Political Connections and Misallocation of Procurement Contracts: Evidence from Ecuador*

Felipe Brugués, Javier Brugués, Samuele Giambra

November 16, 2018
[Preliminary: Please do not cite]

Abstract

This paper uses detailed ownership information of private firms in Ecuador and the identity of bureaucrats to document the effects of political connections on firm size and the allocation of government contracts. Reduced-form estimates show a significant positive effect of political connection on sales, assets, debt, and costs. Using contract-level data, we find that politically connected firms enjoy higher probability of winning discretionary contracts and charge higher prices for homogeneous goods and services than unconnected firms. Back-of-the-envelope calculations indicate a political connection premium of 475 million USD per year in overpricing. Further analysis from production function estimates suggest that politically connected firms are less efficient than unconnected ones. This translates into a 1.5 to 3.5 percent excess cost of provision.

Keywords: Corruption, contracts allocation, efficiency costs
JEL codes: D73, H72, P16

1 Introduction

Anecdotal and survey evidence suggests that corruption is a pervasive phenomenon in developing countries (Svensson 2005). However, despite an increase in researchers' ability to measure corruption due to new micro-level data, we still lack academic consensus on its actual magnitude and efficiency consequences (Olken & Pande 2012). This paper contributes to this literature by investigating how connections between bureaucrats and private firms affect firms dynamics, the allocation of government procurement contracts, and its efficiency cost. To this end, we assemble novel data for

*Felipe Brugués: Brown University (e-mail: felipe_brugues@brown.edu); Javier Brugués: University College London (e-mail: javier.brugues.13@ucl.ac.uk); Samuele Giambra: Brown University (e-mail: samuele_giambra@brown.edu). We gratefully acknowledge funding from the Corporación Andina de Fomento. We thank Rafael La Porta, Jesse Shapiro, Matthew Turner, and seminar participants at Brown University and Corporación Andina de Fomento for helpful comments. We thank Andrea Rebolledo and Vanya Cohen for excellent research assistance.

the period 2006-2018 that combines (i) balance sheet information of Ecuadorian private firms, (ii) the universe of government procurement contracts with information on value and degree of discretion in the allocation mechanism, (iii) the identity of firms shareholders and shares held, and (iv) dates of bureaucrats entry in office with information on type of job and agency/ministry they work for.

We classify a firm as politically connected if any of its (past, current, or future) shareholders is a bureaucrat (Faccio & Parsley 2009). Using the detailed information on the identity of the shareholders, we extend the notion of political connectedness to account for connections through siblings relationships. With this information at hand, we look for evidence of corruption in the public contracts allocation mechanism. This, in our view, requires either (i) an increase in the allocation of government contracts *after* a firm becomes politically connected, or (ii) a price inflation in public contracts executed by connected firms.

Relying on an event study methodology, we provide descriptive evidence of a positive relationship between firms political connectedness and firm size and allocation of public contracts. In our framework, the event is defined as the year in which a firm gains its first link to a bureaucrat (either directly through one of its shareholders or indirectly through a shareholder sibling). We show that, after becoming politically connected, firms experience an increase in sales and assets, and rely more heavily on external finance. This confirms previous findings in the context of the US (Goldman et al. 2013, Tahoun 2014, Do et al. 2015, Brogaard et al. 2016) and Korea (Schoenherr 2015). Moreover, we find that connected firms have a 1% higher probability of receiving a contract (from a 5% basis) whenever bureaucrats have discretion in the allocation process. On the other hand, we see less significant effects of political connections on the probability of winning public auctions, and no impact on the probability of receiving random contracts.

We then analyze whether politically connected firms charge the government higher prices for otherwise identical goods. Using detailed information for public contracts for standardized goods (electronic catalogue) we find an average markup between 4 and 6 percent. Back-of-the-envelope calculations suggest that this markup translates to an overall contracts value inflation of about 475 million USD per year. Both this and the result of a positive relation between political connectedness and discretionary contracts are in line with our view that political connections are used as channels for corrupt behavior.

Our main contribution consists in providing a quantitative measure of the aggregate inefficiencies generated by allocating public contracts to politically connected firms. With this aim, we start by building on the recent production function estimation literature (De Loecker 2011, Lee et al. 2018) to recover plausibly unbiased estimates of firm level productivity. We observe that politically connected firms are on average less productive than unconnected competitors in the same industry. We estimate only small, although positive, productivity gains *after* a firm becomes politically connected. As a final step, we develop a new framework similar to the one in De Loecker & Warzynski (2012) that allows us to quantify the aggregate inefficiency cost of allocating government contracts to politically connected firms. We find that connected firms have an average excess cost ranging between 1.5 and 3.5 percent of the value of discretionary contracts they are allocated.

This paper contributes to several strands of the literature on corruption in developed and developing countries. First, it relates to the literature that establishes the existence of a positive relationship between political connections and firm value. This association has been recently documented for many developed and developing countries such as the US (Acemoglu et al. 2016), Tunisia (Rijkers et al. 2014), Denmark (Amore & Bennedsen 2013), China (Fan et al. 2007), Malaysia (Johnson & Mitton 2003), Indonesia (Fisman 2001), and Pakistan (Khwaja & Mian 2005). The most relevant pieces of work in this literature in relation to this paper are Goldman et al. (2013), Tahoun (2014), and Do et al. (2015), which find that in the US politically connected firms enjoy higher firm value as measured by size and obtain a larger amount of government contracts. Our paper contributes to this literature by evaluating the effects of political connection in a developing country setting and by looking at privately held firms, which are widespread in this environment, rather than at public companies.

Second, our paper relates to the literature of the economic consequences of corruption through social networks. Previous evidence suggests that the causal effect on total welfare could go in either direction. On the one hand, political connections might increase efficiency by reducing information asymmetries and moral hazard. This hypothesis is known in the literature as *greasing wheels* (Kaufmann & Wei 1999). On the other hand, connected firms might engage in rent-seeking behaviors (*grabbing hand hypothesis*) which leads to long-lasting negative consequences on welfare (Shleifer & Vishny 2002). Our paper contributes to this literature by providing empirical estimates of the costs of political connection due to rent-seeking and offering estimates of the inefficiency cost in the allocation of government contracts to inefficient firms.

The work of Schoenherr (2015), Brogaard et al. (2016), Colonnelli & Prem (2017), and Szucs (2017) are the closest to ours. Schoenherr (2015) finds that politically connected firms win a larger number of contracts and that they execute these contracts systematically worse and at higher costs than non-connected firms. Brogaard et al. (2016) find that politically connected firms obtain a larger number of government contracts and favorable renegotiation terms. Colonnelli & Prem (2017) exploit local variation in anti-corruption audits to study the effects of corruption on firm performance and show that corruption acts as a barrier to firm growth by distorting the incentives for efficiency. Lastly, Szucs (2017) studies the effect of procurement discretion on contract level indicators and firm productivity. Our paper extends these contributions by precisely identifying political connections to include shareholder information and family ties, and by mapping corruption to aggregate statistics in order to obtain welfare estimates of corruption.[1]

The remainder of the paper is organized as follows. Section 2 describes the data sources used in this study. Section 3 offers our definition of political connection and corruption. Section 4 provides descriptive statistics about firm size and the presence of politically connected firms in government contracts. Section 5 details the empiri-

[1] In Schoenherr (2015), political connections are defined only *indirectly* through membership in one of two large networks of the new president of Korea: the Korea University Business School Alumni and the network of former executives from the Hyundai Engineering & Construction. Brogaard et al. (2016) link firms to politicians via campaign contributions. Colonnelli & Prem (2017) estimate firm-level effects of corruption but do not include a full welfare analysis. Finally, Szucs (2017) focuses on the contract specific costs of corruption.

cal methodology used for the reduced-form estimation and results relating political connection to firm size and allocation of public contracts. Section 6 presents welfare estimates from price inflation, introduces a model to estimate excess costs of procuring from connected firms, and offers welfare estimates for these excess costs. Section 8 concludes.

2 Data

Our paper joins various administrative datasets collected by the Ecuadorian government for the years 2006-2018. Sources using firm-level information are matched using unique firm identifiers, which are assigned and collected by the government for tax purposes, and generated when owners constitute their firms. We identify firms ownership using the unique national ID for shareholders and the unique firm identifier for firms. We then link ownership information with the roster of bureaucrats using the two last names of each individual (appendix B.2 contains more details on the algorithm used to identify families).

Balance Sheets & Income Statements

In order to obtain firm-level information, we use balance sheet and income statements information collected by the Superintendencia de Compañias (Business Bureau) for 2007-2017. It contains information on outputs (such as revenue and exports), inputs (wages, physical capital, intermediates, imports), assets, and debt. We also observe the main economic activity of firms at the ISIC 6-digit level. Following convention, we winsorize all variables at the one percent level to deal with outliers.

Ownership

The second dataset, which is also collected by the Business Bureau, contains information regarding all legal changes to ownership composition of private for-profit companies in Ecuador for the years of 2006-2017. The dataset contains information regarding the identity of the owners of the firm (ID and name) and the share they represent. As in other countries, pyramids do exist in the shareholding network: business owners can use firms as owners of other firms. We cleaned the pyramid iteratively until reaching the beneficial owner.

One shortcoming of this dataset is that it does not have information on the beneficiaries of mutual funds, and therefore if a mutual fund invests in a company, it will appear as owner but we will not be able to observe the beneficial owner of the company. To the extent that bureaucrats and their families use mutual funds to control their firms, this would bias our estimates against finding differences between politically connected and unconnected firms.

Bureaucrats

In Ecuador, all workers in the public sector are required by law to report all their properties each time they change job in the public sector.[2] This information is publicly available from the Contraloría General del Estado del Ecuador (Comptroller General). The dataset contains ID and full name of each public official, the institution where he/she works, the start year at the institution, and the type of job. We use this information to identify the first period an individual worked for a public institution. Although the data allows us to identify any subsequent move inside the government it does not keep track of whether an individual stops working for the government.

