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. 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

Government purchases have been widely used throughout the world as a tool to foster economic activity and increase employment. A significant share of this spending is done through public procurement. Among OECD countries, for example, governments spend on average 13 percent of their GDP on public procurement. Consequently, several countries have begun to experiment with public procurement as a policy instrument for encouraging firm growth and innovation, and strengthening industrial capabilities.[1] But whether public procurement is effective in stimulating economic activity ultimately depends on whether government contracts help firms overcome barriers to growth such as lack of market access.

The literature on public procurement has unfortunately offered few insights into this question. While there is a large literature focused on the optimal design of procurement auctions, there is little evidence on how procurement contracts affect firm performance.[2] At some level, this is not surprising. Governments do not assign contracts at random, but instead target specific types of firms. In some cases, they may target the most productive firms when picking winners; or the less productive firms when political favoritism and corruption become a consideration. Thus, winning a government contract is likely to be correlated with unobserved firm characteristics, which makes it difficult to isolate the effects of government contracts on firm performance.

This paper examines whether firms that win government procurement contracts in Brazil grow more compared to firms that compete for these contracts but do not win. To address this question, we assemble one of the most comprehensive data sets to date, in which we combine the universe of federal government procurement contracts auctioned out over the internet during the period of 2005 to 2010 with matched employer-employee data for the universe of formal firms in Brazil.[3] From the procurement data, we observe not only the characteristics of the auction and the winning firm's bids, but also the bids of all the losing firms that participated in the auction. From the firm data, we observe the size of firms, their age, the characteristics of all workers, and the exact date workers were hired and fired. We combine these datasets to estimate the effects of winning government contracts on firm growth for over 47,000 firms that participated in over 6.5 million lots auctioned off by Brazil's federal government during this period.

To identify the effects of winning a government contract on firm growth, we introduce a novel research design that exploits three unique aspects of our setting. First, unlike most auctions that end at a predetermined time (or based on a predetermine rule), our auctions end unexpectedly

[1] See, for example, the review of industrial policies described in O'Sullivan et al. (2013).

[2] See Dimitri et al. (2011) on the importance of procurement and evidence on different contracts and designs.

[3] Starting in 2005, bidding on all federal procurement contracts were done via an Internet portal, called *ComprasNet*.

based on an unknown random number drawn by the auctioneer. Second, these auctions do not contain a proxy-bidding system. Instead, firms must enter their bids manually, and will routinely outbid each other several times until the auction ends at random. Third, because we observe the entire distribution of firms' bids in electronic procurement auctions we can 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). We show that winning these types of close auctions can be considered as good as random and that they can be used as an exogenous demand shock to the firm.

We find that winning a government contract has a significant effect on firm growth both during the quarter in which they win a contract, as well as over the medium horizon. Our estimates imply that winning one additional auction increases firm growth by a sizable 2.3 percentage points over the quarter, which is sufficient to move a firm located at the median of the firm growth distribution to the 75^{th} percentile of the distribution. These effects also persist over time as firms experience growth for at least 10 quarters after winning a contract, which is beyond the time when most government contracts have expired.

These persistence effects are, in part, attributed to firm behavior in future auctions. Firms that win a close auction participate in 30 percent more auctions over the next three months compared to those firms that barely lose. Moreover, even projecting a year later, we find that close winners are participating in 20 percent more auctions than close losers over a 30 day window. These participation effects translate into higher win rates, and significantly more contract winnings.[4] We also find that close winners are much more likely to participate in auctions located outside of their municipality, suggesting that winning government contracts help firms to expand their market.

An important feature of our employer-employee dataset is that we can follow workers over time as they switch firms or enter in and out of the formal sector. This aspect of our data permits us to decompose our growth effects into the part of firm growth that comes from workers joining the formal sector versus those who were already in the formal sector and simply switched firms. We find that 93 percent of the growth in new hires comes from individuals who were either unemployed, in the informal sector, or first-time workers. We also find that winning a contract reduces job destruction, which represents an important component of the overall growth effect. As a whole, our main findings highlight the importance of demand shocks for firm dynamics.

Our study relates to three broad literatures. First, we contribute to a new empirical literature that examines the role of demand factors to explain firm growth. Most of this literature has

[4]These results are consistent with a learning-by-doing process, as highlighted in Jofre-Bonet and Pesendorfer (2003) and Tiererova (2013).

relied on the availability of price data and functional form assumptions in order to disentangle demand from productivity shocks (Pozzi and Schivardi (2012) and Foster et al. (2012)).[5] We complement this analysis using quasi-experimental variation on demand shocks that affect firms and are orthogonal to productivity shocks. Our quasi-experimental design of comparing winners and losers in close-auctions is similar in spirit to Greenstone and Moretti (2003). 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.

Our findings also relate to an extensive literature that examines the life cycle of firms (e.g. Sutton (1997)). As the literature has pointed out, firms tend to grow as they age, and this life-cycle pattern is often interpreted as evidence of firm-specific accumulation of organizational capital Atkeson and Kehoe (2005); Hsieh and Klenow (2014). Growth in organization capital can come about due to investments in new technologies, managerial practices, or customer capital.[6] If younger firms have not yet developed this organization capital and do not, for instance, have the customer base of older firms, then we would expect the effects of these government-induced demand shocks to be more pronounced among younger firms. This is precisely what we find. The effects for firms less than 5 years old are twice the size of the effects for firms between 5 and 15 years old, and more than 4 times the effects size among firms 25 years and older. [7]

Finally, our paper contributes to a growing literature that studies the barriers faced by small and medium firms in developing countries. Credit constraints, market access, and labor regulations have been frequently cited as potential explanations for why in developing countries small and medium sized-firms fail to growth. Differentiating between these alternative explanations is 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 increases firm growth, but that demand effects interact with the local characteristics.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.[8]

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

[5]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. 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.

[6]See for example Cabral and Mata (2003), Rob and Fishman (2005), Arkolakis (2010), Dinlersoz and Yorukoglu (2012), Gourio and Rudanko (2011), Luttmer (2011), Drozd and Nosal (2012), Kueng et al. (2014).

[7]These results are consistent with Fort et al. (2013) who find that younger business in the U.S. are more sensitive to cyclical shocks.

[8]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).

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.[9]

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.[10]

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.[11]

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 deposits to municipal GDP, winning a contract leads to an increase in firm growth compared to places with less access to credit. Moreover, this differential impact is even more pronounced among older firms. We also find that firms respond more to demand shocks in municipalities where the probability of being inspected in lower, which is again consistent with the recent literature. We do not however find that firms that are further from a large market grow relatively more given a demand shock.

The plan for the paper is as follows. The next section offers some background on Brazil's public procurement auction, followed by Section 4, which describes our dataset and estimation sample. In Section 5 we present our research design and tests of its validity. Section 6 begins by documenting the effects of winning a close auction on future contracts and participation in future auctions. We then present our results on the effects of winning a government contract on firm growth. Section 7 concludes.

