 0.0395 |
| | [0.2921] | [0.1406] | [0.1022] | [0.0817] | [0.0417] |
| Amount Won (logs) | 0.1514 | 0.0450 | 0.0719 | 0.0310 | 0.0036 |
| | [0.0274] | [0.0132] | [0.0096] | [0.0077] | [0.0039] |
| | Panel B: OLS Estimates | | | | |
| Won | 0.9074 | 0.3102 | 0.4171 | 0.1570 | 0.0231 |
| | [0.0858] | [0.0377] | [0.0385] | [0.0231] | [0.0127] |
| Amount Won (logs) | 0.1162 | 0.0420 | 0.0529 | 0.0187 | 0.0025 |
| | [0.0096] | [0.0042] | [0.0045] | [0.0025] | [0.0013] |
| # of Obs. | 1,257,904 | 1,257,904 | 1,257,904 | 1,257,904 | 1,257,904 |
| Mean dep. var. | 6.3596 | 3.0642 | 1.5300 | 1.4063 | 0.3592 |

Notes: All specification include bidder fixed-effects and quarter dummies. Robust standard error in brackets.

Table 8: The Effects of Winning a Government Contract on Firm Growth Next Quarter

| Dependent variable | Firm Growth Next Quarter | | | | Won | Amount Won | Firm Growth Next Quarter | |
|---|---|---|---|---|---|---|---|---|
| | (1) OLS | (2) OLS | (3) OLS | (4) OLS | (5) OLS | (6) OLS | (7) IV | (8) IV |
| Won | 0.0129 | | | | | | 0.0191 | |
| | [0.0015] | | | | | | [0.0041] | |
| Amount Won (logs) | | 0.0016 | | | | | | 0.0017 |
| | | [0.0001] | | | | | | [0.0004] |
| Won a close auction | | | 0.0123 | | 0.6471 | | | |
| | | | [0.0026] | | [0.0015] | | | |
| Share of close auctions won | | | | 0.0148 | | 8.5334 | | |
| | | | | [0.0032] | | [0.0213] | | |
| $R^2$ | 0.061 | 0.061 | 0.061 | 0.061 | 0.455 | 0.467 | | |
| # of Obs. | 1,192,502 | 1,192,502 | 1,192,502 | 1,192,502 | 1,257,904 | 1,257,904 | 1,192,502 | 1,192,502 |
| Mean dep. var. | 0.0420 | 0.0420 | 0.0420 | 0.0420 | 0.1511 | 1.6230 | 0.0420 | 0.0420 |

Notes: Notes: All specifications include bidder fixed effects and quarter dummies. Robust standard errors are reported in brackets. Firm growth (the dependent variable in Column (1)-(4) and (7)-(8) is defined as the change in the firm's number of employees between the end of the previous and current quarters divided by the average number of employees between the two quarters.

Table 9: The Effects of Winning a Government Contract on the Probability of Firm Exit

| Dependent variable | Firm Exit | | | | | |
|---|---|---|---|---|---|---|
| | (1) OLS | (2) OLS | (3) OLS | (4) OLS | (5) IV | (6) IV |
| Won | -0.0074 | | | | -0.0100 | |
| | [0.0002] | | | | [0.0005] | |
| Amount Won (logs) | | -0.0007 | | | | -0.0008 |
| | | [0.0000] | | | | [0.0000] |
| Won a close auction | | | -0.0065 | | | |
| | | | [0.0002] | | | |
| Share of close auctions won | | | | -0.0066 | | |
| | | | | [0.0002] | | |
| $R^2$ | 0.091 | 0.091 | 0.090 | 0.090 | | |
| # of Obs. | 1,252,252 | 1,252,252 | 1,252,252 | 1,252,252 | 1,252,252 | 1,252,252 |
| Mean dep. var. | 0.0036 | 0.0036 | 0.0036 | 0.0036 | 0.0036 | 0.0036 |

Notes: All specification include bidder fixed-effects and quarter dummies. Robust standard error in brackets.

Table 10: The Effects of Winning a Government Contract on Firm Growth: comparing areas with low versus high access to credit