Government purchases

Starting in 2008, the Ecuadorian government introduced new regulations for public expenditure aimed at centralizing and modernizing public procurement. The most relevant changes were introduced with the Ley Orgánica del Sistema Nacional de Contratación Pública, approved in February 2008, and the Ley Orgánica de Empresas Pública, ratified in October 2009. Together with these two laws, the Ecuadorian government created a new web portal aimed at facilitating the way suppliers interact with the government: once suppliers provide some basic information[3] and register in the website, they can participate in the bids for government contracts. The type of contract varies by type of object to be provided. For normalized services and products, the government would mainly use an Electronic Catalog similar to that studied in Bandiera et al. (2009), or reverse auctions. For public works and non-normalized services and products, the government uses quotations, public contests, auctions or a process called "menor cuantía".

Following the allocation criteria of the government, we classify contracts into four different types: (1) auction, (2) discretionary, (3) electronic catalog, (4) random. Auction contracts are used for normalized goods and services and for the allocation of public works. Discretionary contracts include quotations and public contests. Electronic catalog includes purchases of standardized goods and services. Lastly, we define random contracts as those that were assigned through the menor cuantia method. (Refer to appendix C for further details on the different types of contracts.)

With this context in mind, our last administrative dataset contains information on all public procurement contracts collected by the Superintendencia de Compras Públicas (SERCOP). This dataset contains the start date, value and type of every contract allocated to national and foreign firms for years 2008-2018. Additionally, for the electronic catalog purchases, we have access to a dataset for 2014-2018 which contains product-level information that allow us to infer unit-prices of goods at a very detailed level. For instance, although we cannot see the brand of the good offer, we can distinguish between pencils with erasers and without erasers.

[2]This regulation became effective in 2003 for high rank positions under the Regulating Law for Net Worth Sworn Affidavit. It has been subsequently extended to all public positions in 2008 through the Constitution Article 231.

[3]The information provided usually consists of the supplier's type of company, economic sector, and products they can provide down to 9 digits of detail. For instance, a firm could register as able to provide product 48110.01.05 - X-Ray machines, nationality of the firm, size, city.

Unfortunately, not all the IDs of the suppliers are observed in the dataset and therefore contracts assigned to unknown suppliers cannot be used to identify firm level effects of political connections. In appendix figure A.1 we show the total value of assigned contracts to known vs. unknown firms by type of contract. The prevalence of unknown firms appear to be low, and we have almost full coverage in the auctions, e-catalog, and random contracts. Discretionary contracts have a larger proportion of missing IDs but they only represent a 10 percent of the total value of discretionary contracts.

3 Definition of Political Connections and Corruption

We define a firm as politically connected if any of its shareholders (past, current, or future) is a bureaucrat or a direct family member of a bureaucrat. As a firm can have many shareholders that can be politically connected, we denote as *entry* the first year in which the firm becomes politically connected.[4] Our definition of family membership is strict: we only consider direct siblings relationships. That is, we define connections through a family link only when bureaucrats and shareholders share their *two* last names. We believe misclassification risk is small as this definition of family membership generates small family groups. Figure A.3 in the appendix shows the cumulative distribution of family sizes. We observe that around 90 percent of families are of size 9 or less.[5]

Under this classification system, we define corruption as either (i) the increase in allocation of public procurement contracts *after* a firm becomes politically connected, or (ii) the extraction of higher rents from government contracts by connected firms. The first type of corruption could imply misallocation of contracts if politically connected firms are also less efficient firms. This would translate into aggregate welfare losses related to inefficiencies in procuring the good or service. The second type of corruption does not necessarily imply aggregate inefficiencies, to the extent that the contract is not misallocated. Its more direct economic concern relates to the shadow cost of raising government funds and the opportunity cost of spending a dollar.

4 Descriptive Statistics

In this section, we present descriptive statistics comparing (i) politically connected firms to unconnected firms, and (ii) firms signing public procurement contracts to firms that are not government contractors. We then offer descriptive evidence of the pervasiveness of politically connected firms across sectors and in the allocation of contracts awarded to private firms.

[4]Unfortunately, our current data does not allow us to identify with certainty the period when an individual stops working for the government. Therefore, we do not present results for when firms stop being politically connected.

[5]In a series of robustness checks we verify that firms becoming connected to large families do not experience any discontinuous growth in sales and other balance sheet information. This is consistent with the idea that large families derive from the misclassification of common last names.

As described in section 3, we define a firm as politically connected if one of its shareholders is a bureaucrat or shares his/her two last names with a bureaucrat. Our measure of ownership is time-independent to prevent failing to classify firms as connected due to strategic changes to the ownership structure of the firms around the time that individuals enter a position in the government.

Table 1 provides descriptive statistics of various firm balance sheet information. The first column refers to the full sample, while columns (2) to (4) identify different subsamples based on whether the firm is politically connected, connected to a high rank public officer, or unconnected, respectively. We observe that, on average, politically connected firms are smaller than unconnected ones. They have 25% lower revenues and 14% lower sales, together with 40% smaller costs. Connected firms are also heavily undercapitalized if compared to unconnected firms (65% lower assets) and rely less on external financing. Further, there is no significant difference between the average politically connected firm and firms connected to high rank bureaucrats.

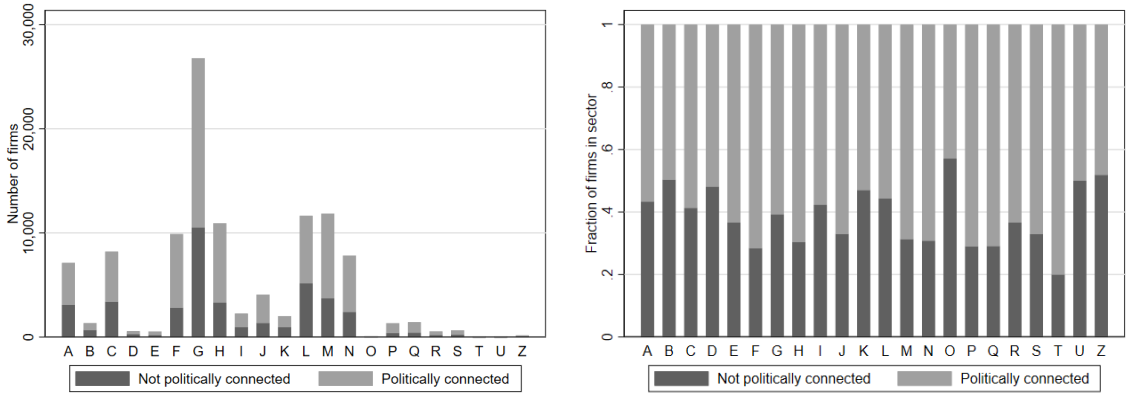
Column (5) and (6) describe instead differences between firms that appear as government contractors at some point between 2009 and 2017 and those that are not government providers. We observe that government contractors are on average significantly larger along all balance sheet metrics than non-contractors. They have for instance about four times larger revenues, sales and costs, and twice as large assets and debt.

Figure 1 panel (a), shows the total number of firms by sector (ISIC 1-digit level).[6] Our data shows that Ecuador has a large number of wholesale and retail trade firms (sector G), followed by real estate firms (sector L), technical services (sector M), transport services (sector H) and administrative services (sector N). Panel (b) shows a relatively constant presence of connected firms across sectors. In general, we identify around 57 percent of the firms in our data as connected either directly or indirectly through a sibling to a bureaucrat. The remaining 43 percent of the firms are not politically connected according to our definition. It is worth pointing out that sectors Transportation (ISIC code H) and Construction (ISIC Code F) stand out as two large sectors (in terms of number of firms) with a high share of politically connected firms. As shown in figure A.2a and discussed in more detail below, procurement contracts related to transportation and accommodation present the largest presence of politically connected contractors.

[6] Refer to appendix D for a description of each ISIC code.

	(1) Full sample	(2) Politically connected	(3) Politically connected high rank	(4) Politically unconnected	(5) Contractors	(6) Not contractors
ln(Revenue)	6.941	6.853	6.803	7.093	10.497	6.457
	(5.071)	(4.935)	(4.940)	(5.293)	(3.685)	(5.041)
ln(Sales)	6.634	6.579	6.501	6.729	10.381	6.124
	(5.157)	(5.017)	(5.029)	(5.388)	(3.761)	(5.110)
ln(Costs)	7.388	7.241	7.216	7.641	10.668	6.942
	(4.881)	(4.778)	(4.775)	(5.043)	(3.522)	(4.870)
ln(Assets)	9.711	9.472	9.513	10.121	11.116	9.52
	(2.806)	(2.680)	(2.659)	(2.967)	(2.490)	(2.793)
ln(Debt)	7.371	7.087	7.144	7.86	9.687	7.056
	(4.597)	(4.493)	(4.484)	(4.730)	(3.601)	(4.627)
ln(Wages)	4.729	4.707	4.719	4.767	8.076	4.274
	(4.576)	(4.467)	(4.482)	(4.759)	(3.894)	(4.472)
ln(Materials)	4.569	4.487	4.434	4.71	7.417	4.181
	(4.098)	(3.978)	(3.953)	(4.294)	(3.576)	(4.011)
Number of firms	109044	68969	29181	40075	13061	95983

Table 1: **Firm descriptive statistics for different subsamples.** Notes: This table shows average yearly means (standard deviations in parenthesis) of the main accounting metrics in the balance sheet data. The sample in column (1) is the set of firms having accounting information in at least one year between 2009 and 2017. Column (2) refers to the subset of firms that are connected to a bureaucrat at any point between 2007 and 2017, column (3) refers to the sample connected to high ranked bureaucrats, while column (4) describes firms that are never politically connected. Column (5) refers to the subsample of firms that sign at least a contract with the government, while column (6) refers to firms that are not government contractors.



(a) Number of firms in each sector, connected vs. unconnected

(b) Fraction of firms in each sector, connected vs. unconnected

Figure 1: **Political Connection by Sector.** Notes: This figure shows the composition of firms by sector including all firms in our sample years 2006-2018. We categorize a firm as connected if any of its shareholders shares two last names with a bureaucrat in our dataset.

Figure 2 presents the share of the total amount of procurement contracts (in nominal USD) allocated to each type of firm over the different types of contracts. As explained in section 2, we classify contracts in four categories: (1) discretionary, (2) auction, (3) random, (4) e-catalog. The first bar from left to right shows that less than 20 percent of the approximately 90 thousand contractors in our data is politically connected to a bureaucrat. Political connections are however over-represented in discretionary contracts. The second bar in the plot shows that more than 55 percent of the total value of discretionary contracts is allocated to politically connected firms. We observe a strong presence of politically connected firms also in auctions. However, this should not be taken as evidence of their relative productivity over competing firms. In fact, we suspect that a large share of the auction contracts may be incorrectly classified, given that around 50 percent of all auction contracts had only one competitor. We are currently working towards collecting additional information that will allow us to reclassify contracts according to their competitiveness.