[9] See for example Levine (2005), Guiso et al. (2004). See also Manova (2008) for the case of exporting firms.

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

[11] Hsieh and Klenow (2014) suggest that labor regulations for larger firms can explain why firms decide to stay small in developing countries. Levy (2010) 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 (2007); World Bank (2004); Aterido et al. (2009). Fisman and Svensson (2007) show that taxation and bribery are negatively correlated with firm growth.

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.[12] 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, 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.[13] Several lots can be procured at the same session. Next, the public body must provide a reservation price for each

[12] 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).

[13] 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.

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 **??** 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.[14] 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.[15]

To illustrate that auctions indeed end at random, Figure **??** 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

[14] 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.

[15] 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 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.

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[16], 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 Equilibrium Bidding Behavior

The ComprasNet auction mechanism modifies the ending rule of an otherwise standard English auction. Instead of ending the auction when no bidder is willing to outbid the previous bid, auctions in ComprasNet end at random. This institutional feature raises the following questions: How should bidders behave under a random ending rule? What are the equilibrium bidding strategies, if any? Can the close auctions we use in our empirical strategy be generated in equilibrium play?

To shed light on these questions, we present a model by Celicktemur and Szerman (2014), which characterizes equilibria of ascending auctions with a random-ending rule. Their model extends the Ockenfels and Roth (2006) model of eBay auctions to allow for a random close.[17]

Consider the following environment. There is a single seller auctioning a single indivisible object. There are $n \geq 2$ buyers (bidders), denoted by $N = \{1, 2, \dots, n\}$. Each bidder has a private valuation $v_i \in [0, \bar{v}]$ that is drawn identically and independently according to some distribution $F(v)$. The strategy structure of the auction can be summarized as follows:

- The minimum initial bid equals zero (i.e. there is no reservation price for the seller).[18]
- A player can place a single bid b_i^t at any time $t \in T = \{0\} \cup \{t_1(m) = \frac{m}{m+1}; m = 1, 2, \dots\} \cup \{1\} \cup \{t_2(m) = \frac{2m+1}{m+1}; m = 1, 2, \dots\} \cup \{2\}$. If a player $i \in N$ at some time $t \in T$ does not bid, then we denote her bid as $b_i^t = \emptyset$. This formulation states that the auction game has

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

[17] Ascending auctions are complex dynamic games, and generally cannot be fully analyzed with available methods. Such complexity has led researchers to rely on abstractions for tractability, modeling ascending auctions as a "button auctions", as in Milgrom and Weber (1982). Time limits bring additional difficulties in modeling ascending auctions by augmenting bidders' strategy space. As a result, models of ascending auctions with time limits are bound to be very stylized, aiming at capturing only the most salient features of the auction game.

[18] For any seller's reservation price $r \in (0, \bar{v})$, the results do not change.

four periods, two of which are divided in an infinite and countable number of subperiods. This resembles the bidding timeline of ComprasNet, see Figure **??**. Every new bid of a player has to be higher than her last nonempty bid, i.e. $b_i^{t'} > b_i^t$ if $t' > t$ for $b_i^{t'} \neq \emptyset$ and $b_i^t \neq \emptyset$. At any given time $t \in T$, players can submit bids simultaneously without knowing what other bids are placed. The bid history at some time t lists all the bids placed up to that time along with the identities of the bidders. The auction ends either at the end of time $t = 1$ with probability $h \in (0,1)$ or at the end of time $t = 2$ with the remaining probability, $1 - h$.

- Depending on the ending time realization $\bar{t}$, the highest bidder wins the auction paying the highest submitted bid from another bidder according to the bid history and the last bids placed at $\bar{t}$ (if any).
- A bidder who wins the auction at some price p earns $v_i - p$, a bidder who does not win earns 0.
- A player has time to react to another player's bid at any time $t \in T \setminus \{1,2\}$, however the reaction can not be instantaneous. Any reaction $b_i^{t'}$ to a bid b_j^t for $i \neq j$ can arrive earliest at $t' = t_1(1)$ if $t = 0$, or at $t' = t_1(m+1)$ if $t = t_1(m)$ for some m, or at $t' = t_2(m'+1)$ if $t = t_2(m')$ for some m'.
- Equal bids from different bidders are resolved by order of arrival (first bidder to submit has priority) or, if they were simultaneously submitted, at random with equal probability.
- Any bid submitted at $t \in T \setminus \{1,2\}$ is transmitted with certainty.
- A bid submitted at time $t = 2$ is successfully transmitted with probability $0 < q < 1$, where q is an exogenously given probability.
- Similarly, a bid submitted at time $t = 1$ arrives at the end of $t = 1$ with probability $q \in (0,1]$. If the auction does not end at $t = 1$, and the bid does not arrive at $t = 1$, then it arrives at $t_2(1)$[19]. This is a crucial difference between the last-minute bid at $t = 2$ and (possibly) a last-minute bid at $t = 1$.

We search for equilibria that display late bidding, and more importantly sniping. Sniping will be referred to as a situation in which a player places a bid that cannot be retaliated against. In our game, conditional on the game ending at $t = 2$, a bid successfully placed at $t = 2$ is a snipe. Similarly a bid successfully placed at $t = 1$ may be a snipe with probability h. We show by construction that there may exist equilibria with sniping at $t = 2$ in the presence of a random ending time. Before we state the main result consider the subgame at $t = 2$.

[19]This implies that the other bidders have opportunity to reply to a bid placed at $t = 1$ with probability $1 - h$, i.e. the probability that the auction ends at $t = 2$.

Theorem 3.1. *There may exist symmetric perfect Bayesian equilibria where bidders with valuation above a threshold $p \in [0, \bar{v})$ snipe each other mutually at $t = 2$ and do not place any bids in $(0, 2)$.*

Proof. Without loss of generality, consider the case of 2 bidders. Then the following strategies comprise the equilibrium profile. There exists a cutoff bid $p \in [0, \bar{v})$ such that the following strategy profile (S1, S2) along with the beliefs form a perfect Bayesian equilibrium,

S1. If $v_i \leq p$, then she bids $b_i^0 = v_i$ and never updates after time $t = 0$, i.e. $b_i^t = \emptyset$ for all $t > 0$.

S2. If $v_i \geq p$, then she bids $b_i^0 = p$ at time $t = 0$. If the opponent has bid $b_j^0 < p$ then she bids $b_i^{t_1(1)} = v_i$. Otherwise, she does not update until $t = 2$, i.e. $b_i^t = \emptyset$ at any $t \in (0, 2)$. At $t = 2$ she bids $b_i^2 = v_i$. If i observes that $b_j^0 > p$ or $b_j^t \neq \emptyset$ at some $t \in (0, 2)$, then she bids $b_i^{t'} = v_i$ at the next possible period.