| | Lending/GDP | | Deposits/GDP | | Number of Banks | |
|---|---|---|---|---|---|---|
| | (1) Low Access | (2) High Access | (3) Low Access | (4) High Access | (5) Low Access | (6) High Access |
| | Panel A: IV Estimates | | | | | |
| Won | 0.0404 | 0.0425 | 0.0370 | 0.0455 | 0.0346 | 0.0477 |
| | [0.0059] | [0.0054] | [0.0058] | [0.0055] | [0.0057] | [0.0056] |
| Amount Won (logs) | 0.0036 | 0.0035 | 0.0032 | 0.0039 | 0.0032 | 0.0039 |
| | [0.0006] | [0.0005] | [0.0005] | [0.0005] | [0.0005] | [0.0005] |
| | Panel B: OLS Estimates | | | | | |
| Won | 0.0218 | 0.0221 | 0.0207 | 0.0231 | 0.0214 | 0.0225 |
| | [0.0020] | [0.0020] | [0.0020] | [0.0020] | [0.0021] | [0.0020] |
| Amount Won (logs) | 0.0022 | 0.0023 | 0.0021 | 0.0024 | 0.0022 | 0.0023 |
| | [0.0002] | [0.0002] | [0.0002] | [0.0002] | [0.0002] | [0.0002] |
| # of Obs. | 615,631 | 611,755 | 621,347 | 606,039 | 627,184 | 600,202 |
| Mean dep. var. | 0.0457 | 0.0400 | 0.0453 | 0.0404 | 0.0450 | 0.0407 |

Notes: All specification include bidder fixed-effects and quarter dummies. Robust standard error in brackets.

Table 11: The Effects of Winning a Government Contract on Firm Growth: Heterogeneity by Remotness and Labor Regulations

| | Distance to nearest municipality with population density $\geq$ median | | | Probability of Inspection | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| | $<$ 400km | [400km, 2,200km) | $\geq$ 2,200km | Low | High |
| | | | Panel A: IV Estimates | | |
| Won | 0.0212 | 0.0422 | 0.0529 | 0.0314 | 0.0511 |
| | [0.0128] | [0.0044] | [0.0147] | [0.0054] | [0.0058] |
| Amount Won (logs) | 0.0018 | 0.0037 | 0.0041 | 0.0027 | 0.0043 |
| | [0.0012] | [0.0004] | [0.0013] | [0.0005] | [0.0005] |
| | | | Panel B: OLS Estimates | | |
| Won | 0.0177 | 0.0223 | 0.0234 | 0.0188 | 0.0249 |
| | [0.0041] | [0.0016] | [0.0044] | [0.0020] | [0.0020] |
| Amount Won (logs) | 0.0016 | 0.0023 | 0.0023 | 0.0019 | 0.0026 |
| | [0.0004] | [0.0001] | [0.0004] | [0.0002] | [0.0002] |
| # of Obs. | 128,785 | 966,596 | 132,056 | 618,635 | 608,214 |
| Mean dep. var. | 0.0372 | 0.0426 | 0.0503 | 0.0410 | 0.0449 |

Notes: All specification include bidder fixed-effects and quarter dummies. Robust standard error in brackets.

Table 12: Randomization Checks: Correlates of Phase C Duration period

| | (1) Regime 1 | (2) Regime 2 | (3) Regime 3 |
|---|---|---|---|
| Estimated value of the goods being auctioned (logs) | -0.0001 | 0.3031 | 0.0033 |
| | [0.0066] | [0.0017] | [0.0066] |
| Number of Bidders | 0.0009 | 0.2992 | 0.0022 |
| | [0.0033] | [0.0007] | [0.0028] |
| Share of Bidders who are from the State | -0.0289 | -0.4927 | 0.0028 |
| | [0.0445] | [0.0124] | [0.0448] |
| Share of Bidders who were Rejected Before the Auction | -0.0566 | -2.4326 | 0.0736 |
| | [0.1493] | [0.0514] | [0.1842] |
| $R^2$ | 0.0000 | 0.0710 | 0.0000 |
| # of Obs. | 414,413 | 4,359,247 | 440,589 |
| F-test: Quarter of Year Intercepts | 1.32 | 699 | .921 |
| Prob $>$ F | 0.265 | 0 | 0.429 |
| F-test: Region Intercepts | .295 | 1155 | 1.41 |
| Prob $>$ F | 0.881 | 0 | 0.229 |
| F-test: Ministry Intercepts | 1.21 | 552 | 1.06 |
| Prob $>$ F | 0.297 | 3.10e-240 | 0.348 |
| F-test: Type of Good Intercepts | 1.81 | 3345 | .661 |
| Prob $>$ F | 0.106 | 0 | 0.653 |

Notes: The unit of observation is an auction (lot). The dependent variable is the duration Phase C of the auction. Regime 1 corresponds to the period 6/28/04-4/15/06. Regime 2 corresponds to the period 4/16/06-9/13/10. Regime 3 corresponds to the period 9/14/10-12/16/10. In Regime 1 and 3, durations are drawn from a uniform distribution between [0,30] minutes. In Regime 2, durations are initially drawn from a uniforem [5,30] minutes, and a draw from the uniform [0,2] minutes is added for every bid placed, but overall duration remained capped at 30 minutes.