Looking next at E-catalog contracts, we estimate that around 30 percent of their total value is allocated to connected firms. Reassuringly, the presence of politically connected firms procuring random contracts matches closely the share of politically connected contractors.

Lastly, figure A.2a shows the total value of discretionary contracts allocated by type of good and service (CPC 1-digit level) and the fraction of these contracts that was offered to politically connected firms. The largest share of the value of discretionary contracts is captured by procurement of tradeable goods, with a strong presence of supplying firms connected to bureaucrats. Similarly, contracts related to transportation and accommodation amount to a large fraction of the total value of discretionary contracts, and have a strong presence of politically connected firms in their suppliers.

Overall, our analysis suggest a strong presence of politically connected firms in the procurement of public works, and in particular, in contracts in which the government officials have some degree of discretion in choosing the winner of the public contest.

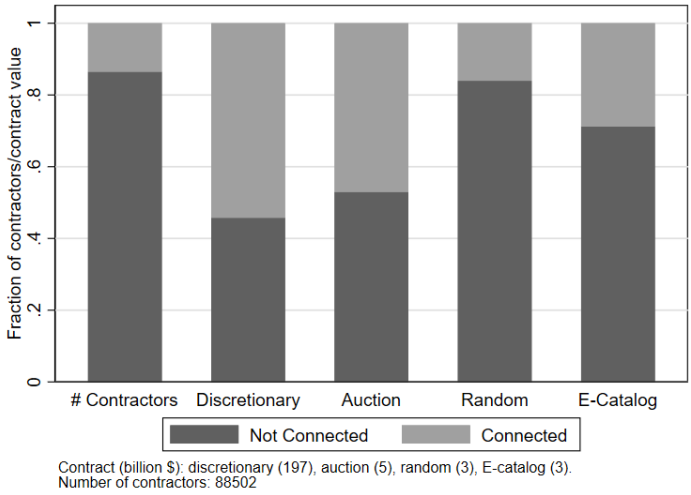


Figure 2: **Political Connection and Type of Contracts.** Notes: This figure shows the share of contracts assigned to each type of firm for our sample years 2006-2018. Details about the type of contracts can be found in Appendix C. We categorize a firm as connected if any of its shareholders shares two last names with a bureaucrat in our dataset.

5 Reduced Form Analysis

5.1 Event Study Design

We next exploit the fine time variation in number of public contracts, balance sheet information, and degree of political connectedness of private firms that we observe in the data. We adopt an event study design, with the event being the appointment of a shareholder of a firm, or one of her siblings, as government official. We currently consider only political connections of "relevant" shareholder families, namely those detaining at least five percent of the shares of a given firm.[7] Our empirical methodology of choice can be explained using the following example. Assume for instance that one of the principal shareholders of firm i is appointed as secretary of an Ecuadorian ministry at time e. Then, we can for instance examine changes in the public procurement contract allocation to firm i around the appointment data to investigate whether it experiences a significant increase in its contracts volume. More formally, let $Contract_{it}$ denote the public contracts volume allocated to firm i. The event study regression can be written as

$$Contract_{it} = \sum_{\tau=-T}^{T} \mathbb{1}(t - e = \tau)\beta_\tau + \alpha_t + \gamma_i + \varepsilon_{it}, \tag{1}$$

where the set of β_τ's are the coefficient of interest. Assuming that the timing of the appointment is exogenous with respect to other variables potentially correlated with contracts volume, we can argue that any significant mean shift at the time of the event can be interpreted as the causal effect of political connectedness on public contracts allocation. We can test this indirectly looking at pre-trends in the event study plot, which should be flat around the event if the assumptions of the model are satisfied.

[7] Several robustness checks show that the results are not sensitive to this specific threshold.

In a similar fashion, we can adapt the same design to analyze changes in each firm balance sheet information by replacing the dependent variable with $ln(sales)_{it}$, and so on.

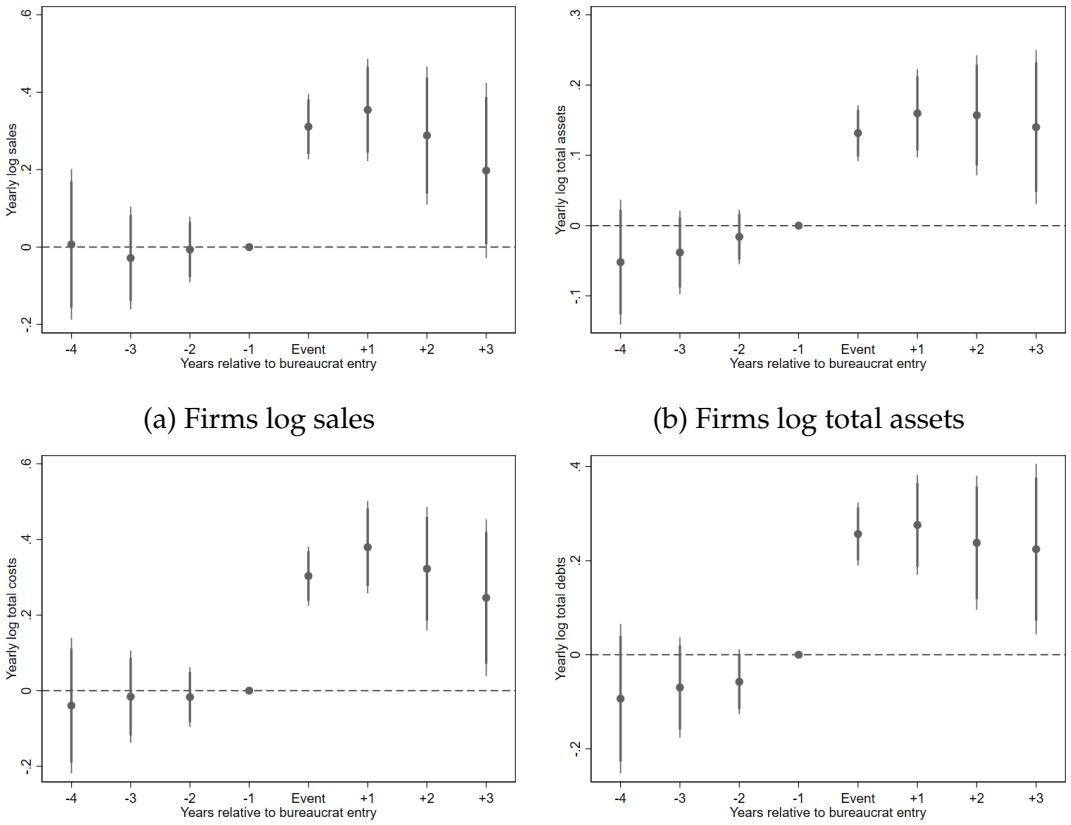
5.2 Effect of Political Connections on Firm Size

In this section, we present evidence of a positive relation between political connections and firm size using our event study design approach. Firm size is treated as a multi-dimensional vector and measured by various balance sheet data such as sales, assets, debt, and costs. The purpose of this exercise is noting that the timing of the event appears to be exogenous and that the event has sizable effects on relevant measures of firm size.

We estimate equation 1 for four firm measures in our balance sheet data (namely, total sales, costs, assets and debt). We define the event as the first year in which the firm gains a (directly or indirectly through a sibling) political connection due to a bureaucrat's entry into her political appointment. Since the bureaucrats data only started to be systematically collected for all positions in 2008, we run our event study for entry years post 2010 only. It is worth noting that we do use firm level information for the years pre 2010.

Figure 3 presents the results of the event studies relative to bureaucratic entry. Sales and costs show no pre-trend, while assets and debt are already growing in the four years before the event. This indicates that, on average, connected firms in our sample are growing over time, i.e. our specification does not fully correct for the constant growth rate in the life-cycle of a firm. Despite the growing pre-trend, we fail to reject that firm size in the year before the event ("-1") is statistically different from the pre-treatment years. Importantly, however, the figure shows clear and large jumps in all studied variable in the event year. In particular, we find a 35 percent increase in reported sales at the time of bureaucrat entry. The effect continuous to be positive for an extra year, while starting to decrease afterwards. The pattern for costs is similar, with another 35 percent jump at the time of the event and a similar cycle-pattern. With respect to total assets, we observe an increase in 15 percent at the time of entry, with little changes over time, suggesting that firms conduct long-term investments in assets. Lastly, total debt also experiences a discontinuous growth rate at the time of the event, with total firm debt increasing by about 30 percent at the time of entry. As with assets, the decline in levels of debt appears to be slow.

Taken together, these results suggest that (i) firms becoming politically connected maintain a similar input composition structure, as the jump is sales is perfectly matched by a jump in production costs, (ii) they finance part of their expansion through debt in the formal sector, and (iii) firms gaining a connection to a bureaucrat experience better performance, but these results are short-lived and the firms tend on average to return to their previous growth path.



(a) Firms log sales

(b) Firms log total assets

(c) Firms log total costs

(d) Firms log total debts

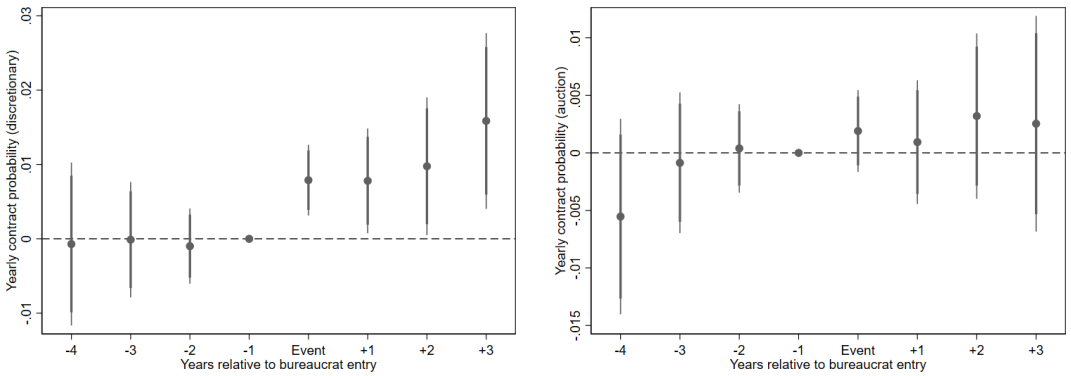
Figure 3: **Event study for firm size.** Notes: The sample is the set of private firms having accounting information and that were linked directly or indirectly through a family tie to a bureaucrat entering the government. Each figure plots coefficients from a regression of different accounting metrics on a vector of lead and lagged indicators for years relative to the time of bureaucrat entry, with the year prior to the event ("-1") as the omitted category. The unit of observation is the firm-year. Error bars are estimated using their 90 and 95 percent confidence levels, obtained from standard errors that are clustered at the firm level. Each regression includes year fixed effects and firm fixed effects.

5.3 Effect of Political Connections on Contracts Allocation

We adapt now equation 1 to study how political connections affect the allocation of public procurement contracts to private firms. These results are important to highlight that reallocation of contracts actually occur *after* the entry into the government. As previously noted, this reallocation could entail a welfare gain or loss, depending on whether politically connected firms are more or less efficient than competing unconnected firms in the sector.

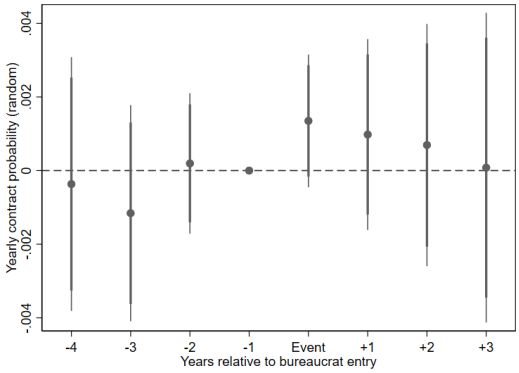
Figure 4 shows the results distinguishing between discretionary contracts (top left panel), auctions (top right panel), and randomly allocated contracts (bottom panel). The top left panel shows a relatively flat pre-trend followed by a significant one percent increase in the probability of winning a discretionary contract after a firm gains its first political connection. Considering that the baseline probability of winning a discretionary contract is about 4.5 percent, we therefore find an increase of more than 20 percentage points. For the other panels, we find no economically nor statistically significant effect of political connections on the probability of winning a contract. In Appendix Figures A.4 and A.5, we show similar event studies but using the number of contracts and mean value of contracts as dependent variables. The overall pattern is similar, with large and significant jumps for the size and number of discretionary contracts awarded, and no significant effects for other types of contracts.

These figures indicates a reallocation of contracts towards politically connected firms, which could potentially lead to inefficiencies. In particular, the reallocation seem to happen only for contracts for which bureaucrats have discretionary power in picking the winner. The results of this section also confirm the evidence presented in figure 2, where we saw that politically connected contractors are over-represented in discretionary contracts. We will now develop a framework to estimate the size of inefficiencies generated by the reallocation of contracts, or, in other words, a model that allows to estimate the size of contract misallocations.



(a) Discretionary contracts

(b) Auctions



(c) Randomly allocated contracts

Figure 4: **Event study for probability of winning a contract:** Notes: The sample is the set of private firms executing at least one public procurement contract and that were linked directly or indirectly through a family tie to a bureaucrat entering the government. Each figure plots coefficients from a regression of the probability of winning a contract on a vector of lead and lagged indicators for years relative to the time of bureaucrat entry, with the year prior to the event ("-1") as the omitted category. The unit of observation is the firm-year. Error bars are estimated using their 90 and 95 percent confidence levels, obtained from standard errors that are clustered at the firm level. Each regression includes year fixed effects and firm fixed effects.

6 Welfare Analysis

In this section we offer two measures of aggregate welfare effects. First, we consider the possibility that politically connected firms charge the government inflated prices for products of similar quality. We test this hypothesis using a subset of contracts for homogeneous goods with product-quantity-price information. This allow us to estimate the difference in the price markup charged by connected and unconnected firms. Although we can only perform this analysis for a subset of all the contracts, this exercise allows us to test whether price inflation exists and its magnitude.

The second is a measure of the excess cost generated by politically connected firms in procuring to the government. Our hypothesis is that connected firms are less efficient than unconnected ones and need therefore larger amounts of resources to execute a contract. We verify this in three steps. First, we compute firm-level productivities and compare the average for connected versus unconnected firms within sectors (two-

digit level). Next, we estimate the marginal cost of raising one dollar revenue. Last, we conduct a counterfactual analysis that informs us on the amount of resources wasted in allocating procurement contracts to connected firms as opposed to the median unconnected firm, in terms of marginal cost, in the same sector (3-digit level).[8] This result does not speak about differences in quality of output, although this is an important dimension along which corruption can take place. We instead assume that every firm produces the same quality (independently on whether it sells it to the private sector or the government) and estimate the amount of resources required to raise revenue from the market.

6.1 Effect of Political Connections on Procurement Prices

In the previous section, we observed an increase in the size of politically connected firms and volume of public procurement contracts assigned to them. This finding however does not necessarily imply additional costs for the economy as a whole. Comparing how connected firms differ from unconnected ones in the execution of government contracts would be the most direct way to measure inefficiencies in the contract allocation. Unfortunately, data on increases to the budgeted cost of public projects is not available in Ecuador.

Nevertheless, we can have a rough estimate of the direct costs of assigning public contracts to connected firms looking at the E-catalog dataset. As explained above, in this data we observe *transaction-product* information for standardized goods for the years 2014-2018. With this information we can compute the unit price of standardized items charged by supplying firms.

We follow DellaVigna & Gentzkow (2017) and let P_{ijat} denote the transaction price charged by firm i for one unit of good j to agency a at time t. This is computed as the ratio of the total value of the sale divided by the total quantity purchased. We then compute the standardized log price $p_{ijat} = log(P_{ijat}) - \bar{p}_{jt}$ with $\bar{p}_{jt}$ denoting the average log price of product j across all firms in a given year t. This allow us to compare prices charged by each firm for the same standardized good relative to all other supplying firms in a given year. In this way we can look at systematic over/under pricing done by particular type of firms.

Given that there is no significant amount of entry into government for firms that are contractors of E-catalog contracts, we cannot follow the event study methodology. Instead, we simply run cross-sectional regressions that capture systematic differences in pricing between politically connected and unconnected firms.

In particular, we estimate the following equation (with a few variations)

$$\begin{aligned} p_{ijat} = \alpha + \beta_{pc} PoliticalConnection_i + \gamma ln(Q_{ijat}) \\ + \nu_a + \nu_t + Province_a + ProviderType_i + \varepsilon_{ijat}, \end{aligned} \tag{2}$$

where $PoliticalConnection_i$ indicates if supplying firm i is related to a bureaucrat, $ln(Q_{ijat})$ is the quantity purchased of the good. Moreover, ν_a are buying agency fixed effects, ν_t are year fixed effects, $Province_a$ are agency's province fixed effects,

[8] We also consider as alternative counterfactual the median contractor in the same 3-digit sector.

$ProviderType_i$ are fixed effects for whether the provider is a firm or an individual. Notice that we use buying agency fixed effects in order to account for the possibility that some agencies systematically pay more than others for the same good (Bandiera et al. 2009). At the same time, we control for the size of the purchase in order to account for possible bulk discounts offered to providers. We include agency's province fixed effects to account for possible regional differences in prices. We further distinguish between different types of bureaucrats: namely, high rank bureaucrats, mid and low level bureaucrats, and other bureaucrats (teachers, doctors, police, army). It is important to highlight that high rank bureaucrats are also bureaucrats, whereas "Other" are an exclusive category.

Table 2 explores the correlations between political connections and pricing of homogeneous goods. Column (1) and (2) show the results at the transaction level regression. In Column (1), we find that firms connected to bureaucrats and other public officials charge a premium of around 4-5 percent for similar quality goods. The results are similar in column (2), where we exclude "Other" public officials from the regression: in this case, bureaucrats are found to charge an additional 4.5 premium to the price of homogenous goods. In both cases, we do not find evidence of an additional markup for firms connected to high rank bureaucrats relative to other type of bureaucrats.

In Column (3) and (4) instead, we show the average standardized price at the supplying firm-agency level. The size of the premium is comparable to the one in previous columns: namely, we obtain a 6 percent political connection premium for prices. As before, we do not observe an extra effect for high level bureaucrats.

6.1.1 *Price Inflation Estimates*

We can use these estimates to provide a back-of-the-envelope estimate of the total accounting costs that corruption generates for the economy. If we assume that a constant 4.5 percent wedge over unconnected firms for all types of contracts, we can then adjust the total value of purchases by the inflation generated from political connections. Our calculations suggest that, relative to the provision of unconnected firms, procurement with politically connected firms increases total government expenditure by 4.75 billion USD in nominal terms over 10 years. That is, we measure an excess cost generated by political connections of 475 million USD per year. Putting it under a different perspective, 2 percent of all government expenditures could be attributed solely to the price inflation due to political connections. Of course, these estimates have to be considered with caution, but they give some first impression of the magnitude of corruption in the allocation of public procurement contracts.

	(1) Std. Price	(2) Std. Price	(3) Avg. Std Price	(4) Avg. Std Price
Bureaucrat	0.0396***	0.0445***	0.0600**	0.0596**
	(0.00548)	(0.00861)	(0.0248)	(0.0249)
High Level	-0.00474	-0.00625	0.00646	0.00812
	(0.0595)	(0.0538)	(0.0518)	(0.0516)
Other	0.0489*		0.0644***	
	(0.0276)		(0.0218)	
Quantity Control	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Agency FE	Yes	Yes	No	No
Province FE	Yes	Yes	Yes	Yes
Provider Type FE	Yes	Yes	Yes	Yes
Observations	871,839	779,163	23,615	22,506

Table 2: **Transaction Unit Prices and Political Connections.** Notes: This table shows the correlation between political connection and standardized unit prices of homogeneous goods procured to the government in years 2014-2018. All regressions are at the transaction level and include year fixed effects and province fixed effects. Regression models with buying agency fixed effects are indicated above. Standard errors clustered at the buying agency level. High rank bureaucrats are also bureaucrats, whereas "Other" are an exclusive category. Therefore, the effect for high rank should be considered on top of the effect for bureaucrat. Standard errors in parenthesis are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

6.2 Misallocation of Procurement Contracts

In this section, we estimate the excess costs of provision for politically connected firms. Our framework uses insights from the industrial organization literature in order to estimate variable costs of production, which allow us to compare costs between firms.

The structure of this section is the following: in step 1, we detail a methodology based on De Loecker (2011), which allows us to recover unbiased revenue production function estimates despite the presence of unobserved demand and price shocks. We follow this approach rather than other traditional production function estimation frameworks, because we consider the construction of a link to a bureaucrat a particular important demand shock faced by firms. Remember that, as shown in section 5.2, firms becoming politically connected see their sales increase discontinuously at treatment. Section 5.3 further showed that more procurement contracts are allocated to firms establishing a connection. Finally, in section 6.1, we saw that connected firms are able to charge higher prices to the government. We argue that the De Loecker (2011) framework allows us to parse out these demand effects from the revenue productivity. Therefore, we can eliminate the bias that could be present in the productivity and elasticities estimates obtained with less complex techniques.

In step 2, we set up a simple cost minimization framework similar to the one developed by De Loecker & Warzynski (2012). This model takes as input the revenue elasticities estimated in step 1, together with the cost shares of variable inputs. It allows us to back out the variable costs of raising an arbitrary amount of revenue for any firm in our sample.

Finally, in step 3, we use the variable cost estimates from step 2 and perform an accounting exercise where we estimate the additional costs of procuring from politically connected firms relative to median firms in the sector or median contracting firms in the sector.

Before conducting the analysis, it is worth offering a brief discussion of why estimates from revenue production rather than quantity production estimation are interesting. Consider two firms that produce pencils. One of them, C, is politically connected, while the other one, U, is not. Both of them face same prices of inputs in the market. Suppose C is extremely efficient in making pencils and can produce one full box of pencils in one hour with little resources. Firm U instead uses the sames resources per hour of work but requires around three hours to output the same box of pencils. However, firm C sells pencils without any ink, which makes them practically useless. If we were to concentrate in quantity productivity, we may conclude that assigning a contract to firm C was the efficient thing to do, since it requires less resources per box. This would be a misguided conclusion. One way to get around this problem is using revenue productivity. Given that the pencils of firm C are probably worthless in the market, they actually require significantly more resources to raise the same revenue as U can raise in an hour of work. Comparisons of costs required to raise revenue will take these vertical differences into account. Under this framework, we will conclude that it is more efficient to allocate the contract to firm U. For this reason, we argue that using estimates from revenue production function are both interesting and useful.

Step 1: Elasticities from Production Function Estimation

Assume firm i produces output Q_{it} at time t according to a Cobb-Douglas production function

$$Q_{it} = L_{it}^{\alpha_l} M_{it}^{\alpha_m} K_{it}^{\alpha_k} exp(\omega_{it} + u_{it}), \tag{3}$$

where L_{it} denotes labor, M_{it} intermediate inputs, and K_{it} capital. Production additionally depends on a firm-specific productivity term, ω_{it}, and u_{it}, which captures measurement error and idiosyncratic production shocks.

Following De Loecker (2011) we introduce a constant elasticity of substitution (CES) demand system for firm i operating in sector s

$$Q_{it} = Q_{st} \left(\frac{P_{it}}{P_{st}} \right)^{\eta_s} exp(\xi_{it}), \tag{4}$$

which implies that each firm i faces a demand that depends on its own price, P_{it}, on the average price in the sector, P_{st}, on an aggregate sector demand shifter, Q_{st}, and on unobserved demand shocks, ξ_{it}. The parameter η_s allows substitution patterns to vary between segments. Combining the CES demand system with monopolistic competition implies a constant markup of $\frac{\eta_s}{1+\eta_s}$.

As we do not observe firms physical output Q_{it}, we leverage on the market equilibrium condition to derive an expression for revenue

$$\begin{aligned} R_{it} &= P_{it} Q_{it} \\ &= Q_{it}^{(1+\eta_s)/\eta_s} Q_{st}^{-1/\eta_s} P_{st} (exp(\xi_{it}))^{-1/\eta_s}, \end{aligned} \tag{5}$$

where we substitute for P_{it} rearranging equation 4. Taking logs of equation 5

$$\begin{aligned} r_{it} &= \frac{1+\eta_s}{\eta_s} q_{it} - \frac{1}{\eta_s} q_{st} + p_{st} - \frac{1}{\eta_s} \xi_{it} \\ &= \beta_l l_{it} + \beta_m m_{it} + \beta_k k_{it} + \beta_s q_{st} + p_{st} + \xi^*_{it} + \omega^*_{it} + u^*_{it}, \end{aligned} \tag{6}$$

where $\beta_h = \frac{1+\eta_s}{\eta_s}\alpha_h$ for each $h = \{l, m, k\}$, and $\beta_s = -\eta_s^{-1}$. Moreover, the unobservables enter the above equation scaled by the relevant demand parameter, namely $\xi^*_{it} = -\frac{1}{\eta_s}\xi_{it}$, $\omega^*_{it} = \frac{1+\eta_s}{\eta_s}\omega_{it}$, and $u^*_{it} = \frac{1+\eta_s}{\eta_s}u_{it}$.

Bringing equation 6 to the data, we will not be able to separate q_{st} from p_{st} since we do not observe aggregate industry demand nor average industry price indices. Therefore, our measure of firm productivity will reflect ω^*_{it} which in turn allows only for within sector comparisons.

Estimation and Identification

We decompose the unobserved demand shock ξ^*_{it} as

$$\xi^*_{it} = \xi_s + \tau_t + PC_{it} + \widetilde{\xi}_{it}, \tag{7}$$

where ξ_s and τ_t capture sector and time specific averages, respectively. Importantly, the variable PC_{it} allows the dependence between demand shocks and firm political connectedness. The last term, $\widetilde{\xi}_{it}$ denotes unobserved demand shocks and is assumed to be independent and identically distributed across firms and time.

Together with equation 6 we obtain the following estimating equation

$$\begin{aligned} r_{it} = \beta_l l_{it} + \beta_m m_{it} + \beta_k k_{it} + \sum_s \delta_s D_{is} + \sum_t \delta_t D_{it} \\ + \sum_{s,t} \delta_{st} D_{is} \times D_{it} + \pi PC_{it} + \omega^*_{it} + \varepsilon_{it}, \end{aligned} \tag{8}$$

where D_{is} denotes sector dummies, D_{it} time dummies, and ε_{it} collects idiosyncratic shocks to demand ($\widetilde{\xi}_{it}$) and production (u^*_{it}). Notice that unobserved prices are picked up by the sector dummies and the correlation with inputs.

We estimate the parameters of equation 8 following the recent production function estimation literature (De Loecker 2011, Lee et al. 2018). We make the following assumptions on the primitives of the model:

Assumption 1 Information set: *The firm information set at t, I_{it}, includes current and past productivity shocks, $\{\omega_{i\tau}\}_{\tau=0}^{t}$, but no future productivity shocks, $\{\omega_{i\tau}\}_{\tau=t+1}^{\infty}$. The firm idiosyncratic shock ε_{it} satisfies $[\varepsilon_{it}|I_{it}] = 0$.*

Assumption 2 Timing of input choices: *Capital is a dynamic input to the production function that is accumulated according to*

$$k_{it} = \kappa(k_{it-1}, i_{it-1}), \tag{9}$$

with i_{it-1} denoting investments in the previous period. Labor l_{it} and intermediate inputs m_{it} are instead non-dynamic and chosen at t.

Assumption 3 Scalar unobservable: *Firm's intermediate input demand is given by*

$$m_{it} = f_t(k_{it}, \omega_{it}, D, PC_{it}), \tag{10}$$

where D collects all time and sector dummies, together with their interaction.

Assumption 4 Strict monotonicity: $f_t(k_{it}, \omega_{it}, D, PC_{it})$ *is strictly increasing in* ω_{it}.

Following the standard production function estimation literature (Olley & Pakes 1996, Levinsohn & Petrin 2003), we can break down the estimation algorithm into two stages. To set up the first stage equation, notice that assumption 3 and 4 together allow to express productivity as a function of observables

$$\omega_{it} = f_t^{-1}(k_{it}, m_{it}, D, PC_{it}). \tag{11}$$

Plugging this in equation 8 we obtain

$$\begin{aligned} r_{it} &= \beta_l l_{it} + \beta_m m_{it} + \beta_k k_{it} + \delta D + \pi PC_{it} + f_t^{-1}(k_{it}, m_{it}, D, PC_{it}) + \varepsilon_{it} \\ &= \beta_l l_{it} + \Phi_t(k_{it}, m_{it}, D, PC_{it}) + \varepsilon_{it}, \end{aligned} \tag{12}$$

where $\Phi_t(\cdot)$ is estimated nonparametrically (usually through a third order polynomial). Estimates of β_l and $\Phi_t(\cdot)$ can be obtained from the first stage using the moment condition

$$[\varepsilon_{it}|I_{it}] = [r_{it} - \beta_l l_{it} - \Phi_t(k_{it}, m_{it}, D, PC_{it})|I_{it}] = 0. \tag{13}$$

For the second stage, we further assume that firm productivity changes according to a first order Markov process

$$\begin{aligned} \omega_{it} &= [\omega_{it}|\omega_{it-1}, \eta_i, PC_{it-1}] + \nu_{it} \\ &= \eta_i + g(\omega_{it-1}, PC_{it-1}) + \nu_{it}. \end{aligned} \tag{14}$$

As in Lee et al. (2018), we introduce a firm-specific intercept, η_i, that allows for persistent productivity differences between firms. Additionally, the lagged political connectedness status is allowed to impact today's productivity. By construction, the law of motion of productivity also implies $[\nu_{it}|I_{it-1}] = 0$.

Plugging equation 14 into 8 we get

$$\begin{aligned} r_{it} &= \beta_l l_{it} + \beta_m m_{it} + \beta_k k_{it} + \delta D + \pi PC_{it} + \eta_i + g(\omega_{it-1}, PC_{it-1}) + \nu_{it} + \varepsilon_{it} \\ &= \beta_l l_{it} + \beta_m m_{it} + \beta_k k_{it} + \delta D + \pi PC_{it} + \eta_i \\ &+ g(\Phi_{t-1}(\cdot) - \beta_m m_{it-1} - \beta_k k_{it-1} - \pi PC_{it-1} - \delta D, PC_{it-1}) + \nu_{it} + \varepsilon_{it}. \end{aligned} \tag{15}$$

Using the moment condition $[\nu_{it} + \varepsilon_{it}|I_{it-1}] = 0$ we can consistently estimate $\hat{\beta}_m$, $\hat{\beta}_k$, $\hat{\delta}$, and $\hat{\pi}$ with a semiparametric regression with firm-specific fixed effect.

We however follow Wooldridge (2009) estimating all production function coefficients jointly via the moment condition $[\nu_{it} + \varepsilon_{it}|I_{it}] = 0$.

We finally compute an estimate of firm productivity following

$$\hat{\omega}_{it}^* = (r_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_m m_{it} - \hat{\beta}_k k_{it} - \sum_t \hat{\delta}_t D_{it} - \sum_{s,t} \hat{\delta}_{st} D_{is} \times D_{it} - \hat{\pi} PC_{it} - \hat{\tilde{\xi}}_{it}), \tag{16}$$

where $\hat{\tilde{\xi}}_{it}$ is the estimate of the residual from the first stage (equation 12).

	OLS	Wooldridge uncorrected	Wooldridge corrected
β_l	0.423	0.430	0.423
	(0.012)	(0.024)	(0.034)
β_m	0.577	0.611	0.566
	(0.018)	(0.040)	(0.047)
β_k	0.104	0.063	0.085
	(0.009)	(0.010)	(0.005)
Sum	1.104	1.103	1.074
	(0.015)	(0.023)	(0.016)

Table 3: **Production Function Estimates.** Notes: This table the estimated elasticities from three production function estimation methods. Column (1) shows results for OLS with time fixed effects. Column (2) roughly refers to joint estimation of equation 8 without dummy for political connectedness and time×sector interaction dummies. Column (3) shows the results from full estimation of equation 8. Each regression is run at the sector level, and the reported coefficients are the weighted average of sector coefficients (with number of observations within each sector as weights). Standard errors are the standard errors of the weighted mean.

Results

Table 3 shows the estimates of the revenue elasticities of labor, materials, and capital obtained with three different production estimation techniques. Column (1) uses an OLS regression of log revenue on inputs and time fixed effects to control for inflation. Column (2) follows Wooldridge (2009) by running a GMM model based on the moment condition $[\nu_{it} + \varepsilon_{it}|I_{it}] = 0$. We refer to it as "Wooldridge uncorrected" because we only control for time dummies but not for political connectedness dummies nor for dummies of the interaction between time and sector. Column (3) implements the full corrected procedure detailed in the previous section via Wooldridge (2009) joint estimation. As discussed above, our framework is specifically designed to take into account unobserved price and demand shocks. We observe that the coefficients of column (3) are consistent with those previously find in the production function literature for developing (Blattner et al. 2017) and developed countries (De Loecker 2011). The last row of table 3 shows the sum of the estimated revenue elasticities. Crucially, in our preferred specification we are very close to constant returns to scale (CRTS) of revenue.[9]

We then compute firm level productivity following equation 16 and test for differences in efficiency levels between firms that are politically connected at some point in our data versus unconnected firms. Table 4 brings evidence in support of the idea that firms linked to a bureaucrat are less efficient than unconnected firms. On average, our "Wooldridge corrected" estimates suggests a 14% gap in efficiency between connected and unconnected firms.

[9]It is important to notice that the standard errors in the table refer to the standard errors of the weighted average of the estimated coefficients within sectors. We plan to use recent econometric techniques (Davezies et al. 2018) to produce correct standard errors.

	(1) OLS	(2) Wooldridge uncorrected	(3) Wooldridge corrected
Political Connection	-0.081***	-0.069***	-0.136***
	(0.014)	(0.004)	(0.015)
2-digit Sector FE	Yes	Yes	Yes
Observations	668,504	558,966	547,415

Table 4: **Political Connections and Productivity.** Notes: This table shows differences in revenue productivity (TFPR) between connected and unconnected firms, as obtained from the different production function estimation methods. Column (1) uses TFPR estimates via OLS, column (2) from "Wooldridge uncorrected", and column (3) from "Wooldridge corrected". Standard errors in parenthesis are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1

Step 2: Estimating Firm Level Variable Costs

Suppose two firms in the same sector with different productivity levels are competing for a government contract for which the government is willing to pay Y USD. How large would the losses of awarding the contract to the less efficient one? One way to estimate misallocation losses would be to quantify the additional costs the inefficient firm requires in order to raise the same level of revenue in the market as the efficient one. In this section, we argue it is possible to use revenue production function estimates, following De Loecker & Warzynski (2012), to quantify the size of these type of losses, in terms of additional resources needed by the firm.

Using equation 3 and 5 we can express the revenue production function for firm i at time t as

$$R_{it} = A_{it} L_{it}^{\beta_l} M_{it}^{\beta_m} K_{it}^{\beta_k}, \tag{17}$$

where R_{it} is firm revenue, $A_{it} = exp(\omega_{it}^* + u_{it}^*) Q_{st}^{-1/\eta_s} P_{st} (exp(\xi_{it}))^{-1/\eta_s}$ is revenue productivity, L_{it} is labor, M_{it} is intermediate inputs, and K_{it} is capital stock, and $\beta_i = \frac{1+\eta_s}{\eta_s}\alpha_i$ are the scaled-up production function parameters. Similarlte ω_{it}^* and u_{it}^* are the scaled-up productivity and unobserved shock. Notice that revenue productivity incorporates plausibly unobserved (to the econometrician) demand shocks. Therefore, making step 1 necessary to recover unbiased estimates of the revenue elasticities. As in the previous section, we take labor and intermediate inputs as static inputs, whereas capital is considered to be dynamic.

Assuming producers are cost minimizers, we can consider the associated Lagrangian function

$$\mathcal{L}(L_{it}, M_{it}, K_{it}, \lambda_{it}) = P_{it}^l L_{it} + P_{it}^m M_{it} + r_{it} K_{it} + \lambda_{it}(R_{it} - A_{it} L_{it}^{\beta_l} M_{it}^{\beta_m} K_{it}^{\beta_k}), \tag{18}$$

where P_{it}^l, P_{it}^m, and r_{it} denote a firm's input price for labor, intermediate inputs, and capital, respectively. In De Loecker & Warzynski (2012), firms may face different input prices and charge different output prices. However, given our estimated elasticities

come from a framework that requires equal input prices, we are effectively assuming equal input prices under this approach as well.

The first-order condition for intermediate inputs (and similarly for labor) is given by

$$\frac{\partial \mathcal{L}(\cdot)}{\partial M_{it}} = P_{it}^{m} - \lambda_{it} \frac{R_{it}\beta_m}{M_{it}} = 0, \tag{19}$$

where the marginal cost of revenue at a given level of revenue is λ_{it}, as $\frac{\partial \mathcal{L}(\cdot)}{\partial R_{it}} = \lambda_{it}$. We can rewrite this equation to obtain an expression for the total costs of intermediate inputs (and similarly for labor)

$$P_{it}^{m} M_{it} = \lambda_{it} R_{it} \beta_m. \tag{20}$$

Given that capital is dynamic, the problem for the social planner in the assignment of the marginal contract is given by the comparison of the variable costs of competing firms. From equation 20, we obtain that the variable costs of production are given by

$$VC_{it} = P_{it}^{m} M_{it} + P_{it}^{l} L_{it} = \lambda_{it} R_{it} (\beta_m + \beta_l). \tag{21}$$

From equation 21 above we can obtain estimates for the marginal cost of revenue for each firm i at time t using

$$\lambda_{it} = \frac{P_{it}^{m} M_{it} + P_{it}^{l} L_{it}}{R_{it}(\beta_m + \beta_l)}. \tag{22}$$

Estimates for the revenue elasticities of the variable inputs are obtained from production function estimation in step 1.

Step 3: Total Misallocation Costs

Now, let us return to the problem of assigning a contract of size Y to one of two competing firms, namely, firm U and C. First, we assume that each firm uses the same technology in all of their production. Further, we assume firm U is more productive than firm C, i.e. $A^U > A^C$. The variable costs of raising Y dollars in the market for each firm i will be given by:

$$VC_i(Y) = \lambda_i Y (\beta_m + \beta_l). \tag{23}$$

Note that the marginal cost of revenue λ_i includes already input prices and productivity level of the firm.

Therefore, the excess in inputs costs (EC) required in the execution of the contract by firm C relative to firm U will be

$$EC(Y) = (\lambda_C - \lambda_U)Y(\beta_m + \beta_l). \tag{24}$$

Equation 24 gives us the misallocation loss in terms of additional costs required to execute the same contract. We can then extend this framework to quantify the overall misallocation in government contracts. This can be done by comparing the excess costs of politically connected firms relative to the median unconnected firm in their 2-digit sector. That is, for the set $\mathbb{C}$ of all contracts c assigned to politically connected firms, we define overall contract misallocation losses Λ as

$$\Lambda = \sum_{c \in \mathbb{C}} (\lambda_{icst} - \widetilde{\lambda}_{st}) Y_c (\beta_m^s + \beta_l^s), \tag{25}$$

where β_m^s and β_l^s are the revenue elasticities of intermediate inputs and labor for sector s, λ_{ist} is the marginal cost of revenue for firm i winning contract $c \in \mathbb{C}$ at time t, and $\widetilde{\lambda}_{st}$ is the marginal cost of revenue for the median firm in the same sector (3 digits level) of firm i. As mentioned above, we obtain $\hat{\beta}_m^s$ and $\hat{\beta}_l^s$ from production function estimation (step 1). $\hat{\lambda}_{ist}$ is computed as discussed above (step 2), while the value of each contract, Y_c, is observed directly from the data.

6.2.1 *Contract Misallocation Estimates*

With all our estimates in hand, we perform the accounting in step 3. We use the estimated elasticities from our preferred "Wooldridge corrected" specification, which allows for endogenous responses in productivity to political connection and controls for sector level demand shocks. The exercise only considers the possibility of misallocation once the firm becomes politically connected. We consider two counterfactuals: we compare the costs of procurement 1) relative to the median firm in the same 3-digit ISIC sector as the winning firm in that year, and 2) relative to the median firm in the same 3-digit sector that was a contractor of the same type of contract (discretionary or auction) during the same year.[10]

Table 5 presents our estimates of excess costs of misallocating contracts. For discretionary contracts, we find excess costs equal to 1.5 percent of the value of the awarded contracts, relative to a counterfactual scenario where the contracts are awarded to the median firm in the sector. The size of the losses increases to 3.5 percent when we consider assigning the contract to the median contractor in the sector. For auction contracts, we observe that, relative to the median firm in the sector, the allocation of government contracts to connected firms is actually slightly welfare increasing.[11] However, relative to the performance of other contractors in the sector, we find that political connections generate losses of over 2 percent of the value of auctions. Given substantial differences between contractors and non-contractors as noted in 1, our preferred estimates are those of median contractors in the sector.

[10] We omit comparison from the random contract given little scope for active misallocation in this mechanism.

[11] This might be statistically insignificant. We are currently working on producing the standard errors for our estimates.

	Median in Sector	Median Contractor in Sector
Discretionary	1.50	3.51
Auction	-0.12	2.01

Table 5: **Contract Misallocation Losses (as percentage value of assigned contracts)** Notes: This table shows the estimated excess costs of procuring from a politically connected firm relative to the median firm in the sector or the median contractor in the sector, both for discretionary and auction contracts.

7 Conclusion

This paper aimed to provide a lower bound of the costs of corruption to society generated in the allocation of government procurement contracts. For this task, we assembled a detailed dataset where we can track entry into government offices and link bureaucrats to private firms shareholders. This allowed us to analyze the dynamics of politically connected firms and whether they differ from unconnected ones in the allocation of government contracts.

With this database in hand, we first showed that the creation of a connection to a bureaucrat in office has a large and significant effect on firm size and the number of procurement contracts received. This result cannot be explained by selection into working for the government, but rather we find that entering the government has a causal effect on these margins.

Next, using detailed level price information and various tools from the industrial organization literature, we estimated two sources of welfare costs of corruption: (1) excess costs to the government via price inflation, and (2) excess costs to society via extra resources needed for production. With respect to price inflation, our study found that political connections allow firms to charge an average markup of 4.5 percent relative to unconnected firms for homogeneous goods and services. This translates into additional 475 million USD in expenses per year accrued solely from the existence of political connection. In regards to excess costs, our preferred estimates suggest a waste of resources worth around 3.5 percent of the value of discretionary contracts and 2 percent of the value of auction contracts.

While this paper offers a sense of the size of losses generated from corruption, it is also silent regarding two important aspects of corruption that are relevant for welfare. First, much of corruption happens also between unconnected firms and public officials, so the plausible losses in general price inflation and further misallocation of contracts are omitted in our analysis. Second, besides the extensive-side of reallocation of contracts and intensive-side in price inflation, corruption in developing countries also relates to underprovision of quality (e.g. expired medicines), which we cannot capture with our available data. A future comprehensive measure of the effects of corruption on welfare would need to account for these aspects as well.

References

Acemoglu, D., Johnson, S., Kermani, A., Kwak, J. & Mitton, T. (2016), 'The value of connections in turbulent times: Evidence from the united states', *Journal of Financial Economics* **121**(2), 368–391.

Amore, M. D. & Bennedsen, M. (2013), 'The value of local political connections in a low-corruption environment', *Journal of Financial Economics* **110**(2), 387–402.

Bandiera, O., Prat, A. & Valletti, T. (2009), 'Active and passive waste in government spending: evidence from a policy experiment', *American Economic Review* **99**(4), 1278–1308.

Blattner, L., Farinha, L., Rebelo, F. et al. (2017), When losses turn into loans: The cost of undercapitalized banks, Technical report, Job Market Papers.

Brogaard, J., Denes, M. & Duchin, R. (2016), 'Political influence and government investment: Evidence from contract-level data'.

Colonnelli, E. & Prem, M. (2017), 'Corruption and firms: Evidence from randomized audits in brazil'.

Davezies, L., D'Haultfoeuille, X. & Guyonvarch, Y. (2018), 'Asymptotic results under multiway clustering', *arXiv preprint arXiv:1807.07925* .

De Loecker, J. (2011), 'Product differentiation, multiproduct firms, and estimating the impact of trade liberalization on productivity', *Econometrica* **79**(5), 1407–1451.

De Loecker, J. & Warzynski, F. (2012), 'Markups and firm-level export status', *American Economic Review* **102**(6), 2437–71.

DellaVigna, S. & Gentzkow, M. (2017), Uniform pricing in us retail chains, Technical report, National Bureau of Economic Research.

Do, Q.-A., Lee, Y. T. & Nguyen, B. D. (2015), 'Political connections and firm value: Evidence from the regression discontinuity design of close gubernatorial elections'.

Faccio, M. & Parsley, D. C. (2009), 'Sudden deaths: Taking stock of geographic ties', *Journal of Financial and Quantitative Analysis* **44**(3), 683–718.

Fan, J. P., Wong, T. J. & Zhang, T. (2007), 'Politically connected ceos, corporate governance, and post-ipo performance of china's newly partially privatized firms', *Journal of financial economics* **84**(2), 330–357.

Fisman, R. (2001), 'Estimating the value of political connections', *American economic review* **91**(4), 1095–1102.

Goldman, E., Rocholl, J. & So, J. (2013), 'Politically connected boards of directors and the allocation of procurement contracts', *Review of Finance* **17**(5), 1617–1648.

Johnson, S. & Mitton, T. (2003), 'Cronyism and capital controls: evidence from malaysia', *Journal of financial economics* **67**(2), 351–382.

Kaufmann, D. & Wei, S.-J. (1999), Does "grease money" speed up the wheels of commerce?, Technical report, National bureau of economic research.

Khwaja, A. I. & Mian, A. (2005), 'Do lenders favor politically connected firms? rent provision in an emerging financial market', *The Quarterly Journal of Economics* **120**(4), 1371–1411.

Lee, Y., Stoyanov, A. & Zubanov, N. (2018), 'Olley and pakes-style production function estimators with firm fixed effects', *Oxford Bulletin of Economics and Statistics* .

Levinsohn, J. & Petrin, A. (2003), 'Estimating production functions using inputs to control for unobservables', *The Review of Economic Studies* **70**(2), 317–341.

Olken, B. A. & Pande, R. (2012), 'Corruption in developing countries', *Annu. Rev. Econ.* **4**(1), 479–509.

Olley, G. S. & Pakes, A. (1996), 'The dynamics of productivity in the telecommunications equipment industry', *Econometrica* **64**, 1263–1295.

Rijkers, B., Freund, C. & Nucifora, A. (2014), *All in the family: state capture in Tunisia*, The World Bank.

Schoenherr, D. (2015), 'Political connections and allocative distortions'.

Shleifer, A. & Vishny, R. W. (2002), *The grabbing hand: Government pathologies and their cures*, Harvard University Press.

Svensson, J. (2005), 'Eight questions about corruption', *Journal of economic perspectives* **19**(3), 19–42.

Szucs, F. (2017), 'Discretion and corruption in public procurement'.

Tahoun, A. (2014), 'The role of stock ownership by us members of congress on the market for political favors', *Journal of Financial Economics* **111**(1), 86–110.

Wooldridge, J. M. (2009), 'On estimating firm-level production functions using proxy variables to control for unobservables', *Economics Letters* **104**(3), 112–114.

Appendix

A Appendix Figures and Table

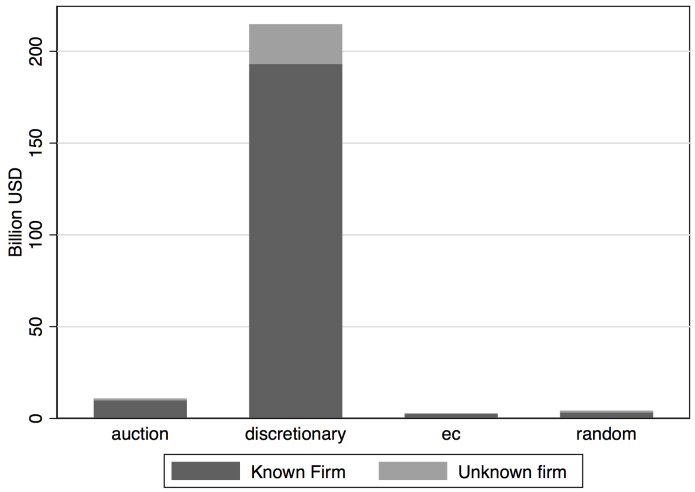
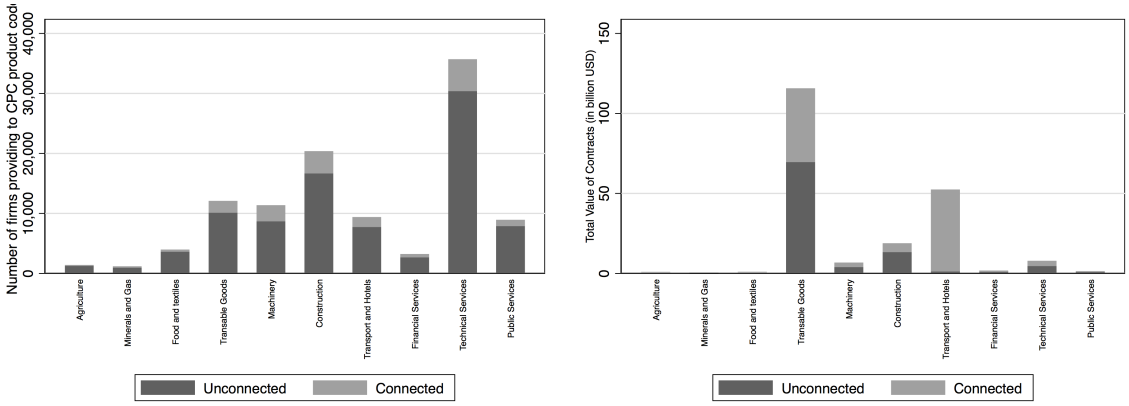


Figure A.1: **Known Provider by Contract.** This figure the proportion of contracts allocated to known vs. unknown ID firms.



(a) Number of Firms (b) Fraction of Total Contracts by Type

Figure A.2: **Political Connection by Type of Good and Service Procured (Discretionary).** This figure shows the count of connected vs unconnected supplying firms by type of good and service procured in discretionary contracts, as well as the share of contracts allocated to each type of firm by type of good and service in discretionary contracts.

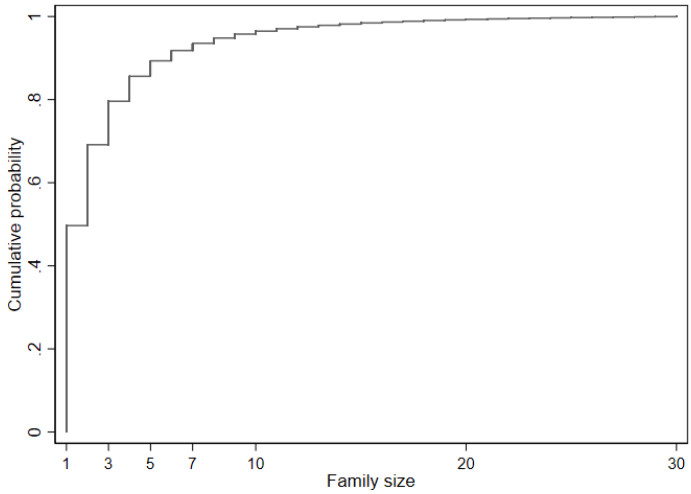
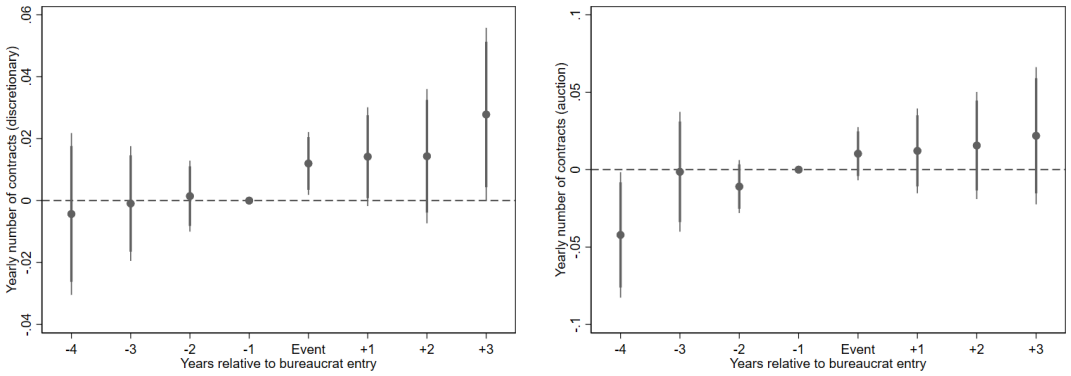
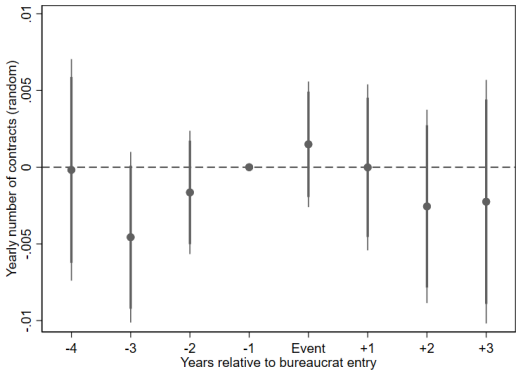


Figure A.3: **Cumulative Distribution – Family Sizes.** This figure shows the cumulative distribution function of family firm sizes.



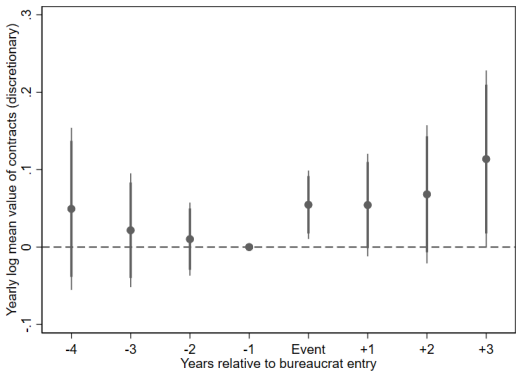
(a) Discretionary contracts

(b) Auctions

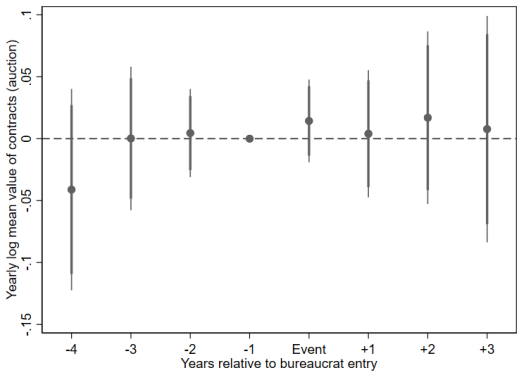


(c) Randomly allocated contracts

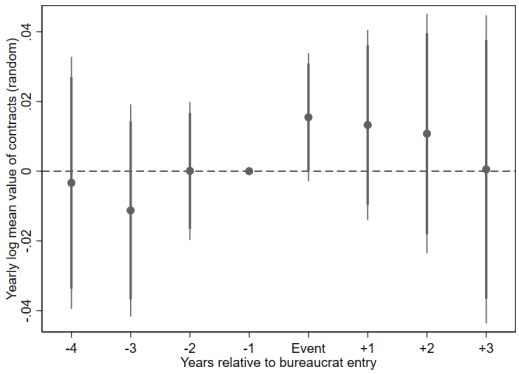
Figure A.4: **Event study for the number of allocated contracts.** Notes: The sample is the set of private firms executing at least one public procurement contract and that were linked directly or indirectly through a family tie to a bureaucrat entering the government. Each figure plots coefficients from a regression of the number of allocated contracts on a vector of lead and lagged indicators for years relative to the time of bureaucrat entry, with the year prior to the event ("-1") as the omitted category. The unit of observation is the firm-year. Error bars are estimated using their 90 and 95 percent confidence levels, obtained from standard errors that are clustered at the firm level. Each regression includes year fixed effects and firm fixed effects.



(a) Discretionary contracts



(b) Auctions



(c) Randomly allocated contracts

Figure A.5: **Event study for the mean value of allocated contracts.** Notes: The sample is the set of private firms executing at least one public procurement contract and that were linked directly or indirectly through a family tie to a bureaucrat entering the government. Each figure plots coefficients from a regression of the mean value of allocated contracts on a vector of lead and lagged indicators for years relative to the time of bureaucrat entry, with the year prior to the event ("-1") as the omitted category. The unit of observation is the firm-year. Error bars are estimated using their 90 and 95 percent confidence levels, obtained from standard errors that are clustered at the firm level. Each regression includes year fixed effects and firm fixed effects.

B Data Construction

B.1 Identifying Families

To determine family links, we considered that two or more people are part of the same family if they share their first and second last names. Blindly taking the first two words in a name string as the last names would misclassify families. Given last name conventions in Hispanic countries, we may find that compounded last-names as ”De la Torre” are actually just one last name rather than three. For this purpose, we created an algorithm that allowed us to identify which words in a name belonged to each of the last names of the individual. The first step was to separate the names into different words. Then, the algorithm allowed us to consider as one last name all the combination of words that started with ”De la”, ”Del”, ”De los”, ”Di”, ”San”, ”Von” and ”Van der”. Because there were still many other combinations of compound last names left, we manually imputed together words that consistently repeated in the same order for more than three people. The result is the correct identification of the first and second last names.

C Description of Methods of Allocation of Public Procurement Contracts

As explained above, we consider four different type of contracts: 1) auction, 2) discretionary, 3) electronic catalogue, 4) random. The methods for purchasing under each contract type are the following. For reverse auctions, the government must first present the information regarding the contract, e.g. product detail, referential value, date of auction, date of delivery. All firms registered to become suppliers in a given economic or product sector will be invited to participate and those interested must submit an initial quote that must be between 50 and 100 percent of the referential value. Firms that present these quotes will then participate in a virtual reverse auction that lasts between 15 to 60 minutes in which they have to submit downward bids. For every auction, the government will set a minimum level of changes to the bids. Moreover, following the preferential treatment regulation, the winning bid may not be the lowest one since, for example, small firms have a 5 percent margin with respect to medium size firms and 10 percent with respect to large firms.

Random contracts are limited to small public works. In this case, the government agency must present the details for the contract, which include a fixed price. The system will send invitations to small and medium-size firms. If no firms were interested, the agency will then send information to large firms as well. After the automatic invitations are sent, firms signal their interest of becoming suppliers for the given contract at the published price. If at least 3 firms have submitted their signals, the system will select one at random. In case there are less than 3 interested suppliers, the government agency must restart the process and make another call.

For e-catalogue contracts, providers apply to become suppliers of an e-catalogue good. There is an selection process in which the government studies different suppliers and their offers. Once a supplier is accepted, they offer a stock of products to

the government agencies on the public procurement website. They register the goods and services with a base unit price, which can only be updated downwards when an actual sale to a government agency occurs. The agencies have no limit in how many items or what goods they can purchase, subject to the constraint that their quantities fall within their yearly budget. For products available in the catalogue, agencies can choose among different providers.

For discretionary contracts, the process varies depending on the specific type of contract to be executed. The general framework is the following. First, agencies post a public procurement contract with a base value and details about the contract. Then, providers present quotes. Then the agency evaluates the quotes using a scoring system previously defined, where price represents no more than 50% of the scoring function. The contract is awarded to the firm with the highest score.

D ISIC Codes and Description

- A - Agriculture, forestry and fishing
- B - Mining and quarrying
- C - Manufacturing
- D - Electricity, gas, steam and air conditioning supply
- E - Water supply; sewerage, waste management and remediation activities
- F - Construction
- G - Wholesale and retail trade; repair of motor vehicles and motorcycles
- H - Transportation and storage
- I - Accommodation and food service activities
- J - Information and communication
- K - Financial and insurance activities
- L - Real estate activities
- M - Professional, scientific and technical activities
- N - Administrative and support service activities
- O - Public administration and defence; compulsory social security
- P - Education
- Q - Human health and social work activities
- R - Arts, entertainment and recreation

- S - Other service activities
- T - Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
- U - Activities of extraterritorial organizations and bodies
- V - no information
- W - Dependent worker, private sector
- X - Dependent worker, public sector