The condition for the equilibrium to exist is given by

$$(\bar{v} - p)\left[\frac{F(p) + q}{1 + q} - \frac{h \cdot q}{1 - h}\frac{(1 - F(p))}{(1 - q^2)}\right] \geq \int_p^{\bar{v}} F(v)dv$$

See Celiktemur and Szerman (2014) for further details on the proof.

□

As this theorem suggests, in a model of based on the ComprasNet auctions, there may exist equilibria where bidders with high enough valuations engage in late bidding. The key element for late bidding to arise in equilibrium is the probability that bids are not transmitted towards the end of the auction, which may happen due to bidding frictions (Ockenfels and Roth, 2006). For example, even in eBay there may be delays due to Internet traffic and connection times, which may cause bids to arrive late. In ComprasNet, the absence of a proxy bidding system creates further frictions in the bidding technology, as bidders need time to respond to their opponents' bids.

When some bids are not transmitted, the winning price is effectively lower, causing expected surplus to be transferred from the auctioneer to bidders. This situation can be interpreted as a tacit collusive equilibrium: bidders tacitly avoid a "price war" early on the auction. Celicktemur and Szerman (2014) show that such equilibirum can be sustained with a likelihood that is non-monotonic on the probability that bids do not get transmitted: if the probability is too low, then there is little to be gained by delaying bidding. On the other hand if the probability is too high, then the chances of winning the auction are too low. [20]

[20] Celicktemur and Szerman (2014) also show that the random ending reduces the incentives for late bidding vis-à-vis the situation with a fixed ending time. In fact, they note that when ComprasNet changed its ending rule effectively putting more mass between the 27th and 29th minutes, late bidding increases.

Two comments further are in order. Due to eBay's proxy bidding system, late bidding in eBay equals sniping–a one-shot bid at the end of the auction. In ComprasNet, late bidding should be interpreted as an incremental bidding strategy in the random stage of the auction. This is the bidding behavior that gives rise to the close auctions we use. Secondly, Celicktemur and Szerman (2014) also show that there are equilibria without late bidding. In particular, there are equilibria where all bidders bid up to their true valuations before the random phase starts. These equilibria are payoff equivalent to the standard equilibrium in weakly dominant strategies of a Vickrey auction. These are not however the type of equilibria we use in our close auctions. To sum up, Celicktemur and Szerman (2014) give theoretical grounds that justify our empirical strategy.

4 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.

4.0.1 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 **??**); 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 cate-

gories by 2-digit codes, and sub-categories by 4-digit codes[21]. 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 **??** 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 **??** 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 Electronic Equipment Components), while other are divided in only 3 subcategories (e.g., Cleaning

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

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.

4.0.2 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 28.2 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 2.1 percent during the period, compared to only 2 percent for the sample as a whole. The majority of the workforce consists of permanent workers: Only 1.36 out 28.2 employees are classified as temporary workers.

On average, firms hire 3.43 new employees per quarter. Most of these new employees come from either unemployment or from the informal sector. Only 0.77 of an employees comes from other firms, and more than half of these new hires come from outside of the municipality.

From Table **??**, we also see that on average firms participate in over 30 auctions per quarter, winning on average 4.8. This amount to an average BRL $183,200 per quarter, which is quite sizeable when we compare to an average monthly wage bill of BRL $164,000 for the firms in our sample. Participation in a close auction is less common occurrence, as firms on average participate in only 0.55 of them per quarter.

The average age of the firms in our sample is 7 years. In Figure **??** we plot the share of employ-

ment by the age of the firm. Forty percent of formal sector employment comes from firms that are below the age of 15. This number is between those documented for Mexico (60%) and US (30%) Hsieh and Klenow (2014). In Brazil, less than 10 percent of the formal sector is employed by firms over the age of 39, whereas in the U.S. almost 30 percent are employed by these older firms.

In Figure **??**, we plot the relationship between firm size and age of the firm, distinguishing between firms that are located in municipalities below the median in per capita GDP and those located above the median. The difference in the life-cycle of these two sets of firms is quite striking and consistent with the patterns documented across countries. For firms below the age of 15, the relationship between firm size and age is very similar for firms located in poorer municipalities compared to those located in richer municipalities. But for firms 15 years old and older, there is a pronounced divergence. Among these older firms, the relationship is much flatter for firms located in poorer municipalities. For example, among firms 40 years old and older, firms located richer municipalities are more than 2.8 times larger than firms located in poorer regions. This stylized fact will serve as part of the motivation for whether the effects of demand shocks vary according to the characteristics of the firm's location and it's age.

5 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 ε_{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:

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

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.

5.1 Close Auctions

Our research design exploits two complementary sources of variation. First, the design of the auction with a random phase implies that firms do not know exactly when the auction will end. Thus, as long as firms have a similar valuation for the project and are bidding sequentially to outbid each other, the random ending is likely to generate winners and runner-ups that are very similar. In order to restrict our comparison to firms that have similar valuations, we focus on auctions with two characteristics: first, firms bid one after the other after the announcement of random phase. Second, the final winner bid is very close to the runner-up bid (i.e. the win margin is very small).

Our design resembles a Regression Discontinuity Design where the treatment is assigned for firms that barely pass a treshold defined over a running variable that cannot be directly manipulated by the firm. In our case the treatment is defined as 1 for the firm that gave the largest bid and won the auction and zero for the runner-up. The running variable is defined as the win margin (i.e. difference between the final bid of the winning firm minus the bid of the runner-up firm). Although the firm observes the bid of the competitor and can manipulate the running variable by placing a bid that is just slightly lower, the random ending of the auction introduces noise in this possibility and breaks the direct link between the original valuation and the final

bid.

Thus, if firms were entering one auction that will define whether they are winners or losers, we could estimate the following specification:

evidence at the auction level auction outcomes

In traditional Regression Discontinuity Designs, the treatment is determined and we are interesting in analyzing the outcome for winners and losers. Our setting is slightly different because firms enter auctions almost every day (sometimes more than one auction per day), but the outcome that we are interested (firm growth) does not vary at the daily level.

Moreover, while we are interested in whether a firm won a contract or not, our mains

equation for individual RD at the firm and auction level

The intuition for our empirical strategy is that, if it was not for the random ending, the runner-up firm could have won the auction. Thus, conditional on having two firms bidding one after the other with close bids, the identity of the winner of the auction is as good as random.

Our definition of a close auction is that firms make bids close to each other and that the final bids of the winner and runner-up are very similar.[22] If every close-auction can be treated as an event that is as good as random, then the average of these events can also be treated as random. Thus the share of close-auctions won by a firm can be treated as random.

need that both firms make sequential bids over time and that the win margin is small. Thus, we focus on the variation that comes from close-auctions defined as auctions where xxxx.

and another based on the closeness of competitive auctions. The empirical design exploits the fact that in the random phase of the auctions,

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participating in a highly competitive auction, winning a very close auction can be considered a random event. This is particularly true in the type of auctions that we study where the length of the auction is random on an uniform distribution of zero to thirty minutes.

Thus the number of contracts that a given firm wins in very close auctions can be used as an instrument for the total number of contracts won by a firm in a given quarter.

Share of winnings in close auctions

The proportion of close auctions that a firm wins is used as an instrument for the proportion of auctions that a firm wins

[22] We show that our results are robust to using alternative measured of closeness in the rsults section.

What we are doing: amount won instrumented by share of winnings in close auctions What political paper does: share won instrumented by share of winning in close auctions

firm win close/ (firm win close + firm lose close)

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. As we restrict the sample to firms who were issuing similar bids just prior to the auction's end, it is likely that firms that barely win and barely lose are similar in their productive characteristics, on average.

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 a further validity check of our research design, in Table **??** we compute for our sample of close auctions, the proportion of auctions the winning and losing firms would win if the auction had ended at an earlier point in time. For instance, in row 1 of the first column we computed the proportion of auctions the winning firm would have won had the auction ended 6 seconds before its actual end time. In column 2 of the same row, we computed the proportion of auctions the losing firm would have won. The sample used in columns 1 and 2 is based on preferred definition of close auction, and in the remaining columns we repeat the exercise for alternative definition of closeness.

Given the random duration of auction and certain frictions in the bidding technology that don't allow firms to bid faster than every 6 seconds, we should expect to see the identity of the winner switch back and forth as we arbitrarily end the auction. This is precisely what we see. When we end the auction 6 seconds prior to actual end time, we see that actual winning firm would have won 51 percent of time, which is expected since the winning firm was the last one to bid by definition. Had the auction the end 12 seconds earlier, the runner-up firm would have won 48 percent of the time compared to only 40 percent of the time for the winning firm. The identity of the winning firm then switch back when we look at the 18 second mark. This pattern is consistent with the idea that as firms outbid each other, it is the random end time of auction that ultimately determines which firm wins the auction.

Figure **??** provides another validity check of our research design. Here, 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 the 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 η_i and δ_t are firm and time fixed-effects. Estimates of the parameter α yield the causal effect of a government-induced demand on firm growth conditional on participation.

5.2 Adjusting for Endogenous Participation

As we discuss in Section 4, 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 5.2 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, λ_{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 6 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 ε_{it} and Z_{it-1} and our exclusion restriction would not hold.

6 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. These results are then followed by a series of robustness checks, as well as analysis on the heterogeneity of the impacts.

6.1 The Effects of Winning a Close Auction

Figure **??** displays a series of plots depicting the effects of winning a close auction on a firm's participation and performance in future auctions. The estimation sample is at the auction level and based on auctions in which at least two firms bid within 30 seconds before the end of the auction. The x-axis of each plot denotes the difference between the winning bid and second place bid as a share of the second place bid. In the top panel, we plot three future outcomes that are measured over the next 3 months: the number of auctions the firm participates (logs), total amount of contracts firms wins, and the firm's win rate. In the bottom panel, we plot the same future outcomes over a 3 month window but starting one year after the auction.

Winning a close auction has a significant impact on how firms participate and perform in future auctions. Firms who win a close auction will participate in 30 percent more auctions over the next 3 months compared to those that barely lose the auction. This difference persists even with year out, as close winners participate in 20 percent more auctions. Greater participation translates into about 46 percent more contracts winnings over a 3 month period and a 24 percent more contract winnings over the next year. Close winners also benefit from a higher future win

rate of about 2 percentage point during the 90 day window, a difference however that decreases to only 1 percentage point over the following year.

These results, and others, are also presented in regression format in Table **??**. For each outcome we present the estimation results corresponding to three different models, which only differ in their functional form assumptions about the running variable, win margin. In columns 1,4,7, we estimate a model that controls for a third-order polynomial in win margin and auction fixed-effects. In columns 2,5,8, we control for a linear spline in win margin, and in columns 3,6,9 we assume a cublic spline for win margin.

The regression results in Panels A-C confirm the patterns seen in the figures. Winning a close auctions today implies more participation and success in future auctions. These results are statistically significant and very robust to our various functional form assumptions. Despite the future success that barely winners have over barely losers, we do not find evidence that they will participate in large auctions, as measure by the lot's estimated cost (see Panel E).

The fact that winning a close auction leads to success in future auctions raises the question of what is the underlying mechanism. There are at least two potential stories. First, this demand shocks has allowed firms to become more productive over time, which allows them to bid more competitively in future auctions. It is hard to rule out this possibility, particularly given that we are estimating effects even a year after winning the contract. At the same time, our findings are also consistent with a story of market access and learning. If winning a contract induces firms to learn more about the new marketplace then our effects could also be capturing the fact that firms are gaining access to a much larger market.

The panels in Table **??**, which is an extension of Table **??**, suggest exact this. In Panel A, winning firms are more likely to participate in auctions that are not in their home city. They are also more likely to participate in auctions of different products. For instance, in panel B we identify the product code for which the firm competes in the most. We then compute the share of auction in this product, as well as the share of acution in the top 3 product codes. In both cases, winning firms are much less likely to participate in these auctions, suggesting that they are diversify to other products.

Overall, these results make clear that winning just one close auction may lead to firm growth that can be sustained over a lengthy period.

6.2 The Effects of Winning a Government Contract on Firm Growth

Regression Analysis

In this section, we present in Table 6 our main results for the effects of winning a government contract 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 estimated with firm and time fixed-effects. The OLS estimates show that winning a contract in a given quarter will increase firm growth by 0.93 percent. In column 2, we estimate the effects of the amount of the contracts on firm growth and we find that a 10 percent increase in the value of the contract increases firm growth by 0.99 percent.

While the models estimated in columns 1 and 2 do account for unobserved firm characteristics that are fixed over time, productivity shocks to the firm can still be an important source of bias in our estimates. If firms that are experiencing positive productivity shocks are also more likely to win government contracts, then these OLS estimates will be overestimates of the true effects. To overcome this source of bias, in columns 3-8 we estimate models that rely on the variation in contract winnings that depends on close auctions, which as we documented in Section 2 approximates a random event.

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. We find reduced-form estimates that are slightly larger than the OLS estimates. The reduced-form effects in column 3 suggest that winning a random contract leads to 1.5 percent increase in firm growth, whereas the point estimate in column 4 implies that a 10 percentage point increase in the share of winnings in close auctions increases firm growth by 1.3 percent.

In columns 5 and 6, 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 (the first-stage regression are presented in columns 7 and 8). From column 5, the IV estimate on winning a contract is 0.023 compared to 0.009 for the OLS, suggesting that the OLS coefficient was an under estimate. At least three channels could lead to a downward biased of the OLS coefficient. First, as discussed Section **??**, if government and private contracts serve as substitutes then any decrease in demand from the private sector will also be reflected in the estimates of winning a government contract. Second, if smaller and/or younger firms represent the subpopulation that is most responsive to our instrument (something we will explore later), then this could also be an explanation for why the LATE estimates are larger than the average effects. Third, it is also possible that our instrument reduced some of the measurement error associated in contract winnings.

Overall the results in Table 6 suggest that winning a government contract does lead to an immediate and sizeable increase in firm growth. Based on our point estimates, for a firm located at the median of the firm growth distribution, winning a government contract moves the firm to 75 percentile of the distribution in that given quarter.

Accounting for Endogenous Participation

One potential concern with the results presented in Table 6 is that the estimation treats the participation decision into the auctions as exogenous. Moreover, one might be concerned that the number of close auctions a firm is involved is a function of the number of auctions it participated in. The models estimated in Table 8 addresses these concerns.

In column 1, we present the estimation of Equation 5.2, which includes a Mills Ratio to corrects for sample selection. As we discussed in Section 5, identification of the Mills Ratio comes from the share of close auctions the firm won in the previous period. The estimates in column 1 suggest that if anything we are under-estimating the effects of winning a government contract on firm growth: Firms that won a government contract grew by 3.2 percent during the quarter.

In column 2, we extend the model estimated in column 1 to flexibly control for the number of auctions the firm participated in during the quarter. By conditioning on the number of auctions a firm participated in, we can account for the firms that participate in more auction are more likely to win even if winning a close auction is random. As reported in column 2, even after controlling for a 5^{th} degree polynomial in the number of auctions, our main point estimate remains virtually unchanged. Of course, the ex-ante probability of winning an auction is not constant across firms, and so even if we are comparing firms who are participating in the same number of auction, the "effective" number of auctions that they are participating in can be quite different. In column 3 we account for this possibility by controlling for a firm's average win rate up until the period. Again, our main estimates remain highly robust.

Obviously, the results presented in columns 1-3 conditioned the sample on participation into an auction. In column 4, we re-estimate our original model (without the Mills Ratio) but controlling for the number of auctions a firm participated in during the quarter and it's average win rate. Perhaps not too surprising given the previous results, the effects are again virtually unchanged. In Panel B, we repeat the exercise for our continuous measure of contract amounts: Our conclusions remain unchanged.

Given that winning a close auction induces participation in future auctions, another way to test for endogenous selection effects is to estimate the our main model restricting the sample to just the periods when the firm wins for the first time. This specification check eliminates all future dynamics after a firm wins for the first time. Thus, winning a contract cannot affect

future participation by construction. Also note that in this specification we are estimating the employment effects based on variation in the intensive margin, since our sample only comprises of winners. Although we do not report it the table, we find an IV estimate on the value of contracts a firm won in the quarter of 0.018 (clustered standard error = 0.004), with a sample size of 30,267 observations. Although the point estimate is larger than those reported in main tables, the employment growth rate for this sample of firms is also much higher. The magnitude implies that a 10 percent increase in contracts increase employment growth by 4.2 percent, which is slightly smaller than the magnitudes of our other point estimates.

The Effects of Winning a Contract over the Medium Run

Thus far we have documented that firms who win a government contract experience growth during the quarter. If firms higher additional workers to simply fill the contract, then we would not expect this growth to persist beyond the length of the contract.[23] There are two reasons why it is unlikely that these effects are not simply capturing temporary shocks to employment. First, as we report in the Appendix, the effects of winning a government contract are largely concentrated on permanent workers as opposed to temporary contract workers. Given the labor regulations in Brazil with respect to firings, it is unlikely that a firm will hire a permanent status worker for the duration of single contract length. Second, given the length of our panel data, we can simply estimate the effects of winning a contract on future growth rates.

In Figure **??** we plot the effects of winning a government contract on growth rates of different length. As an example, for quarter 2 we estimate the effects of winning a contract on growth defined over two periods (i.e. $g_{it} = E_{i,t+1} - E_{i,t-1}/(0.5 \times E_{i,t+1} + 0.5 \times E_{i,t-1})$) , and for quarter 3, growth defined over 3 periods (i.e. $g_{it} = E_{i,t+2} - E_{,it-1}/(0.5 \times E_{i,t+2} + 0.5 \times E_{i,t-1})$, and so on.[24] As the figure depicts, the effects remain robust over at least 10 quarters, which is well beyond the length of an average contract.[25] From these results, we can conclude that two years after winning a contract, firm size has increased by on average 6 percent.

Decomposing Firm Growth

One interpretation of our findings is that demand shocks are an important component of firm growth, and that government procurement can play an important policy role in inducing these shocks. This interpretation however assumes that firms who win government contracts aren't

[23] The average contract length is 6 months.

[24] Once we extend beyond 10 quarters, we experience significant attrition due to the length of our panel.

[25] Although not shown here (see the Appendix), the effects are qualitatively similar when we also use the amount of the contract won.

simply displacing the workers who are simply employed in other firms. An advantage of our dataset is that it allows us to observe workers transition in and out of the formal sector, as well as between firms. Thus based on these data, we can decompose our growth effects into various mutually exclusive categories, such as the fraction of new hires that come from either the informal or unemployed sector versus those that come from other formal firms. Specifically, for any mutually exclusive set of categories, c, we decompose our employment measure as follows:

$$g_{i,t} = \frac{E_{i,t} - E_{i,t-1}}{0.5 \times E_{i,t} + 0.5 \times E_{i,t-1}} = \sum_c \frac{E_{i,t,c} - E_{i,t-1,c}}{0.5 \times E_{i,t} + 0.5 \times E_{i,t-1}}$$

$\frac{E_{i,t,c} - E_{i,t-1,c}}{0.5 \times E_{i,t} + 0.5 \times E_{i,t-1}}$ represent category c^{th} contribution to firm growth.

In Table **??**, we present the results from re-estimating our main IV specification using as a dependent variable the growth in employment associated with each category. In columns 1 and 2, we decompose our effects on firms growth into changes coming from hiring new workers, as well as from employees (not) leaving the firm. In columns 3-5, we decompose the effects coming from new hires further by exploring new hires coming from other formal firms versus new hires coming from either unemployment or the informal sector.

As we see in column 1, 65 percent of the growth effects come from firms, who by winning a government lay off fewer workers, relative to those who did not. The remaining 35 percent of the effect comes from the hiring of new employees. Of this 35 percent, less than 7 percent came from workers switching firms. The remaining 93 percent of new hires came either from informal firms or unemployment. Overall, our finding suggest that 32.5 percent of the increase in employment that we estimate from procurement contracts can be attributed to bringing individuals out of unemployment or informality.

6.3 Demand Shock Heterogeneity

In this section, we explore how the effects of winning a government contract vary according to characteristics of the firm, as well as the marketplace.

Heterogeneity by Firm Characteristics

We begin by investigating whether the effects of winning a government contract depends on whether the firm is in manufacturing versus retail. From columns 1 and 2, we find that the effects are much more pronounced among retail firms.

In columns 1-2, we examine whether winning government had a differential effect based on the initial size of the firm. As a measure of firm size prior to the start of the online auctions, we rely

on the government's classification of firms as a small medium enterprise (SME). Seventy-six percent of the firms in our sample are classified as small-medium enterprises. Among those classified as such, the median firm size at the start of our sample period is two employees, compared to 15 employees for firms who were not classified as an SME. When we estimate the effects separately for SME firms versus non-SME firms, we find that the effects are less pronounced for larger firms. Among larger firms, winning a government contract increases growth in employment by 1.3 percent compared to 2.3 percent for smaller firms.

In Figure **??** we explore how effects of these demand shocks vary by the age of the firm. As the literature has highlighted and as we document with our data, older firms tend to grow slower than younger firms. While there are various hypotheses for why this might be the case, as pointed out by Fort et al. (2013) part of the explanation may lie on the demand side. As Figure refFigure:Age depicts, our findings are consistent with this hypothesis. The effects for firms that are less than 5 years of age are twice the size of the effects for firms between 5 and 15 years old, and more than 4 times the effects size among firms 25 years and older. While some of this variation in effect sizes may be attributable to the differences we find in firm size, these differential effects are robust even when we allow the effects to vary by firm size as well.

Heterogeneity by Location Characteristics

Access to financing is widely considered one the major obstacles affecting the profitability, survival and growth of firms. While the 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 panel A of Table **??**, we test this hypothesis using as a measures of access credit, the amount of bank deposits in 2005 as a share of municipal GDP. In columns 1 and 2, we distinguish firms that are located in municipalities with access to credit below the median (column 1), and those firm located in municipality above the median (column 2). In columns 3-6, we split the sample even further by the age of the firm to create four comparison groups of firms: 1) below 10 years and low access to credit; 2) at least 10 years old and low access to credit; 3) below 10 years and high access to credit; 2) at least 10 years old and high access to credit. The coefficients and their corresponding standard errors reported in each cell of the table corresponds to a separate IV regression, where the dependent variable is firm growth and main dependent variable is an indicator for whether or not the firm won an auction in that quarter.

The effects of winning a government contract are much higher among firms located in areas with more access to credit, which is consistent with the notion that firms need access to credit to fill the contract order. This differential impact is even more pronounced among older firms. For firms that are at least 10 years old and located in areas with low credit access, the effects of the demand shock are only 1.3 percent compared 2.6 percent among older firms in municipalities with higher credit access. In interpreting these results, one might be concerned that places with more access credit are also richer and more developed municipality, and that the effects are varying along this margin as well. While it is true that wealthier municipalities do have greater access to credit, our results hold even when we partial out the differential effects by the municipality's per capita income. Overall these findings suggest that financial constraints do matter for a firm's ability to respond to a demand shock, and that the response from older firms are more muted, which might provide an additional explanation for while older firms are able to grow less.

An argument that is commonly put forth in the literature is that labor regulations are another source of impediments to firm growth. In Panel B, we explore whether there is a differential impact based on the probability that a firm gets inspected. As a proxy for a firm's probability of being inspected, we compute the share of firms that have been inspected by sector in 2005. Using this measure, there is 17 percent chance of getting inspected across all sectors. In municipalities below the median, firms can expect to be inspected 6.7 percent of the time, compare to 22 percent of the time for municipalities above the median. Consistent with the hypothesis, firms respond more to demand shocks in municipalities where the probability of being inspected in lower, although the difference is measured imprecisely. Younger and older firms also seem to respond similarly.

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 50,000, 100,000, and 300,000 inhabitants. In addition, we also compute the distance of each municipality to the state capital. Then, as before we re-estimate our model distinguishing between places that above and below the median. Contrary to our hypothesis, we find that the effects of winning a government contract are much larger for firms located to a major city. There doesn't appear to be a clear pattern when splitting the sample further by age of the firm.

7 Conclusions

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.

Table 1: Sample Descriptive Statistics: Firms

	Mean	Std. Dev.
Number of employees		
Total	28.2	194.1
Temporary	1.36	14.0
Growth	0.021	0.24
Number of new hires		
Total	3.48	29.7
From other firms	0.77	11.3
From same municipality	1.38	9.50
Employees' Characteristics		
Average monthly wages	880.5	1276.9
Average hourly wages	20.7	31.3
Average years of schooling	7.93	4.50
Wage bill (R$ 1,000)	164.1	1811.6
All auctions...		
Participated	31.5	268.5
Won	4.80	58.3
Winnings (R$ 1,000)	183.2	130350.9
Close auctions...		
Participated	0.55	7.74
Won	0.28	4.63
Winnings (R$ 1,000)	4.14	227.4
Number of firms	42,398	
Number of observations	962,562	

Notes: Table shows summary statistics for a quarterly unbalanced panel of firms from 2004Q3 to 2010Q4. Growth in quarter t is defined as the difference between the number of employees at the end of quarters t and $t-1$, divided by the average number of employees in the end of the two quarters.

Table 2: Sample Descriptive Statistics: Auctions

	All auctions		Close auctions	
	Mean	Std. Dev.	Mean	Std. Dev.
Reserve price	18155.3	620599.2	29780.4	916777.9
Winning bid	10314.2	340152.8	16828.9	492363.7
$100x\frac{Ranked2-Ranked1}{Ranked2}$	10.0	17.9	0.13	0.14
Winning bid/Reserve	0.69	0.31	0.71	0.28
Number of Bidders	7.00	4.97	8.44	5.81
Auction duration				
Total (minutes)	66.3	55.2	70.0	53.7
Random phase (minutes)	21.2	8.16	26.2	5.90
Number of bids				
Total	22.7	37.4	81.4	62.5
In random phase	19.0	34.6	75.3	58.9
In random phase, placed by winner	6.75	12.8	27.0	22.4
In random phase, placed by runner-up	5.60	11.3	24.8	21.1
Rank of first bid placed				
Winner	2.81	2.79	3.85	3.55
Runner-up	2.95	2.77	3.62	3.46
Number of outbids in random phase	13.2	22.3	51.0	34.0
Number of auctions	4,291,040		265,642	

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. 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%. Monetary values are measured in 2010 R$.

Table 3: Winners vs Runnerups: Sample Balance

	Runnerups		Winners		
	Mean	Std. Dev	Mean	Std. Dev	p-value
Sample: 265,749 auctions with 2 active bidders in last 30 seconds; bid difference <0.005					
Number of Employees in previous quarter	12.96	111.2	10.43	94.7	0.13
Growth rate in previous quarter	0.05	0.3	0.06	0.3	0.88
Growth rate in previous 12 months	0.18	0.5	0.20	0.5	0.63
Average real wages in previous quarter	634.58	622.5	612.66	615.5	0.09
Employees' Schooling in previous quarter	7.30	4.9	7.19	4.9	0.23
Accumulated win rate	0.19	0.1	0.20	0.1	0.36
Bidder in same city as Auction	0.22	0.4	0.19	0.4	0.81
Bidder registred as SME	0.90	0.3	0.94	0.2	0.11
Sample: 108,604 auctions with 2 active bidders in last 12 seconds; bid difference <0.005					
Number of Employees in previous quarter	11.21	107.4	9.25	90.1	0.06
Growth rate in previous quarter	0.06	0.3	0.06	0.3	0.43
Growth rate in previous 12 months	0.20	0.5	0.21	0.5	0.38
Average real wages in previous quarter	620.22	595.4	598.53	584.5	0.21
Employees' Schooling in previous quarter	7.23	4.9	7.07	5.0	0.27
Accumulated win rate	0.18	0.1	0.19	0.1	0.23
Bidder in same city as Auction	0.19	0.4	0.16	0.4	0.93
Bidder registred as SME	0.93	0.3	0.96	0.2	0.07
Sample: 143,500 auctions with 2 active bidders in last 30 seconds; bid difference <0.001					
Number of Employees in previous quarter	13.86	125.6	10.40	103.0	0.10
Growth rate in previous quarter	0.06	0.3	0.06	0.3	0.41
Growth rate in previous 12 months	0.18	0.5	0.20	0.5	0.30
Average real wages in previous quarter	645.34	631.3	601.70	622.0	0.04
Employees' Schooling in previous quarter	7.32	4.9	7.03	5.0	0.09
Accumulated win rate	0.19	0.1	0.20	0.1	0.20
Bidder in same city as Auction	0.21	0.4	0.18	0.4	0.74
Bidder registred as SME	0.89	0.3	0.93	0.2	0.05

Notes: Table shows means and standard deviations of selected variables for winners and runnerups of close auctions, for different deffinitions of closeness. p-value test for the null that the means are the same, and are obtained from a regression with auction-fixed effects and standard-errors clustered at the firm level.

Table 4: Placebo test: Who would win a close auction had it ended seconds before?

Close auction definition	30secs, pwin$<$ 0.005		12secs, pwin$<$ 0.005		30secs, pwin$<$ 0.001	
	winner	runner-up	winner	runner-up	winner	runner-up
2 seconds	0.672	0.267	0.484	0.428	0.682	0.253
6 seconds	0.498	0.429	0.350	0.536	0.505	0.424
8 seconds	0.457	0.465	0.399	0.469	0.462	0.463
12 seconds	0.423	0.484	0.575	0.245	0.429	0.483
18 seconds	0.445	0.441	0.506	0.324	0.459	0.436
24 seconds	0.500	0.371	0.480	0.354	0.517	0.362
Unif[6, 24] seconds	0.468	0.422	0.492	0.345	0.480	0.417
Number of Auctions	265,714	265,714	108,595	108,595	143,482	143,482

Notes: To compute the figures shown in this table, we artifically end auctions early and see which firm would win it under the new duration. Column (1) shows the fraction of auction where the winner's identity would not change. Column (2) shows the fraction of auction in which the runner up would be the new winner under the new duration. Note that it is possible that a third firm would win the auction, so the two columns do not add to one. The first row cuts actuall auction durations by 5 seconds. The other rows are analogous. The two last rows randomly cut auction durations by drawing numbers from the uniform distribution and subtracting it from the actual auction duration.

	30 days			90 days			1 year		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Number of auctions participated (log)									
Winner	0.393	0.411	0.468	0.397	0.414	0.466	0.194	0.200	0.212
	[0.031]	[0.033]	[0.041]	[0.032]	[0.034]	[0.042]	[0.052]	[0.056]	[0.073]
Observations	513,716	513,716	513,716	513,716	513,716	513,716	513,716	513,716	513,716
Mean of Dep. Var.	5.71	5.71	5.71	6.59	6.59	6.59	3.10	3.10	3.10
Panel B: Win rate									
Winner	0.017	0.017	0.016	0.015	0.015	0.014	0.008	0.008	0.007
	[0.004]	[0.005]	[0.006]	[0.004]	[0.005]	[0.006]	[0.003]	[0.003]	[0.004]
Observations	479,146	479,146	479,146	495,638	495,638	495,638	214,248	214,248	214,248
Mean of Dep. Var.	0.195	0.195	0.195	0.191	0.191	0.191	0.170	0.170	0.170
Panel C: Winnings in particpated auction (log)									
Winner	0.579	0.593	0.643	0.530	0.544	0.588	0.337	0.341	0.342
	[0.045]	[0.048]	[0.059]	[0.041]	[0.043]	[0.053]	[0.084]	[0.090]	[0.116]
Observations	453,668	453,668	453,668	479,962	479,962	479,962	513,716	513,716	513,716
Mean of Dep. Var.	11.29	11.29	11.29	12.32	12.32	12.32	5.51	5.51	5.51
Panel D: Share of participated auctions in the same city									
Winner	-0.025	-0.025	-0.026	-0.024	-0.025	-0.027	-0.019	-0.019	-0.018
	[0.002]	[0.003]	[0.003]	[0.002]	[0.002]	[0.003]	[0.003]	[0.003]	[0.004]
Observations	477,926	477,926	477,926	494,406	494,406	494,406	213,814	213,814	213,814
Mean of Dep. Var.	0.15	0.15	0.15	0.15	0.15	0.15	0.14	0.14	0.14
Panel E: Average size of participated auction									
Winner	-1296.4	-1762.6	-1369.1	-1866.7	-2291.5	-3083.7	-1094.9	-1174.3	-1857.0
	[1335.2]	[1398.6]	[2094.5]	[2317.2]	[2589.9]	[3942.2]	[1615.9]	[1848.3]	[2693.0]
Observations	513,716	513,716	513,716	513,716	513,716	513,716	513,716	513,716	513,716
Mean of Dep. Var.	24,921	24,921	24,921	28,890	28,890	28,890	21,866	21,866	21,866
Panel F: Number of different product codes									
Winner	5.8	6.0	7.1	7.7	8.0	9.4	1.9	1.9	2.1
	[0.9]	[1.0]	[1.1]	[1.2]	[1.2]	[1.4]	[0.4]	[0.4]	[0.5]
Observations	510,946	510,946	510,946	510,946	510,946	510,946	510,946	510,946	510,946
Mean of Dep. Var.	30.8	30.8	30.8	45.1	45.1	45.1	15.3	15.3	15.3
Panel G: Share of auctions in the top product code									
Winner	-1.8917	-1.9890	-2.3142	-1.5990	-1.6926	-2.0302	-0.8402	-0.8735	-0.9009
	[0.2679]	[0.2810]	[0.3333]	[0.2622]	[0.2738]	[0.3205]	[0.2411]	[0.2557]	[0.3196]
Observations	472,536	472,536	472,536	490,922	490,922	490,922	206,904	206,904	206,904
Mean of Dep. Var.	53.46	53.46	53.46	51.23	51.23	51.23	55.85	55.85	55.85
Panel H: Share of auctions in the top 3 product codes									
Winner	-2.0410	-2.1623	-2.6537	-1.9097	-2.0215	-2.4660	-1.0062	-1.0664	-1.2840
	[0.3035]	[0.3178]	[0.3786]	[0.3005]	[0.3134]	[0.3692]	[0.2606]	[0.2778]	[0.3474]
Observations	472,536	472,536	472,536	490,922	490,922	490,922	206,904	206,904	206,904
Mean of Dep. Var.	72.47	72.47	72.47	69.84	69.84	69.84	75.51	75.51	75.51
Controls	Cubic polynomial	Linear Spline	Cubic spline	Cubic polynomial	Linear Spline	Cubic spline	Cubic polynomial	Linear Spline	Cubic spline

Notes: Sample is winners and runner-ups in close auctions. Each coefficient is the effect of being the winner in a close auction, controling for auction fixed-effects and flexible controls on the

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

Dependent variable	Firm Growth				Won	Amount Won	Firm Growth	
	(1) OLS	(2) OLS	(3) Reduced-form	(4) Reduced-form	(5) First-stage	(6) First-stage	(7) IV	(8) IV
Won	0.009						0.023	
	[0.001]						[0.002]	
Amount Won (logs)		0.001						0.002
		[0.000]						[0.000]
Won a close auction			0.016		0.689			
			[0.001]		[0.002]			
Share of close auctions won				0.013		7.588		
				[0.002]		[0.022]		
R^2	0.053	0.053	0.053	0.053	0.459	0.472	.	.
Observations	949,252	949,252	949,252	949,252	949,252	949,252	949,068	949,068
Mean dep. var.	0.021	0.021	0.021	0.021	0.146	1.522	0.021	0.021

Notes: All specifications include firm fixed effects and quarter dummies. Standard errors clustered by firm 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 7: Decomposing the Effects on Firm Growth

	Growth	Layoffs	New Hires	New Hires				Same Municipality
	(1)	(2)	(3)	(4) From other firms	(5) Not from other firms	(6) Unemploy-ment	(7) First Job	(8)
Won a contract	0.0249	0.0191	0.0107	0.0010	0.0097	0.0049	0.0036	0.0042
	[0.0021]	[0.0138]	[0.0033]	[0.0011]	[0.0028]	[0.0020]	[0.0013]	[0.0016]
# of Obs.	935,051	935,051	935,051	935,051	935,051	935,051	935,051	935,051

Notes: Regressions include firm-fixed effects and quarter dummies. Standard errors clustered by firm 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. The number of observations in this table differs from that of previous tables because of some missing values for the layoff variable. This will be corrected in future versions of this table.

Table 8: The Effects of Winning a Government Contract on Firm Growth: Controlling for Selection

	Dependent Variable: Employment Growth					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A						
Won	0.032	0.032	0.032	0.029	0.032	0.031
	[0.005]	[0.007]	[0.005]	[0.006]	[0.007]	[0.007]
Inverse Mill's ratio			0.004	0.004	0.003	-0.004
			[0.003]	[0.003]	[0.003]	[0.006]
Inverse Mill's ratio square						0.004
						[0.003]
Panel B						
Amount Won (logs)	0.002	0.002	0.002	0.002	0.002	0.002
	[0.000]	[0.001]	[0.000]	[0.001]	[0.001]	[0.001]
Inverse Mill's ratio			0.001	0.002	0.001	0.002
			[0.002]	[0.002]	[0.002]	[0.009]
Inverse Mill's ratio square						-0.001
						[0.005]
Number of Auctions Participated	No	Yes	No	Yes	Yes	Yes
Cummulative Win Rate (t-1)	No	Yes	No	No	Yes	Yes
Observations	209,625	209,625	209,625	209,625	209,625	209,625
Mean dep. var.	0.0248	0.0248	0.0248	0.0248	0.0248	0.0248

Notes: All specifications include firm fixed effects and quarter dummies. Standard errors clustered by firm in brackets. Columns (1) shows IV estimates from the same specification used in Table 6 restricting the sample to firms-quarters with positive participation in auctions. Column (2) adds controls. Columns (3)-(6) shows IV estimates controlling for the inverse Mill's ratio obtained in a probit regression for the probability of participation, as described in equations XX and XX.

Table 9: The Effects of Winning a Contract on Firm Growth: Heterogeneous Effects by Firms' Characteristics

	Manufacturing	Non-Manufacturing	SME	Non-SME
	(1)	(2)	(3)	(4)
Won a contract	0.016	0.024	0.023	0.013
	[0.006]	[0.002]	[0.002]	[0.006]
Observations	175,164	773,904	706,004	243,064
Mean dep. var.	0.027	0.019	0.021	0.019

Notes: Table shows IV estimates for the effect of winning a government contract on firm growth. All specifications include firm fixed effects and quarter dummies. Standard errors clustered by firm in brackets.

Table 10: The Effects of Winning a Contract on Firm Growth: Heterogeneous Effects by Firm's Municipal Characteristics and Firm Age

Firms muncipal characteristic is ...	Below the median	Above the median	Below the median		Above the median	
	(1)	(2)	(3)	(4)	(5)	(6)
Age of firm			Less 10 years	At least 10 years	Less 10 years	At least 10 years
	Panel A: Access to credit – Deposits to GDP ratio					
Won a contract	0.019	0.027	0.023	0.013	0.027	0.026
	[0.003]	[0.003]	[0.004]	[0.004]	[0.004]	[0.004]
	Panel B: Labor regulations – Probability of labor regulation enforcement					
Won a contract	0.026	0.020	0.031	0.019	0.021	0.016
	[0.003]	[0.004]	[0.005]	[0.005]	[0.005]	[0.005]
	Panel C: Access to Markets – Distance to Municipality with population $< 50{,}000$					
Won a contract	0.024	0.022	0.027	0.020	0.023	0.018
	[0.003]	[0.003]	[0.004]	[0.004]	[0.004]	[0.005]
	Panel D: Access to Markets – Distance to Municipality with population $< 100{,}000$					
Won a contract	0.028	0.018	0.029	0.024	0.020	0.015
	[0.003]	[0.003]	[0.004]	[0.005]	[0.004]	[0.004]
	Panel E: Access to Markets – Distance to Municipality with population $< 300{,}000$					
Won a contract	0.027	0.019	0.030	0.020	0.020	0.018
	[0.003]	[0.003]	[0.004]	[0.005]	[0.004]	[0.004]
Number of Obs.	540,439	408,048	303,321	237,118	220,662	187,386
Mean Dep. Var.	0.021	0.020	0.032	0.007	0.032	0.007

Notes: Table shows IV estimates for the effect of winning a government contract on firm growth. In columns (1) and (2), we split the sample on firms located in muncipalities whose characteristics described in each panel are below or above the sample's median. In columns (3)-(6) we further split the sample by firm age. All specifications include firm fixed effects and quarter dummies. Standard errors clustered by firm in brackets.

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