Table 13: First-stage: The Effects of Auction Length on Winning Bid

| | Regime 1 | | Regime 2 | | Regime 3 | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Phase C Dur. (minutes) | -0.0020 | -0.0021 | 0.0327 | -0.0052 | -0.0069 | -0.0071 |
| | [0.0004] | [0.0002] | [0.0001] | [0.0000] | [0.0004] | [0.0001] |
| Controls | No | Yes | No | Yes | No | Yes |
| $R^2$ | 0.0001 | 0.8552 | 0.0124 | 0.8995 | 0.0008 | 0.8717 |
| # of Obs. | 386,843 | 381,519 | 4,097,022 | 3,967,327 | 405,835 | 398,558 |

Notes: The dependent variable is log of winning bid. Phase C Duration corresponds to the length of the last bidding phase measured in minutes. Regime 1 corresponds to the period 6/28/04-4/15/06. Regime 2 corresponds to the period 4/16/06-9/13/10. Regime 3 corresponds to the period 9/14/10-12/16/10. Robust standard errors in bracket. Controls correspond to: log of estimated value of the goods being auctioned, number of bidders, share of bidders from the same state, share of bidders who were rejected prior to the auction, separate indicators for the type of the good being auction (2 digit classification) and for which region, ministry, quarter of the year in which the auction took place.

Table 14: The Effects of Contracts' Prices on Firm Growth

| Dependent variable | Firm Growth | | | Firm Growth Next Quarter | | |
|---|---|---|---|---|---|---|
| | (1) OLS | (2) OLS | (3) IV | (4) OLS | (5) OLS | (6) IV |
| Value of Contracts | 0.0043 | | 0.0048 | 0.0011 | | 0.0017 |
| | [0.0008] | | [0.0012] | [0.0009] | | [0.0013] |
| Value of Contracts based on Phase C Duration | | 0.0046 | | | 0.0016 | |
| | | [0.0012] | | | [0.0013] | |
| $R^2$ | 0.246 | 0.245 | | 0.206 | 0.206 | |
| # of Obs. | 138,555 | 138,555 | 138,555 | 111,749 | 111,749 | 111,749 |
| Mean dep. var. | 0.0430 | 0.0430 | 0.0430 | 0.0383 | 0.0383 | 0.0383 |

Notes: Regressions include bidder-fixed effects and quarter dummies. Robust standard errors are reported in brackets. Firm growth is defined as the change in the firm's number of employees between the end of the previous and current quarters divided by the average number of employees between the two quarters.

Table 15: The Effects of Winning a Government Contract on Firm Growth: Controlling for Endogenous Participation

| Dependent variable | Growth t-1,t | | Growth t,t+1 | |
|---|---|---|---|---|
| | (1) IV | (2) IV | (3) IV | (4) IV |
| Won | 0.0688*** | | 0.0468*** | |
| | [0.0076] | | [0.0084] | |
| mills_dwin | -0.0478*** | | 0.1170*** | |
| | [0.0111] | | [0.0161] | |
| Amount Won (logs) | | 0.0049*** | | 0.0036*** |
| | | [0.0007] | | [0.0007] |
| mills_lwin | | -0.0570*** | | 0.0842*** |
| | | [0.0115] | | [0.0174] |
| Quarter Dummies | Yes | Yes | Yes | Yes |
| $R^2$ | 0.005 | 0.007 | 0.485 | 0.486 |
| # of Obs. | 266,611 | 266,611 | 266,611 | 266,611 |
| Mean dep. var. | 0.0395 | 0.0395 | -0.0905 | -0.0905 |

Notes: All specification include bidder fixed-effects and quarter dummies. Robust standard error in brackets.

Table 16: The Effects of Winning a Government Contract on Hires: Controlling for Endogenous Participation

| | (1) Total # of hires | (2) % from Unemployment | (3) % from Other Firms | (4) % First Job | (5) % Within-firm |
|---|---|---|---|---|---|
| dwins | 1.5306 | -0.0077 | 0.0165 | -0.0017 | -0.0071 |
| | [0.6163] | [0.0093] | [0.0066] | [0.0077] | [0.0049] |
| mills_dwin | -2.8726 | 0.0119 | -0.0031 | -0.0148 | 0.0060 |
| | [1.3012] | [0.0137] | [0.0097] | [0.0115] | [0.0073] |
| lwins | 0.1215 | -0.0007 | 0.0012 | -0.0000 | -0.0005 |
| | [0.0505] | [0.0007] | [0.0005] | [0.0006] | [0.0004] |
| mills_lwin | -1.8820 | 0.0135 | -0.0082 | -0.0125 | 0.0072 |
| | [1.5139] | [0.0140] | [0.0102] | [0.0117] | [0.0074] |
| # of Obs. | 266,611 | 132,253 | 132,253 | 132,253 | 132,253 |
| Mean dep. var. | 10.4195 | 0.5291 | 0.1872 | 0.2178 | 0.0659 |

Notes: