

The Value of Revolving Doors in Public Procurement*

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Abstract

We investigate the impact of revolving door on public procurement outcomes, combining 10 years of Brazilian health procurement data with a comprehensive employer-employee dataset tracking individuals' job trajectories. We identify how movements between public administrations and private providers affect total contracting amounts and acquisition prices. Analyzing career changes in both directions, we uncover positive and negative effects, consistent respectively with reward for high-skill workers' competence, and collusive behavior. Administration-to-supplier movements appear beneficial to public bodies, while supplier-to-administration ones are detrimental. This points to unexpected policy implications related to the tolerance of revolving door practices.

Keywords: Revolving doors, Procurement, Public Officials Career Path, Personnel Economics.

JEL classification: D72, D73, H11, H57, H83, J45.

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1 Introduction

Revolving doors between public sector agencies and the private firms they deal with are common in sectors such as insurance, banking, and lobbying.¹ The existence of such personnel movements raises a natural question: what are the potential social benefits and costs of revolving doors?

There are polar views on the potential impact of public-to-private revolving door arrangements. On the one hand, negligent or complacent behavior by officials may lead to suboptimal effort and waste or, worse, to collusion and corruption (Eckert, 1981). On the other hand, post-administration opportunities may be necessary to attract talents to the public sector. This may be reinforced by the fact that zealous officials have incentives to accumulate and display competence in order to boost their future employment perspectives (Che, 1995; Bar-Isaac and Shapiro, 2011; Bond and Glode, 2014). Similarly, potential conflicting incentives involving either collusion or increased efficiency may arise when considering private-to-public movements. Given those contrasting theoretical predictions, the determination of revolving door effects remains an open empirical matter.

This paper shows that revolving doors are pervasive in the public procurement sector, and analyzes their impact by studying the link between public officials' career path and outcomes in the Brazilian public procurement process. This is a perfect testing ground, thanks to the availability of high quality data on both public purchases and individual careers. Using a dataset covering more than 2 million procurement contracts for standardized medical supplies, hospital equipment, and pharmaceuticals organized by public bodies over 10 years, together with a comprehensive employer-employee dataset tracking individual job experience and characteristics of all public and private formal workers in the country, we systematically identify career changes in two directions. Officials may work first for a public body and then join a private supplier. Alternatively, officials can work first for a private supplier before joining a public body. We investigate how these revolving door career paths affect procurement outcomes: total amount of contracts and acquisition prices.

The empirical identification of revolving door effects is a challenging task. The analysis of public procurement contracts has several advantages in that regard. First, given the high degree of specific knowledge and expertise involved in procurement transactions, it is natural to expect that workers move between administrations and firms, and we do see a

¹See, for example, Blanes i Vidal, Draca, and Fons-Rosen (2012), Bertrand, Bombardini and Trebbi (2014), Lucca, Seru and Trebbi (2014), the investigation on State-level health insurance regulation in the U.S. (Mishak, 2016), or the recent movements of high-ranking EU officials to or from the investment banking group Goldman Sachs (former head of EU commission José Manuel Barroso moving to the bank, *The Guardian*, July 8, 2016; Mario Draghi becoming head of the European Central Bank, *NYT*, June 24, 2011).

large number of such movements. Second, standardized products are recurrently bought by administrations and the outcomes of these transactions (acquisition price and quantities) are comparable between firm-administration pairs and over time. Third, procurement involves repeated relationships, and our long panel allows us to observe transactions in specific firm-administration pairs both before and after specific revolving individuals appear on the payroll of either of the partners. Fourth, uncovering effects of revolving doors is particularly important in the context of public procurement, which involves large amounts of public money and some discretionary decisions by public officials.

We estimate revolving door effects in a staggered difference-in-differences setting, with different firm-administration pairs developing a revolving door connection at different times throughout the period. We compare, for the same products, the changes in our outcome variables within firm-administration pairs over time. That means that our effects are identified out of pairs for which we observe both periods where the revolving door employees do not work for either of the members, and periods in which these employees work for the public entity and then for the firm (or conversely for the firm first, then for the public entity).

We first provide evidence that the needed parallel trend assumption holds. We then show that our results hold when accounting for a range of time-variant characteristics of both institutions and firms. One important threat for our identification strategy is the possibility that revolving door movements are endogenous, in the sense that they are triggered by specific firm- or institution-time variant shocks that also have an impact on their procurement behavior. Our main specification controls for firm-time or institution-time specific fixed effects that flexibly account for such potential shocks. Finally, we also distinguish revolving door workers by type of positions (permanent civil servants versus appointees) and hierarchical level (directors versus other employees).

Interestingly, we uncover both significant positive and negative effects. Our main result is that administration-to-supplier movements, which are the usual target of revolving door laws and regulations, appear to be beneficial to public bodies, in the sense that they lead to purchases at lower prices. More precisely, we find that a public administration employing a public official who in the future will work for a private provider acquires products from the latter at a price that is 13% lower, while no specific distortions are found regarding quantities or the award procedures used. Once this particular public official moves to the private provider, the latter sells more and at lower prices to that public entity.

However, we also show that this effect holds only for civil servants, but not for political appointees who actually increase the transaction price after moving to the private sector. We argue that the main channel at play here involves career public sector workers attempting to

signal competence and special skills to potential post agency employers by doing their job thoroughly, hence improving procurement efficiency.²

To investigate whether the willingness to signal competence explain our findings, we use a structural break in the nature of the Brazilian procurement process, linked to the introduction of the mandatory use of reverse electronic auctions for a range of purchase in 2005. The large increase in the share of such auctions after this date constrained the ability of procurement officials to provide inside information to connected parties, thus allowing us to disentangle the channels at play behind our results. The persistence of the positive effect after 2005, when collusive behavior such as leaking bid prices becomes increasingly difficult, gives support to the signaling story.

On the other hand, we find that supplier-to-administration movements appear to be neutral or even detrimental in some case, with imprecisely estimated coefficients. In the case of private workers moving to the public administration, the latter buys larger amounts from the connected private provider, at prices that are equal or larger than the counterfactual.

Based on our findings, we perform back-of-the-envelope calculations of the aggregate impact of revolving door practices on public sector procurement spending. They show that administration-to-firm movements lead to savings of a bit more than 3.5% of total spending, while firm-to-administration movements increase spending by 1.3%.

Our results have important implications for the regulation of revolving door practices in the context of developing countries. They point to differentiated conclusions depending on the direction of movements as well as the type of positions involved. In particular, it appears that some flexibility for public-to-private movements of career public servants may be desirable in a developing country context in which human capital is scarce or difficult to attract to public positions.

This paper is organized as follows. Section 2 reviews the relevant literature and explains our contributions. Section 3 describes the institutional aspects of public procurement and the labor market for public officials and private sector workers in Brazil. Section 4 details the datasets on procurement contracts and careers, and discusses how they were merged to generate the revolving door indicators. Section 5 describes the empirical strategy, and Section 6 presents the main econometric results and discusses the channels. Section 7 summarizes the aggregate costs and benefits, Section 8 addresses policy implications, and Section 9 concludes. Additional material, including evidence on the impact of revolving doors on workers' remunerations, is in the Supplementary Section.

²This positive effect distinguishes revolving doors, where both sides win from the relationship, from pure lobbying effect, where only the private party does.

2 Related Literature and Contribution

The paper contributes to several strands of the literature. First, it adds to a small but growing literature that documents the existence and consequences of revolving door practices in different industries. To date, contributions have focused on the finance, defense and lobbying sectors and are mostly restricted to the U.S..

Several papers provide evidence of connections and relational capital being the main assets of revolving individuals. This is the case of Blanes i Vidal, Draca, and Fons-Rosen (2012) and Bertrand, Bombardini and Trebbi (2014), who study the lobbying industry, Cornaggia, Cornaggia, and Xia (2016), who find that credit analysts award inflated ratings to their future employers before switching jobs, and Tabakovic and Wollmann (2018), who show that patent examiners grant more patents to their future employers. On the other hand, Lucca, Seru and Trebbi (2014) conclude that the learning and ability channel prevails in the finance industry, and Kempf (2020) finds that movers from rating agencies to investment banks tend to outperform their peers in terms of accuracy, with the exception of ratings related to their future employers.

We add to this literature in several ways. First, we document the existence and impact of revolving door practices in the context of procurement. This matters because procurement is one of the major channels of public expenditures: according to the OECD, as of 2011 public procurement represented 26.1% of government expenditures and 10.2% of Brazilian GDP. Second, this is the first paper to provide such revolving door evidence for a large emerging country, using large-scale administrative data.

Third, thanks to our focus on standardized goods and the information on prices, we can effectively measure the gains and losses for public bodies created by revolving door movements.³ Fourth, we are able to disentangle revolving door effects depending on the direction and timing of movements, i.e., whether these movements are from the public to the private sector, or the reverse, and whether they happen before or after the transaction of interest. This allows us to show that in the context of Brazilian public procurement not all revolving door movements have similar effects, and hence points to the need to fine-tune the related policy recommendations.

Our findings reflect the theoretical literature that has pointed out both the potential social benefits and the costs of an open revolving door between the public and the private sectors. Che (1995) builds a regulation model in which the regulator has revolving door concerns affecting his performance incentives. He concludes that stronger monitoring effort by public

³Asai et al. (2018) document public-to-private revolving door practices in public construction projects in Japan, but only estimate changes in the probability of firms winning contracts after hiring a public official.

officials seeking to signal competence on the job leads to better outcomes for society, while lenient or collusive behavior in the form of decreased monitoring effort leads to the opposite. Bar-Isaac and Shapiro (2011) and Bond and Glode (2013) model worker movements from credit rating and regulatory agencies, respectively, to banks, and show that when individuals are hired primarily because of their expertise, they have incentive to invest in their industry qualifications or to signal their expertise during their employment as regulators.⁴

In addition, this paper has a close connection to the literature on public procurement. Several channels for wrongdoing have been studied, including bid-rigging, collusion and different types of red tape and waste.⁵ Public officials' career concerns and revolving door issues are often mentioned in the press as a likely pervasive channel for wrongdoing in many countries, but their actual impact on procurement outcomes has not yet been documented empirically.

Also relevant are recent papers that look at the effect of political connections on the allocation of procurement contracts, such as Goldman, Rocholl and So (2013), Straub (2014), Boas, Hidalgo and Richardson (2014), and Arvate, Barbosa and Fuzitani (2019).⁶ The present paper differs from these contributions in that it does not focus on connections arising from firms' directors, board members and campaign contributors having ties to political parties or high ranking politicians, but on a much more pervasive channel involving the direct movements of workers in charge of procurement between supplier firms and public offices.

Finally, a few recent papers have shown that the characteristics of workers involved in the procurement process, such as their tenure or the incentives they face, significantly affects outcomes.⁷ More generally, our findings add to that emerging body of knowledge on how internal public servants' incentives map into the performance of public services.⁸

⁴Other relevant theoretical references include career concerns models, such as Holmstrom (1999), Tirole (1994), and Mattozzi and Merlo (2008), as well as the dynamic regulation frameworks of Laffont and Tirole (1993), Salant (1995), and Martimort (1999) among others.

⁵Contributions that have dealt specifically with corruption in public procurement include Di Tella and Schargrodsky (2003), Bandiera, Prat and Valletti (2009), Auriol, Straub and Flochel (2016), Decarolis, Fisman, Pinotti, and Vannutelli (2020), and Decarolis and Giorgiantonio (2020), to mention only a few. Dimitri, Piga and Spagnolo (2006) provide an early review of the literature on procurement practices.

⁶More generally, our paper is related to studies showing that firms with personal and financial connections to politicians boast higher stock valuation and enjoy favorable access to resources such as loans from government banks or regulatory favors. See, among others, Fisman (2001), Johnson and Mitton (2003), Khwaja and Mian (2005), Ferguson and Voth (2008), Claessens, Feijen and Laeven (2008), and Luechinger and Moser (2014).

⁷Best, Hjort and Szakonyi (2017), Coviello and Gagliarducci (2017), Decarolis, Giuffrida, Iossa, Mollisi and Spagnolo (2016), and Lacetera, Larsen, Pope and Sydnor (2016) among others.

⁸Finan, Olken and Pande (2015); Cameron, de Figueiredo and Lewis (2016).

3 Institutional Background

Public Procurement Process. Public procurement rules in Brazil follow the 1993 Public Procurement Act (Law 8,666) in terms of product description, publicity, and award procedures.⁹ In the case of health procurement, public hospitals, and health agencies and centers receive an annual budget, which they use to acquire medical supplies, equipment for hospitals, and pharmaceuticals in a decentralized way.

Subject to the legal obligation to rely on auction-based mechanisms, public entities choose the award mechanism according to the size of procurement transaction. While large purchase must be made through open competitive bidding, smaller ones can be realized through invited bidding or direct purchase in exceptional cases (very small amounts or lack of potential competition, for example in case of patented products). Since around 2005, electronic auctions are the main vehicle and they should be used to purchase standardized goods and services in most cases.

In electronic reverse auctions, the lowest bid is the only criterion to select suppliers. On the other hand, in physical auctions public entities may use other selection criteria, such as best technique (precision, safety, and durability, i.e., quality), or best technique and price.

This combination of ability to invite bidders and to rely on other criteria than prices therefore affords public buyers a margin of discretion that is crucial in explaining the results that we find in the empirical section.

The Revolving Door Legislation. Movement of individuals between public administrations and private organizations in Brazil is regulated by revolving door rules (Provisional Measure 2,216-37/2001, Decree 4,187/2002, Decree 4,405/2002 and Law 12,813/2013), which basically impose time constraints on the ability of a particular set of high-level public officials to move from their offices to the private sector.

Cabinet ministers, directors of regulatory agencies, commissioners of the Brazilian Competition Authority (CADE), governors and directors of the Central Bank of Brazil, and presidents of state-owned companies are prohibited from working for private organizations during a six-month cooling-off period.¹⁰ Noncompliance with the regulations can bring severe sanctions and penalties, including fines.

While the legislation imposes restrictions on revolving door of high-level public workers, it generally does not restrict public officials' movements to suppliers, and movements of supplier workers to public administrations (including their procurement offices).¹¹

⁹See more specific details in the Supplementary Material.

¹⁰In 2013, Law 12,813 established that high-level appointees are also subject to the same restrictions.

¹¹Specific regulations relative to public sector and private sector workers' careers are described in the

4 Data

In order to build a set of revolving door variables, we match the procurement dataset ComprasNet Data Warehouse with the employer-employee data from RAIS. We start by describing each data source and the way the matching process was performed. We then describe in details the different revolving door variables. Finally, we provide descriptive statistics.¹²

4.1 Primary Datasets

ComprasNet Data Warehouse. It contains information on all procurement transactions made by the federal government, and on all purchases made by state and local governments in pooled procurement with federal bodies. In this paper, we focus on purchases of medical supplies, hospital equipment and prescription drugs, i.e., standardized products recurrently acquired by different public administrations (national university hospitals, public medical centers, and health agencies). This data on public procurement contracts was obtained from the Ministry of Planning, Budget and Management (Ministério do Planejamento, Orçamento e Gestão - MP). The dataset contains all contracts for this type of goods over the period 2000-2009. It comprises 2,299,786 contracts over a set of 1,942,210 different items-products,¹³ between 50,481 firms and 977 administrations.¹⁴

For each contract, information covers a full description and codification of the product purchased, the kind of procurement contract used, the award mechanism, the identity of the public officials responsible for the procurement transaction (including negotiators), the reserve price in the procurement auction and the price paid, the month and year of purchase and quantity purchased, the identity of buyers (public administrations) and suppliers (winning firms), including their names, taxpayer identification numbers (CNPJ), and locations. All products are described, standardized, and codified according to the Brazilian Materials and Services Code. This allows us to make a rigorous comparison between prices paid for very similar products when buying from different suppliers and using different award mechanisms.¹⁵

Supplementary Material.

¹²Table S1 in the supplementary material presents all variables used in the paper, along with their definitions and sources. Tables S2 and S3 detail the structure of the procurement data and provide basic descriptive statistics.

¹³The product space is highly skewed, with a relatively limited number of standard products representing a large share of the total.

¹⁴The 10 most common buyers/administrations are the procurement offices of the national university hospitals, which awarded 18.6% of the total number of contracts between 2000-2009 (an average of 50,000 contracts per buyer). The less frequent buyers are national army branches and regional appellate courts, which got an average of 500 contracts each.

¹⁵In Brazil, the standardization and codification of prescription drugs and hospital equipment started in 2000 at the initiative of the Ministry of Health. The aim was to create a national catalog of standardized health products, which includes prescription drugs and medical and hospital equipment, in order to unify the

RAIS. RAIS (Relação Anual de Informações Sociais) is a comprehensive longitudinal matched employer-employee administrative dataset obtained from an annual census of all formal workers in Brazil, which is widely recognized as high-quality (Menezes-Filho, Muendler and Ramey, 2008; Dix-Carneiro, 2014). It is assembled from mandatory reporting by firms and has been compiled yearly by the Brazilian Ministry of Labor since 1976. It contains above 40 million observations per year and includes information on earnings, demographic characteristics (level of education, age, gender), occupations and other aspects of the job (tenure, weekly working hours, features of the employment contract), current and past employers, along with their identification numbers, locations and industries. In addition, there is information on hierarchical level (directors versus other employees) and type of position (permanent civil servants versus appointees). RAIS covers all public and private sector jobs, except for a few categories of workers (a subset of self-employed individuals and elected politicians) for which employers are not required to report information to the Ministry of Labor.¹⁶

Workers have an incentive to be accurately reported in RAIS in order to be eligible to receive the government benefits they are entitled to.¹⁷ Given that employers are subject to severe fines if they do not regularly submit to the Ministry of Labor the information about their workers, firms also have incentives to precisely provide such information via RAIS.

The data consists of job entries identified by both worker identification number (PIS) and firm-plant identification number on the National Registry of Legal Entities (CNPJ). These identifiers are unique and do not change over time. That allows us to track individuals over time and across employers (firms/administrations). In order to have at least two years of pre-data for the analysis of the effect of worker movements between administrations and firms, we make use of the RAIS database for the period between 1998 and 2009.¹⁸

Matching process. To merge the data on procurement with those on workers' careers, the first step is to extract from the RAIS data all individuals who worked at some point during the 1998-2009 period for any of the firms and administrations that appear in the procurement data. This is done by matching the firm and public administration CNPJ numbers between

language within different spheres of the Brazilian government.

¹⁶Because RAIS is a census of the Brazilian formal labor market only, we cannot follow individuals that always have been working for the informal sector. We also lose track of workers who do not hold a job in the formal sector in a given year, but we can track them again once they return to a formal job.

¹⁷For example, RAIS is the main tool used by the government to enable the payment of the “abono salarial” to eligible workers. Abono salarial is a government program that pays one minimum monthly wage at the end of the year to workers whose average monthly wage was below two times the minimum wage and whose job information was correctly declared in RAIS - among other minor requirements.

¹⁸Details on how this information is extracted from RAIS is in the Supplementary Material section.

the two datasets,¹⁹ and it yields a subset of 10,050,913 workers.

For all firm-administration pairs that had one or more contracts at some point during the period of analysis, we then identify among these individuals those who have worked for both members of the pair, and create dummy variables capturing those movements. These “revolving door” variables are described next.

4.2 Revolving Door Measures

For each contract-level observation indexed by j (firm), k (administration), and t (time), we construct four different measures of workers’ movement, which capture whether the movement is from the private to the public sector or the reverse, and where the revolving door employees are located at the time of contracting.

Figure 1 shows our four revolving door dummy variables. Their names indicate the order of movement, as well as the ‘location’ of the revolving door individuals at the time of the contract between the members of the pair, i.e., the stage of the relationship (*Pre* or *Post*). For example, Admin-Firm-Pre means that at the time of a contract closure there are employees who are currently working for the administration and will move to the firm later on, while Admin-Firm-Post means there are employees working for the firm, who have previously worked for the administration.²⁰

In our main estimations below, we use an “any time” version of these dummies. This means for example that Admin-Firm-Post _{jkt} takes value 1 if firm j employs at time t some individual who has worked for administration j in at least one time period before t .

In addition, by summing variables Admin-Firm-Pre _{jkt} and Admin-Firm-Post _{jkt} (resp. Firm-Admin-Pre _{jkt} and Firm-Admin-Post _{jkt}), we obtain a dummy variable that conflates both stages of the relationship, i.e., is equal to one for a given firm-administration pair in all periods where one or more admin-to-firm (resp. firm-to-admin) revolving door workers are active in one of the contracting parties. This variable is named Admin-Firm _{jkt} (resp. Firm-Admin _{jkt}).

Three aspects are worth noting. First, distinguishing the different stages of the revolving door relationship is important because incentives and the behavior of workers may differ across these stages. Second, when identifying revolving door workers, we focus on all the individuals active in the firms and administrations, as it is not always possible to define precisely who has a say in the procurement process.

Third, as an extension we also consider that the impact of revolving door movements

¹⁹The CNPJ code consists of a 14-digit number, where the first eight digits identify the company, and the others the branch or subsidiary. We identify firms and administration by the first eight digits of their CNPJ.

²⁰See a detailed definition of each of the dummy variables in the Supplementary Material.

on public-private procurement transactions is likely to depend on the hierarchical position and employment contract type of the moving individuals. To investigate the revolving door effects according to these dimensions, we further categorize the four revolving door dummies described above according to the kind of public sector engagement (appointees, permanent civil servants, and temporary workers) and the hierarchical level (directors/managers vs. other workers) of the moving workers.

4.3 Descriptive Statistics

Table 1 shows that over 2% of all contracts involve some revolving door connection, representing 5.4% of the value transacted over the period. It is also important to note significant overlaps between the different revolving door dummy variables. Indeed, out of the 20,472 contracts with admin-to-firm connections and the 26,835 with firm-to-admin ones, 8,389 have both types simultaneously, corresponding to a 0.3 correlation between the two dummies.

At the worker level, in our sample 3,639 individuals completed a movement from an administration to one of its private suppliers, and 5,164 moved in the other direction (Table 2). Of these, the vast majority (91%) were employed as regular civil servants while in the public sector, between 4 and 6% were appointees (152 and 295 respectively), and an even smaller number, 1 to 2% corresponding to 39 and 125, were directors, most of them with appointed terms.

Note that our paper is based on a larger number of revolving door workers than other related papers in the literature. For instance, Blanes i Vidal, Draca, and Fons-Rosen (2012) study 257 lobbyists with previous experience in the office of a U.S. Senator, and Luechinger and Moser (2014) study 85 U.S. Department of Defense political appointments from the private sector and 85 corporate appointments of former government officials from the U.S. Department of Defense. On private-to-private revolving doors, Geiger, Lennox, and North (2008) study 193 officers, who were hired from firms' auditors, and Cohen, Frazzini, and Malloy (2012) track the careers of 51 equity analysts hired to sit on the boards of directors of companies they previously covered. Cornaggia, Cornaggia, and Xia (2016) and Kempf (2020) study, respectively, 179 and 33 credit analysts that left rating agencies to work at firms they rated.

5 Empirical Strategy

To identify how workers' movements affect procurement prices $p_{l,jkt}$, we use the contract-level dataset, where an observation is a purchase agreement for a good l , between firm j and

administration k , at time t . We estimate the following equation:

$$\ln p_{ljk t} = \alpha_l + \kappa_t + \tau_{jk} + RD'_{jkt}\beta + \gamma q_{ljk t} + \delta_{jt} + \eta_{kt} + u_{ljk t}, \quad (1)$$

where on the right-hand side α_l , κ_t and τ_{jk} are product, time (months and years), and firm-administration pair fixed effects respectively, $q_{ljk t}$ is the quantity purchased in that transaction, and δ_{jt} and η_{kt} are firm-time and administration-time fixed effects respectively. The variable $u_{ljk t}$ is an error term, which is assumed to have expectation zero, a firm-administration pair-specific variance, denoted by σ_{jk}^2 , and to be uncorrelated with other regressors in equation (1). In all estimations, we cluster standard errors at the firm-administration level.²¹

The main variable of interest is RD_{jkt} , which captures the existence of a revolving door connection within the firm-administration pair jk at time t . We gradually unpack it by estimating three successive specifications where:

- $RD_{jkt} = 1$ if at least one of the four dummy variables defined in Section 4.2 is equal to 1. This is our ‘Any Revolving Door’ measure that captures the generic effect of a pair having some type of revolving door worker.
- RD_{jkt} is the vector (Admin-Firm $_{jkt}$ Firm-Admin $_{jkt}$). This disentangles the overall impact of revolving door connections between the two directions of movements, to assess whether public-to-private and private-to-public revolving doors have different impacts on procurement outcomes.
- RD_{jkt} is the vector (Admin-Firm-Pre $_{jkt}$ Admin-Firm-Post $_{jkt}$ Firm-Admin-Pre $_{jkt}$ Firm-Admin-Post $_{jkt}$). This further disentangles movements in each directions in their first- and second-stage components, allowing for a finer understanding of the dynamics of revolving door movements.

In these three specifications, the effect of all types of connections are thus estimated jointly, at a gradually increasing level of disaggregation. For each type of revolving door connection, the reported effects are therefore net of the impact of any other types of connection. This is important since the descriptive statistics show that pairs may experience several type of connections simultaneously.

²¹Due to the large number of firm-administration pairs (154,673) and products (1,942,210), usual statistical software cannot estimate these equations with all the fixed effects. We therefore transform the original variables into deviations from firm-administration pair means, and then use Correia (2016) estimator of linear models with high dimensional fixed effects. To avoid overstating statistical significance, singleton groups are dropped for fixed effects that are nested within clusters (see also Correia, 2015). See the supplementary material for details on how equations (1) and (2) are transformed.

We also estimate the impact of revolving doors on the total amount of contracts in a pair in a given year. For this, we collapse the data at the firm-administration-year level:

$$\ln y_{jkt} = \kappa_t + \tau_{jk} + RD'_{jkt}\beta + \delta_{jt} + \eta_{kt} + \nu_{jkt}. \quad (2)$$

We build a balanced panel, including years in which a supplier-administration pair does not transact. This allows us to evaluate both the intensive and the extensive margin.²² In addition, we also provide results restricted to the intensive margin for the sake of interpretation. In equation (2), the error term ν_{jkt} is assumed to have expectation zero, a firm-administration pair-specific variance, denoted by σ_{jk}^2 , and to be uncorrelated with other regressors. As before, we cluster standard errors at the firm-administration level in all estimations.

A few things are important to note regarding identification. First, it is possible that the existence of a revolving door connection in a given firm-administration pair is correlated with specific attributes of that pair. To the extent that these are time-invariant, for example if they stem from long-term repeated relationships or from previous individual connections in the case of a firm created by a former public employee to conduct business with its former institution, our within-pair estimates ensure that such determinants are taken care of. The inclusion of firm-administration pair fixed effects implies that the revolving door dummy coefficients are identified within pairs, i.e., from those pairs for which the dummies change value at some point during the 2000-2009 period as a pair revolving door connection is established or lost.²³

In addition, we control for a number of time-variant attributes. At the firm-administration pair-level, the main issue has to do with the potential influence of other types of relationships that would change during the period of interest, so we crucially include all types of connections simultaneously, as explained above.

The main concern left is potential time-variant confounders at the firm- and administration-level. Time-variant firm characteristics, such as productivity shocks or the decision to enter the procurement market of some specific products, may affect sales to the federal government as well as firms' willingness to hire qualified public officials, and potentially confound our estimates. Similarly, administration-level shocks, such as budget changes, or expansions related to the inception of new government programs, may affect the acquisition of goods and services and the need for new staff, some of which may come from previous suppliers. We deal with this in two ways.

In our preferred specification, shown in (1) and (2), we include firm-time and administration-

²²Given the inclusion of zeros, we use the hyperbolic inverse sine transformation to log amount values.

²³This estimation strategy is similar to the one in Blanes i Vidal et al. (2012), who use within lobbyist variations as they lose connection to politicians.

time specific fixed effects that generically capture such potentially unobserved shocks. Alternatively, we also show results including instead a number of time-variant controls, including year-on-year administration budgets, firm sales, and contract-specific award procedures.²⁴

Finally, our estimates may also be affected by measurement error. Some pairs may be using other channels to collude or support long term relationships, for example through side payments and bribes, or shareholder-level connections for example. This would likely generate an attenuation bias if such channels are substitutes. We cannot address this with the data at hand, absent specific information on other channels, but note that this limitation of course applies broadly to the empirical political connections and corruption literature.

6 Main Results

Prices. Table 3 summarizes the results of estimating equation (1) using the contract-level dataset. In columns 1 to 3, we estimate the price effect of any revolving door. Our basic specification, which includes pair, time, and product fixed effects, indicates that connected pairs' transactions exhibit a 18% drop in prices. The coefficient is reduced slightly when adding time-variant controls in column 2 (15%). Our preferred specification in column 3, including firm-time and administration-time fixed effects, yields a 13% price drop, significant at the 1% level.

This net effect appears to be beneficial for the public sector, which buys more at lower prices. While this is a striking result in itself, it may mask important composition effects to which we turn next.

We first disentangle the two directions of movements: public-to-private (A-F) and private-to-public (F-A) by simultaneously estimating the impact of the Admin-Firm and Firm-Admin dummies. In columns 4 to 6, the effect of administration-to-firm movement is clearly negative and significant, with a magnitude between 18% and 30%. On the other hand, firm-to-administration movements have a quite precisely estimated null effect.

Finally, in columns 7 to 9, we break both directions of movement in their successive stages. Regarding the public-to-private movements, the results show that the effect are stronger in the first stage of the relationship, when the workers are in the public sector (-18% in our preferred specification in column 9), but also that they do subside after they join the private counterparts (-10%).

²⁴Because of the concern that some of these controls may be endogenous, for example if aggregate budgets or sales change as a result of the entry of revolving door workers, we use values of the previous year. We exclude workers' characteristics such as average wage from the set of controls, both because of these endogeneity concerns and of a high number of missing values.

Amounts of contracts. Table 4 provides the results of estimating equation (2) using the balanced data set summarizing firm-administration yearly amount of contracts. In columns 1 to 3, pairs experiencing any revolving door appear to generate an additional 11% in contract amounts. Columns 4 to 6 show that this is driven mainly by pairs with private-to-public revolving door movements. Pairs with this type of connection trade an additional 16% amount yearly in our preferred specification.²⁵

Finally, columns 7 to 9 offer additional insights into the dynamic of these results. For pairs with movements from the administration to the firm, a positive effect (+16%) appears once the workers have moved to the firm, but it is only significant at the 10% level. For pairs with movements from the firm to the administration on the other hand, the positive impact (+27%, significant at the 1% level) is only in the first stage of the relationship, i.e., when the worker is still in the private sector.

These results conflate changes on the extensive and intensive margin, as they include, for all pairs that are active at some point, zero values in year without activities. Table S4 in the Appendix provides estimates based on the unbalanced panel composed of strictly positive values only, i.e., on the intensive margin. In our preferred specification, we find a large increase in amounts once workers move from the public to the private sector (A-F-Post), as well as an increase when workers have moved from the private to the public sector (F-A-Post), although slightly less significant.

The results in Table 4, combined with the ones in Table S4, indicate that administration-to-firm movements lead to an increase in the amount of contracts when a former public worker is already in the firm, especially for firms which recurrently trade with administrations. On the other hand, those estimations reveal that firm-administration movements have more extensive margin effects, in that they allow firms to start doing business with the connected administrations.

Robustness and additional results. As discussed in Section 5 above, our results are robust to the inclusion of a variety of time-invariant and time-variant confounders. In particular, our preferred specification, which includes firm-year and administration-year fixed effects, makes us confident that they are not driven by some unobserved productivity or policy shocks.

In order to validate our diff-in-diff strategy, we need to evaluate whether the parallel trend assumption holds. Figure 2 and Table 5 show the results of a year-by-year specification when

²⁵Controls accounts for little additional variation on yearly amount compared to the firm and admin fixed effects once we collapse at the firm-administration-year level. That explains why the estimates in columns 2, 5 and 8 of Table 4 are very similar to ones in columns 1, 4 and 7 in the same table.

two lags and leads are included.²⁶ They strongly support the parallel trend assumption for both prices and amounts.²⁷

Next, we estimate two additional specifications in order to provide additional elements of interpretation. First, we exploit a fundamental evolution in the organization of public procurement tenders that occurred mid-way through our period of analysis. Decree 5.450/2005, in its article 4, established the obligatory use of reverse electronic auctions for the acquisition of goods and common services by most public entities.²⁸ As a result, the share of reverse electronic auctions jumped sharply between 2005 and 2006. In our sample, Figure 3 shows that this share went from 2% of the total amount of contracts in 2005 to 42% the year after, and kept increasing after that.²⁹

This change is likely to have constrained the channels through which workers involved in the procurement process can influence the award and terms of the contracts. In particular, electronic auctions, because they are a fully automated process in which procurement officials are unlikely to have access to the bids, restricts their ability to leak information on the bids of rivals to favor specific bidders. Hence, we expect outcomes due to such behavior to vanish after 2005.

We thus compare the period before and after this structural break, by adding to (1) and (2) an interaction ($RD'_{jkt} * Post2005$), where $Post2005$ is a dummy equal to 1 in all years starting 2006.

Results are summarized in Figure 4.³⁰ The upper part shows the outcomes for pairs with administration-to-firm movements. The negative price effect is very stable across the two periods, while a positive impact on amounts traded appears after 2005. For pairs with firm-to-administration movements, on the other hand, the results are very different across sub-periods. The impact on price goes from negative before 2005 to positive after that, although it is not significant in both periods, while the positive effect on amounts found above vanishes after 2005.

These results are consistent with a positive view of the channels at play in public-to-private revolving door connections, at least one that does not involve leaking sensitive information

²⁶As in Table 4, controls generate little additional variation on yearly amount in Table 5.

²⁷For any given firm-administration pair, the treatment, i.e., the first appearance of a worker who will go on to work for both members of the pair, may occur at any time during the period under analysis. As a result, normalizing all pairs time-path to include a sufficient number of lags generates a strong reduction in the number of observations included. We choose to retain two lags and leads to maintain the sample representativeness.

²⁸See TCU (2012) for the detail of the normative change. Ferraz, Finan, and Szerman (2016) provide a description of these auctions.

²⁹The transition in terms of the share of the number of contracts was similar, although it already started during 2005 for a group of smaller contracts: it was 2% in 2004, 24% in 2005, and 46% in 2006.

³⁰The corresponding results are in Table 6.

to favor firms. For private-to-public connections, they are compatible with a collusion story made more difficult after 2005.

Second, we differentiate the connections according to revolving door workers' roles in the public sector -appointees, civil servants, or temporary workers- and their hierarchical position -directors/managers-, by adding to (1) and (2) an interaction ($RD'_{jkt} * D_w$), where D_w is the corresponding worker type dummy. Results by types of workers are in Figure S1 and Table S5 in the Appendix.³¹ The price-decreasing effect of public-to-private sector movements uncovered above is entirely due to the category of regular civil servants. We also find a negative price effect of private-to-public revolving door appointees. In addition, civil servants moving from the private to the public sector lead to larger amounts being procured from their former firms.

Finally, we investigate a number of additional effects and outcomes in the Supplementary Material. First, we analyze whether revolving door workers generate 'spillover' for other firms or administrations beside the specific pairs in which they operate. The results, displayed in Table S7, show that such spillovers indeed exist for directors, who decrease prices for all firms their administration deals with when in the first term of the public-to-private transition, but they are insignificant for other categories of workers. This is consistent with information from Ministry of Planning's ENAP (Escola Nacional de Administraç ao Pública), which indicates mandatory turnover of most workers in public institutions' procurement committees, leaving directors as the only officials systematically dealing with all providers over time.³² In addition, Table S8 shows that revolving door workers do not lead to a significant increase in the use of less stringent awarding procedures, including direct purchase and less restrictive auction forms.

Interpretation.

Administration-to-supplier movements. Regarding public-to-private movements, our interpretation of the findings is that while in the public sector, the worker attempts to display competence by doing his job thoroughly. In doing so, he brings prices down in deals with his potential future employer. Having secured a post-administration job, the worker now uses his skills to allow the firm that hired him to win more contracts at lower prices. Presumably, this goes through tougher competition, hence lower prices, but compared to the period he was in public office, the firm wins more contracts.

³¹These results should be considered as illustrative only, as some of them may lack statistical power. We only discuss the results for civil servants and appointees, as the one for directors yield no significant results, probably because of the small number of directors in our sample, which leads to very large standard errors.

³²See <https://repositorio.enap.gov.br/handle/1/2122>, last accessed May, 5, 2020.

Overall, these gains support a benign, efficiency-enhancing view of public-to-private revolving door, in which it creates incentives for career public officials to perform while they work in the administration, and the public sector benefits through better procurement outcomes throughout the workers' career cycle.³³

Our additional results also allow us to discard two alternative explanations. The first one is that these positive results point to a personal connection between the public official and the firm. Maybe the worker knows this firm to be good, since he dealt with it many times, or maybe it is not better than others but he has connections there. This official could provide the firm with inside information on other bids, leading the firm to systematically undercut rivals and win contracts. He would then be rewarded with a late career job in the firm.

However, this interpretation is hard to reconcile with three facts. First, we do not find a significant increase in the amount of contracts in the first stage of the relationship, which is inconsistent with the firm benefiting from leaked information to win more contracts. We do not see a significant increase in the use of less stringent awarding procedures either, which could have been another sign of favoritism. Next, in the second period the firm employing the worker is still selling at lower prices to its former administration. Finally, and this is key, our results for the post 2005 period, when electronic reverse auctions become the dominant procedure, are inconsistent with this story. Had bid leakage been the channel behind the observed price decrease, it should have become less important once these auctions took over. However, we find the price effect to be unchanged after 2005.

The second alternative explanation is that the movements of workers from a public administration to a private provider are strategically planned by suppliers trying to remove tough officials from procurement positions. By hiring these public workers, private providers hope to face more lenient or corruptible ones in future procurement transactions, therefore being able to sell more at higher prices. However, this again is not compatible with the observed drop in prices after the former public officer moves to the private provider.

Supplier-to-administration movements. The results for pairs with movements from the private to the public sector tell a very different story. First, we see firms getting larger amounts of contracts thanks to the revolving door connections, but no decrease in prices. Second, the post 2005 evolution is exactly the opposite of the one described above. As more secure procedures are implemented, we see the prices at which these connected pairs trade increase, while the amounts decrease. This is consistent with a collusion story, in which

³³This interpretation is also consistent with the evidence on positive spillovers found in the case of directors. The lack of significance for all workers is likely due to the fact that other workers deal with only a limited number of firms each, and generally for limited periods of time.

the workers were getting privileged information from public sector connections to win more contracts while in the firm, and got later rewarded with a job in the public sector, but this advantage disappeared after 2005.

Our results by workers type offer further details. There is a decrease in prices specifically driven by future appointees in the two stages of the firm-to-administration revolving door process. This is likely to indicate that they are using their political connections to get inside information leading to more contracts for the firm where they work, and are later rewarded with a good job in the public sector where they use their position to favor their former employer.³⁴ As for civil servants, their moving from a firm to the public sector appear to generate a persistent increase in amounts procured from their former private employers, but no price decrease, again consistent with collusion. Note that Colonnelli, Prem, and Teso (2019), Barbosa and Ferreira (2019) and Brollo, Forquesato and Gozzi (2017) show that the competitive process governing civil servant hiring is to a large degree subject to discretion, fraud, and corruption, and hence unlikely to provide much of a protection against such arrangements.

7 Aggregate Impact

We can now compute a back-of-the-envelope aggregate impact of revolving doors on procurement spending.

Given a set of N contracts, the data gives us actual spending equal to:

$$S = \sum_{i \in RD} p_i q_i + \sum_{i \in NRD} p_i q_i, \quad (3)$$

where p_i and q_i are the observed prices and quantities for each contract i , and we make apparent that contracts belong to RD and NRD, which are, respectively, the subsets of transactions with and without active revolving doors.

We can then compute an approximate value of total spending assuming that we shut down the revolving door, i.e., we bring contract value for the relevant observations back to the counterfactual value without revolving door.³⁵

Given β_{pq}^{RD} , which is the estimated semi-elasticity of revolving door contract value, for contracts of observed value $p_i q_i$ in the set RD, the predicted values from shutting down the revolving door is $p_i \bar{q}_i = \frac{p_i q_i}{1 + \beta_{pq}^{RD}}$.

³⁴See for example anecdotal evidence of such practices in Folha de Sao Paulo, 14/01/2016, Journal O Globo, 27/03/2012.

³⁵The derivations that follow are based on the estimates of the impact of revolving doors on contract value (price x quantity) shown in Table S6 in the Supplementary Material. They are largely unchanged if using instead separate elasticities for price and volume (contract size).

The predicted aggregate value \bar{S} is then given by:

$$\bar{S} = \sum_{i \in RD} \frac{p_i q_i}{1 + \beta_{pq}^{RD}} + \sum_{i \in NRD} p_i q_i. \quad (4)$$

In Table 7 we present the results from computing $\bar{S} - S$, making explicit separately the value computed for the admin-to-firm and firm-to-admin connections.

First, the beneficial effects of admin-to-firm revolving doors are not negligible. Shutting down this channel would imply a 3.5% increase in spending. The detrimental effects of firm-to-admin effects are slightly smaller, at 1.3%.³⁶ Extrapolating our revolving door results to a total amount of procurement equal to the OECD estimate of 10% of GDP leads to gains and losses of around 0.35% and 0.13% of GDP, respectively. Overall, shutting down the revolving door would increase spending by to 2.2%, or 0.22% of GDP.

The values are also significant. Health procurement admin-to-firm revolving door savings amount to R\$ 772 million, while firm-to-admin losses represent R\$ 281 million, approximately equivalent to US\$ 420 million and US\$ 150 million respectively at the 2000 exchange rate.

We remain cautious about the interpretation of these figures. First, revolving door connections may affect the nature of transactions along other margins, such as the quality of products or the mix that public institutions acquire. However, assuming the average quality is approximately constant overall, a reasonable assumption for standardized goods and services, lower spending can still be considered a beneficial outcome.

Second, there could be general equilibrium effects affecting other firms and the level of overall competition for example. Finally, we have no way to estimate the ease of moving across sectors, or to say it otherwise, the degree of openness of the revolving door, and what would be optimal arrangements in that respect. We discuss these issues in terms of the policy recommendations that can be drawn from our results in the next section.

8 Policy Implications

Given the possibility, individuals are likely to be willing to move across employers and exploit their experience or their connections. In the supplementary material, we perform estimations of the value of revolving door relationships for workers, using a model with additive fixed effects for workers and public institutions. We find that revolving door individuals command a significant wage premium, of around 25 to 30% of the average sample wage, but also that this is very heterogeneous across workers' type of contracts.

³⁶Note that these are lower bounds on the effects, as they are computed lumping together effects at each stage of the revolving door relationships that sometimes cancel each other.

How should this be addressed? As discussed in the introduction, policies aimed at addressing conflicts of interest and corruption arising through revolving door practices lead to a fundamental tradeoff between regulating or limiting revolving door opportunities on the one hand, and fostering efficiency by allowing skilled individuals to move across sectors when this proves beneficial.

In this paper, we have focused on the two directions of revolving door movements: from the public to the private sector, sometimes referred to as post-public employment, as well as from the private to the public sector, or pre-public employment. While some analysis has recognized the need to address both,³⁷ the policy recommendations often focus much more on the first type of movements, which tend to capture public headlines.

The main recommendations for public to private transitions usually include cooling-off periods such as the ones existing in Brazil, during which former public officials are not allowed to take employment in the private entities they have been overseeing. Such periods typically last one to two years, although in some specific cases lifetime inability can apply. In addition, some countries or international organizations contemplate the obligation for former officials to refer to some committee for advice or approval, although such steps are in most cases only consultative.

Regarding private to public transitions, measures include mandated divestments of direct interests such as stocks or board positions, and mandatory refusal or cooling-off periods from deals and transactions that involve former employers. For example, relevant to our procurement context, the World Bank imposes a one year cooling-off period on procurement interactions for anyone having worked as staff or consultant for the organization.

Our analysis provides interesting insights on the relevance of these different remedies in the context of public procurement. First, and perhaps surprisingly, private to public revolving door appears to be the most detrimental channel.

The recommendations therefore are to reinforce the oversight of transition into the public sector, in this case by closely monitoring potential financial ties with former employers, and possibly by implementing strict rules regarding the handling of deals with them. Strict cooling-off periods or even lifetime restrictions regarding any procurement activity in the public institution may be necessary in the case of individuals coming from firms having previously engaged in procurement transactions with that institution.

In addition, the fact that the civil servant recruitment process, although quite formalized, appears to fail as a way to make a proper selection among mid-career workers needs to be addressed.

³⁷See Transparency International (2010).

Finally, different workers categories appear to warrant differential treatment. In the case of post-public employment, our results show a clear difference between career civil servants, which movements appear beneficial, and political appointees. Rules may need to differentiate between high-level appointees and regular public officials, including the higher levels of the hierarchy, in order to avoid discouraging skilled individuals from seeking employment in the public sector at the beginning of their careers. One way to make this effective would be to impose the passage through a body in charge of approving post-public employment, with the power to enforce its decisions.

9 Conclusion

In this paper, we study the link between workers' two-way movements between public institutions and their private suppliers, and outcomes in Brazilian health public procurement.

Interestingly, we find evidence of both positive effects of administration-to-firm movements, consistent with signaling by high-skill workers, and negative effects of firm-to-administration ones, possibly related to collusion. Revolving doors in procurement jobs have important monetary consequences. Workers obtain significant wage benefits, and we estimate a net overall saving of 2.2% of total spending.

An important implication of our results relates to the fact that reverse electronic auctions prove to have the ability of limiting harmful collusive practices, while still allowing the positive effect of revolving door movement of skilled workers to happen.

Finally, these results point to specific policy implications related to the tolerance of revolving door practices. They indicate in particular that more attention needs to be devoted to regulating potentially detrimental private-to-public types of movements, while possibly avoiding the exclusive focus on director-level employees. On the other hand, in a developing country context where skilled workers are potentially scarce in the public sector, keeping a pathway open between the public and the private sector may be necessary to provide adequate career incentives to prospective civil servants.

References

- Arvate, P., Barbosa, K., and Fuzitani, E., 2019. "Party Expertise, Campaign Donation and Government Contracts: Evidence from an Electoral Quasi-Experiment". Mimeo.
- Asai, K., Kawai, K., and Nakabayashi, J. 2018. "Regulatory Capture in Public Procurement: Evidence from Revolving Door Bureaucrats in Japan." Mimeo.
- Auriol, E., Straub, S., and Flochel, T., 2016. "Public Procurement and Rent-Seeking: The Case of Paraguay." *World Development*, 77, 395-407.
- Bandiera, O., Pratt, A., and Valletti, T., 2009. "Active and Passive Waste in Government Spending: Evidence from a Policy Experiment." *The American Economic Review*, 99(4), 1278-1308.
- Bar-Isaac, H. and Shapiro, J., 2011. "Credit Ratings Accuracy and Analyst Incentives." *American Economic Review*, 101(3), 120-124.
- Barbosa, K., and Ferreira, F., 2019. "Occupy Government: Democracy and the Dynamics of Personnel Decisions and Public Finances." NBER Working Paper No. 25501.
- Bertrand, M., Bombardini, M., and Trebbi, F., 2014. "Is It Whom You Know or What You Know? An Empirical Assessment of the Lobbying Process." *American Economic Review*, 104(12), 3885-3920.
- Best, M., Hjort, J., and Szakonyi, D., 2017. "Individuals and Organizations as Sources of State Effectiveness, and Consequences for Policy Design." Mimeo.
- Blanes i Vidal, J., Draca, M., and Fons-Rosen, C., 2012. "Revolving Door Lobbyists." *American Economic Review*, 102 (7), 3731-3748.
- Boas, T., Hidalgo, F., and Richardson, N., 2014. "The Spoils of Victory: Campaign Donations and Government Contracts in Brazil." *The Journal of Politics*, 76 (2), 415-429.
- Bond, P., and Glode, V., 2014. "The Labor Market for Bankers and Regulators." *Review of Financial Studies*, 27(9), 2539-2579.
- Brollo, F., Forquesato, P., and Gozzi, J.C., 2017. "To the Victor Belongs the Spoils? Party Membership and Public Sector Employment in Brazil." Working Paper.
- Cameron, C., de Figueiredo, J. M., and Lewis, D., 2016. "Public Sector Personnel Economics: Wages, Promotions, and the Competence-Control Trade-off." NBER working paper 22966.
- Claessens, S., Feijen, E. and Laeven, L., 2008. "Political Connections and Access to Finance: The Role of Campaign Contributions." *Journal of Financial Economics*, 88, 554-580.
- Cornaggia, J., Cornaggia, K., and Xia, H. 2016. "Revolving doors on Wall Street." *Journal of Financial Economics*, 120 (2), 400-419.
- Che, Y.-K., 1995. "Revolving Doors and Optimal Tolerance for Agency Collusion." *Rand Journal of Economics*, 26, 378-397.

- Cohen, L., Frazzini, A., and Malloy, C. 2012. "Hiring Cheerleaders: Board Appointments of 'Independent' Directors." *Management Science*, 58 (6), 1039-1058.
- Colonnelli, E., Prem, M., and Teso, E. 2019. "Patronage and Selection in Public Sector Organizations," Forthcoming, *American Economic Review*.
- Correia, S. 2015. "Singletons, Cluster-Robust Standard Errors and Fixed Effects: A Bad Mix." Mimeo.
- Correia, S. 2016. "Linear Models with High-Dimensional Fixed Effects: An Efficient and Feasible Estimator." Mimeo.
- Coviello, D., and Gagliarducci, S., 2017. "Tenure in Office and Public Procurement." *American Economic Journal: Economic Policy*, 3(9), 59-105.
- Decarolis, F., Giuffrida, L., Iossa, E., Mollisi, V., and Spagnolo, G., 2016. "Buyer Quality and Procurement Outcomes: Explorative Evidence From the US." Mimeo.
- Decarolis, F., Fisman, R., Pinotti, P., Vannutelli, S. 2020. "Rules, Discretion, and Corruption in Procurement: Evidence from Italian Government Contracting." Mimeo.
- Decarolis, F., and Giorgiantonio, C. 2020. "Corruption red flags in public procurement: new evidence from Italian calls for tenders." Mimeo.
- Dimitri, N., Piga, G., and Spagnolo, G., 2006. *Handbook of Procurement*, Cambridge (UK): Cambridge U.P., Cambridge (UK).
- Di Tella, R., and Schargrodsky, E., 2003, "The Role of Wages and Auditing during a Crack-down on Corruption in the City of Buenos Aires." *Journal of Law and Economics*, 46(1), 269-292.
- Dix-Carneiro, R., 2014, "Trade Liberalization and Labor Market Dynamics." *Econometrica*, 82, 825-885.
- Eckert, Ross D., 1981. "The Life Cycle of Regulatory Commissioners." *Journal of Law and Economics*, 24, 113-120.
- Ferguson, T., and Voth, H., 2008. "Betting on Hitler – The Value of Political Connections in Nazi Germany." *Quarterly Journal of Economics*, 123 (1), 101-137.
- Ferraz, C., Finan, F., and Szerman, D., 2016. "Procuring Firm Growth: The Effects of Government Purchases on Firm Dynamics", Mimeo.
- Finan, F., Olken, B., and Pande, R., 2015. "The Personnel Economics of the State." In Duflo, E. and Banerjee, A., eds. *Handbook of Field Experiments*, Elsevier, North Holland.
- Fisman, R., 2001. "Estimating the Value of Political Connections." *American Economic Review*, 91 (4), 1095-1102.
- Geiger, M, Lennox, C., and North, D., 2008. "The Hiring of Accounting and Finance Officers from Audit Firms: How did the Market React?" *Review of Accounting Studies*, 13, 55-86.

- Goldman, E., Rocholl, J., and So, J., 2013. “Politically Connected Boards of Directors and the Allocation of Procurement Contracts.” *Review of Finance*, 17 (5), 1617-1648.
- Holmstrom, B., 1999. “Managerial Incentive Problems: A Dynamic Perspective.” *The Review of Economic Studies*, 66 (1), 169-182.
- Johnson, S., and Mitton, T., 2003. “Cronyism and Capital Controls: Evidence from Malaysia.” *Journal of Financial Economics*, 67 (2), 351-382.
- Kempf, E., 2020. “The Job Rating Game: The Effects of Revolving Doors on Analyst Incentives.” *Journal of Financial Economics*, 135 (1), 41-67.
- Khwaja, A., and Mian, A., 2005. “Do Lenders Favor Politically Connected Firms? Rent Provision in an Emerging Financial Market.” *Quarterly Journal of Economics*, 120 (4), 1371-1411.
- Lacetera, N., Larsen, B., Pope, D., and Sydnor, J., 2016. “Bid Takers or Market Makers? The effect of Auctioneers on Auction Outcomes.” *American Economic Journal: Microeconomics*, 8,4, 195-229.
- Laffont, J.J., and Tirole, J., 1993. *A Theory of Incentives in Procurement and Regulation*. MIT Press.
- Luechinger, S., and Moser, C., 2014. “The Value of the Revolving Door: Political Appointees and the Stock Market.” *Journal of Public Economics*, 119, 93-107.
- Lucca, D., Seru, A., and Trebbi, F., 2014. “The Revolving Door and Worker Flows in Banking Regulation.” *Journal of Monetary Economics*, 65, 17-32.
- Martimort, D., 1999. “The Life Cycle of Regulatory Agencies: Dynamic Capture and Transaction Costs.” *Review of Economic Studies*, 66(4), 929-947.
- Mattozzi, A., and Merlo, A., 2008. “Political Careers or Career Politicians?”, *Journal of Public Economics*, 92, 597 -608.
- Menezes-Filho, N.A, Muendler, M.-A., and Ramey, G., 2008. “The Structure of Worker Compensation in Brazil, with a Comparison to France and the United States.” *The Review of Economics and Statistics*, 90, 32346.
- Mishak, M., 2016. “Drinks, Dinners, Junkets and Jobs: How the Insurance Industry Courts State Commissioners.” Center for Public Integrity.
- Salant, D., 1995. “Behind the Revolving Door: A New View of Public Utility Regulation.” *The RAND Journal of Economics*, 26 (3), 362-377.
- Straub, S. 2014. “Political Firms, Public Procurement, and the Democratization Process.” TSE Working Paper 14-461.
- Tabakovic, H., T. Wollmann. 2018. “From Revolving Doors to Regulatory Capture? Evidence from Patent Examiners.” NBER Working Paper 24638.
- Tribunal de Contas da União (TCU). 2012. Auditoria nas bases de dados dos sistemas Siasg-Comprasnet. Brasília: TCU, Secretaria de Fiscalização de Tecnologia da Informação.

Tirole, J., 1994. “The Internal Organization of Government.” *Oxford Economic Papers*, 46(1), 1-29.

Transparency International, 2010. “Regulating the Revolving Door.” Working Paper 06/2010.

Figures and Tables

Figure 1: Revolving Doors Dummies

Timeline
(Contracting time= t)

Connection	$t - n$	t	$t + n$
Admin-Firm-Pre		Administration	Firm
Admin-Firm-Post	Administration	Firm	
Firm-Admin-Pre		Firm	Administration
Firm-Admin-Post	Firm	Administration	

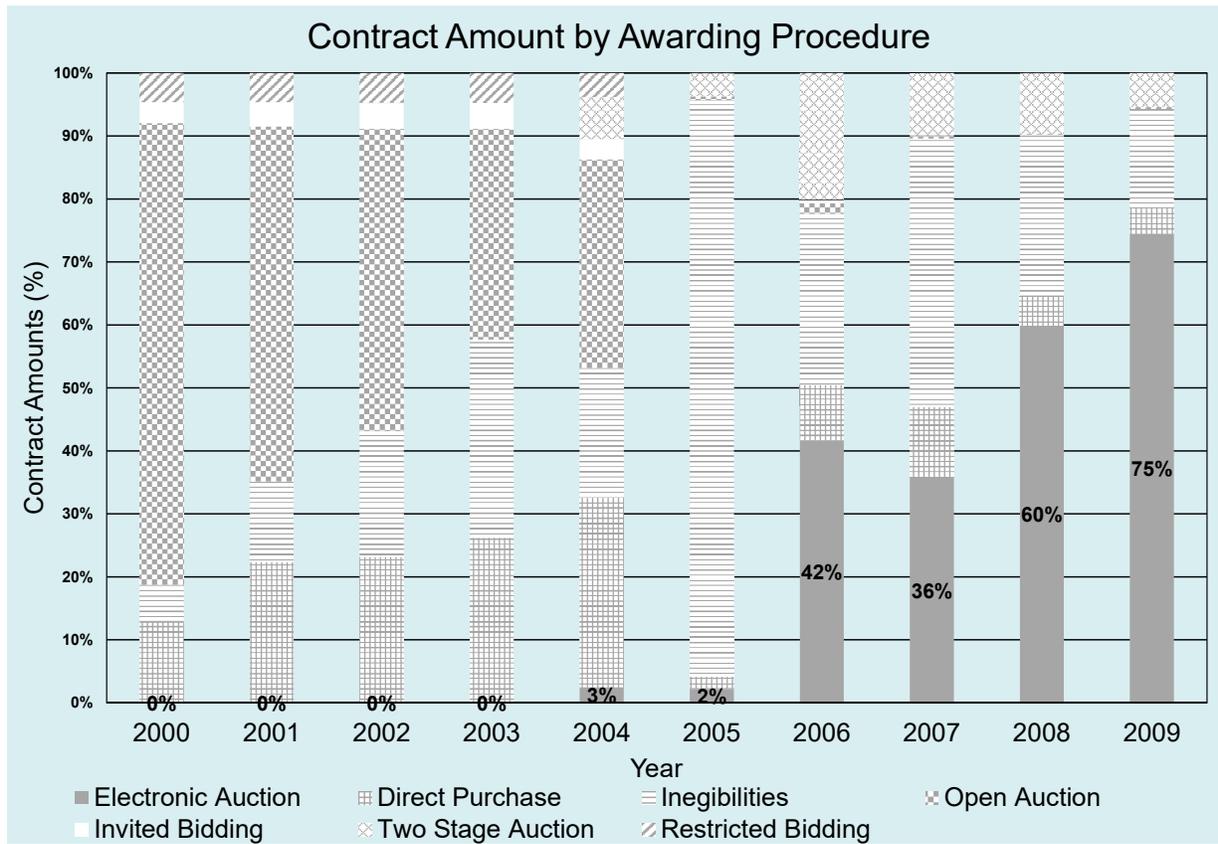
Notes: This figure provides a summary view of the four categories of revolving door variables used in the paper. All variables are contract level ones, and t corresponds to the period in which the contract becomes effective. The dummy variables *Admin – Firm* and *Firm – Admin* identify, respectively, movements of workers from administrations to firms, and from firms to administrations. *Admin – Firm – Pre* identifies an official’s movement from an administration to a firm after contracting time t . The dummy variable *Admin – Firm – Post* diagnoses the movement of an official that worked for an administration before contracting time t and then moved to a firm/supplier. *Firm – Admin – Pre* identifies a worker’s movement from a firm to an administration after contracting time t . *Firm – Admin – Post* establishes the movement of an official that worked for firm before contracting time t and then moved to an administration.

Figure 2: Test of the Parallel Trend Assumption



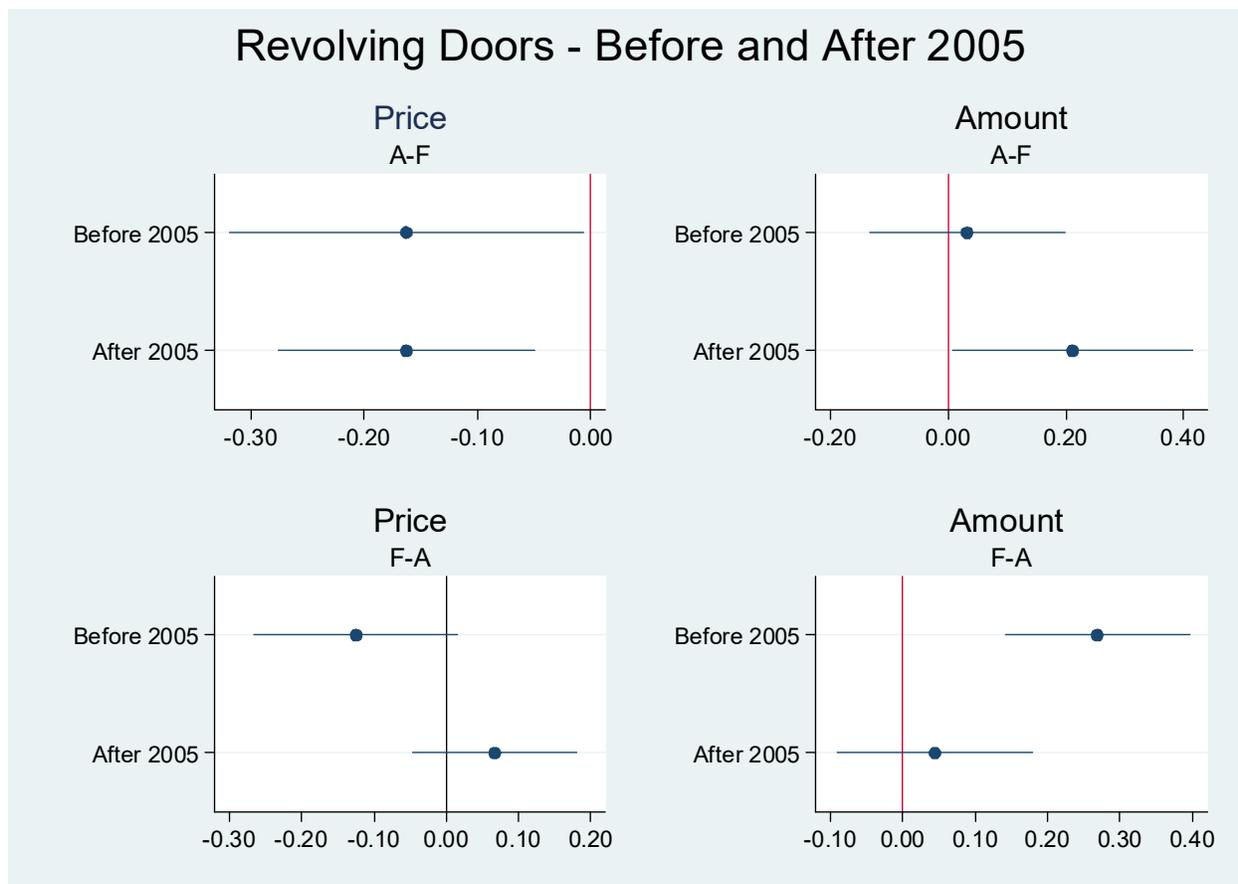
Notes: This figure displays the estimated impacts of revolving door movement (Any Revolving Door) on prices and yearly amounts, including lags and leads, and their respective 95% confidence intervals. These estimations correspond to estimated effects reported in Column 3, for prices, and Column 6, for amounts, of Table 5.

Figure 3: Share of Electronic Reverse Auctions



Notes: This figure reports the fraction of each awarding procedure (as a share of the total amount of contracts) used to allocate procurement contracts in each year of our study period. The percentage numbers displayed in the figure correspond to the share of electronic reverse auctions in every year of our sample.

Figure 4: Impact of Electronic Reverse Auctions after 2005



Notes: This figure displays the estimated impact of revolving door movements (Admin-Firm, A-F; and Firm-Admin, F-A) on procurement prices and yearly amounts, before and after 2005, and their respective 95% confidence intervals. These estimations correspond to estimated effects reported in Column 3, for prices, and Column 6, for amounts, of Table 6.

Table 1: Descriptive Statistics - Revolving Door Workers and Procurement Transactions

	1	2	3	4
	Total Number Contracts	Number RD Contracts	RD Share	% Total Amount of RD Contracts
Any Revolving Door	1 950 318	39 722	2.04%	5.41%
Admin-Firm	1 968 618	20 472	1.05%	2.73%
Admin-Firm-Pre	1 968 618	12 169	0.62%	1.85%
Admin-Firm-Post	2 299 786	13 710	0.60%	1.86%
Firm-Admin	1 968 618	26 835	1.38%	5.01%
Firm-Admin-Pre	1 968 618	16 585	0.85%	4.46%
Firm-Admin-Post	2 299 786	19 050	0.83%	4.19%

Notes: This table presents contract-level summary statistics of revolving door connections. In Column 1, “-Pre” variables have less observations as they cannot be computed for the last sample year (2009).

Table 2: Revolving Door Workers by Type of Employment

Types of Movements	
Panel A - Admin-Firm Movements	Number of Workers
Admin-Firm	3 639
Admin-Firm: Appointees	152
Admin-Firm: Civil Servants	3 304
Admin-Firm: Other Workers	183
Admin-Firm: Directors	39
Admin-Firm: Non-Directors	3 600
Admin-Firm: Appointees - Directors	35
Admin-Firm : Civil Servants - Directors	4
Admin-Firm: Other Workers - Directors	0
Panel B - Firm-Admin Movements	Number of Workers
Firm-Admin	5 164
Firm-Admin: Appointees	295
Firm-Admin: Civil Servants	4 722
Firm-Admin: Other Workers	147
Firm-Admin: Directors	125
Firm-Admin: Non-Directors	5 039
Firm-Admin: Appointees - Directors	92
Firm-Admin: Civil Servants - Directors	24
Firm-Admin: Other Workers - Directors	9

Notes: This table reports the total number of workers that move from administrations to firms, and from firms to administrations, by type of position (civil servants, appointees, and others) and by their hierarchical level (directors and non-directors). Panel A shows the total number of workers involved in admin-to-firm movements. Panel B shows the total number of workers involved in firm-to-admin movements.

Table 3: Price - Main Results

Variables	(1) Price	(2) Price	(3) Price	(4) Price	(5) Price	(6) Price	(7) Price	(8) Price	(9) Price
Any Revolving Door	-0.180** (0.078)	-0.146** (0.074)	-0.129*** (0.044)						
A-F				-0.298*** (0.071)	-0.247*** (0.066)	-0.176*** (0.047)			
F-A				-0.021 (0.090)	0.006 (0.089)	-0.028 (0.063)			
A-F-Pre							-0.213** (0.091)	-0.170** (0.085)	-0.181*** (0.060)
A-F-Post							-0.217** (0.097)	-0.194** (0.088)	-0.099* (0.058)
F-A-Pre							0.018 (0.093)	0.074 (0.094)	-0.047 (0.059)
F-A-Post							0.076 (0.087)	0.019 (0.069)	0.046 (0.069)
Observations	958,166	958,166	950,974	958,166	958,166	950,974	958,166	958,166	950,974
Admin-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	No	Yes	No	No	Yes	No
Admin-Time FE	No	No	Yes	No	No	Yes	No	No	Yes
Firm-Time FE	No	No	Yes	No	No	Yes	No	No	Yes
Within R ²	0.352	0.372	0.322	0.352	0.372	0.322	0.352	0.372	0.322

Notes: This table reports the estimated effect of revolving door movement on procurement prices. The estimated equation is (1). In columns 2, 5, and 8 controls include previous year administration procurement expenditure and previous year supplier procurement revenue, and the awarding procedure used to allocate the procurement contract. Robust standard errors clustered at the firm-administration level are in parentheses: *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table 4: Yearly Amount - Main Results

Variables	(1) Yearly Amount	(2) Yearly Amount	(3) Yearly Amount	(4) Yearly Amount	(5) Yearly Amount	(6) Yearly Amount	(7) Yearly Amount	(8) Yearly Amount	(9) Yearly Amount
Any Revolving Door	0.109** (0.051)	0.109** (0.051)	0.115** (0.052)						
A-F				0.105 (0.081)	0.105 (0.081)	0.103 (0.083)			
F-A				0.153*** (0.056)	0.153*** (0.056)	0.161*** (0.057)			
A-F-Pre							-0.028 (0.083)	-0.028 (0.083)	-0.024 (0.084)
A-F-Post							0.156* (0.082)	0.156* (0.082)	0.162* (0.084)
F-A-Pre							0.267*** (0.063)	0.267*** (0.063)	0.271*** (0.065)
F-A-Post							-0.009 (0.066)	-0.010 (0.066)	0.006 (0.068)
Observations	1,392,057	1,392,057	1,392,057	1,392,057	1,392,057	1,392,057	1,392,057	1,392,057	1,392,057
Admin-Firm FE	Yes								
Year FE	Yes								
Controls	No	Yes	No	No	Yes	No	No	Yes	No
Admin-Time FE	No	No	Yes	No	No	Yes	No	No	Yes
Firm-Time FE	No	No	Yes	No	No	Yes	No	No	Yes
Within R ²	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008

Notes: This table reports the estimated effect of revolving door movement on procurement yearly amounts. The estimated equation is (2). In columns 2, 5, and 8 controls include previous year administration procurement expenditure and previous year supplier procurement revenue. Robust standard errors clustered at the firm-administration level are in parentheses: *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table 5: Test of the Parallel Trend Assumption

	(1)	(2)	(3)	(4)	(5)	(6)
	Price	Price	Price	Yearly Amount	Yearly Amount	Yearly Amount
Any RD: T-2	-0.1389 (0.109)	-0.119 (0.100)	0.041 (0.074)	0.093 (0.061)	0.093 (0.061)	0.096 (0.063)
Any RD: T-1	-0.146 (0.095)	-0.130 (0.093)	-0.017 (0.064)	0.042 (0.065)	0.042 (0.065)	0.041 (0.067)
Any RD: T+1	-0.275*** (0.097)	-0.211* (0.111)	-0.166*** (0.051)	0.164** (0.069)	0.164** (0.069)	0.183** (0.073)
Any RD: T+2	-0.158* (0.097)	-0.132 (0.097)	-0.141** (0.058)	0.131** (0.053)	0.131** (0.053)	0.124** (0.055)
Observations	761,639	761,639	755,392	1,083,814	1,083,814	1,083,814
Admin-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	No	No	No
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	No	Yes	No
Admin-Time FE	No	No	Yes	No	No	Yes
Firm-Time FE	No	No	Yes	No	No	Yes
Within R-squared	0.359	0.380	0.332	0.003	0.003	0.003

Notes: This table reports the estimated effect of revolving door movement on procurement prices and yearly amounts, including lags and leads. The estimated equation is (1) for prices and (2) for amounts. In columns 2 and 5, controls include previous year administration procurement expenditure and previous year supplier procurement revenue as well as awarding procedures (for price only). Robust standard errors clustered at the firm-administration level are in parentheses: *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table 6: Results - Before and After 2005

	(1) Price	(2) Price	(3) Price
A-F: Before 2005	-0.244** (0.105)	-0.188* (0.104)	-0.163** (0.080)
A-F: After 2005	-0.302*** (0.093)	-0.260*** (0.082)	-0.163*** (0.058)
F-A: Before 2005	-0.139 (0.102)	-0.087 (0.107)	-0.125* (0.072)
F-A: After 2005	0.106 (0.077)	0.110 (0.081)	0.067 (0.058)
Observations	958,166	958,166	950,974
Within R-squared	0.352	0.372	0.323
	(4) Yearly Amount	(5) Yearly Amount	(6) Yearly Amount
A-F: Before 2005	0.036 (0.083)	0.036 (0.083)	0.032 (0.085)
A-F: After 2005	0.207** (0.102)	0.207** (0.102)	0.211** (0.104)
F-A: Before 2005	0.270*** (0.064)	0.270*** (0.064)	0.269*** (0.065)
F-A: After 2005	0.031 (0.067)	0.031 (0.067)	0.044 (0.069)
Observations	1,392,057	1,392,057	1,392,057
Within R-squared	0.008	0.008	0.008
Admin-Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Controls	No	Yes	No
Admin-Time FE	No	No	Yes
Firm-Time FE	No	No	Yes

Notes: This table reports the estimated effect of revolving door movement on procurement prices and yearly amounts, before and after 2005. The estimated equation is (1) for prices and (2) for amounts. In columns 2 and 5, controls include previous year administration procurement expenditure and previous year supplier procurement revenue as well as awarding procedures (for price only). Robust standard errors clustered at the firm-administration level are in parentheses: *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table 7: Aggregate Spending Changes from Shutting Down Revolving Door

Panel A - In Million Brazilian Reals of 2000	
Admin-to-Firm	771.9
Firm-to-Admin	-280.9
Any Revolving Door	491.0
Panel B - In % of total spending (22.1 billion of Brazilian Reals of 2000)	
Admin-to-Firm	3.48%
Firm-to-Admin	-1.27%
Any Revolving Door	2.21%

Notes: This table reports the estimated effects on aggregate procurement spending of shutting down the revolving doors, by type of revolving door movement (Admin-Firm, Firm-Admin, and Any Revolving Door). These effects were computed by subtracting \bar{S} from S , respectively defined in equation (3) and (4), and using the estimates from Column 3, for Any Revolving Door, and Column 6, for Admin-Firm and Firm-Admin, of Table S6 in the Supplementary Material. Panel A shows the changes in aggregate procurement spending in millions of Brazilian Reals of 2000. Panel B displays those changes in percentage of total procurement spending from 2000 to 2009, which was 22.1 billion of Brazilian Reals of 2000.

Supplementary Material for
“The Value of Revolving Doors in Public
Procurement”
(Not for publication)

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Supplementary Material: Institutional Background

Public Procurement Legislation. All public bodies in Brazil (national, state and local) are subject to the 1993 Public Procurement Act (Law 8,666), which delineates procurement procedures for the acquisition of goods, works and services (i.e., inputs) as well as sale of government assets. Accordingly, before searching for an input supplier, public bodies have to come up with a clear description of their needs, including detailed specification of the input, quantity, quality, place and delivery time. In addition, they have to make all this information publicly available in an official gazette.

Public bodies usually make purchases in a decentralized way. These are financed by an annual budget assigned to each public body.³⁸ In the case of health procurement, public hospitals, and health agencies and centers acquire medical supplies, equipment for hospitals, and pharmaceuticals to be used for inpatient medical treatments, to be distributed gratuitously, or to be sold to outpatients at subsidized prices in public pharmacies.

For the acquisition of standardized goods and services, such as bandages, medical gloves, syringes, and off-patent pharmaceuticals, the Procurement Act determines that public bodies must rely on auction-based mechanisms to award contracts.

Public bodies can use either electronic or physical auctions. The electronic reverse auctions are held over the internet through official procurement platforms, in which any supplier is allowed to submit a bid.³⁹ Among the physical ones, the legislation has established several auction mechanisms, going from open competitive bidding to invited bidders. It also establishes that all procurement of public inputs must be based on value for money, which is a combination of whole life costs and quality.⁴⁰

Public bodies choose the award mechanism according to the monetary values involved in a procurement transaction. High value contracts must be acquired through open competitive bidding, while those of lower values can be acquired through invited bidding.⁴¹ Electronic

³⁸The legislation also allows public bodies to jointly acquire goods and services through pooled procurement (namely, price registration system). Such arrangements have allowed public entities to attain potential gains from bulk acquisition that would not be achieved in standard procurement. Barbosa (2015) and Barbosa and Fiuza (2011) describe the Brazilian pooled procurement system and study its advantages and costs.

³⁹The most commonly used electronic auction formats are first-price sealed-bid auction, English auction, and two stage auction. There are two other award procedures, which are used for other purposes: Contest and Standard Open Ascending Price Auction. Contest is used for example to award technical studies, scientific or art works, while Standard Auction is used for selling public assets.

⁴⁰Dimitri, Piga and Spagnolo (2006) argue that the value for money awarding rule can be interpreted as a multi-criteria approach where various dimensions of quality, as well as price, are considered to grant a procurement contract.

⁴¹Public acquisition without competitive bidding is allowed for low value contracts (direct purchase) or when competition is not possible (inegibility). The terms of the procurement contract awarded through direct purchase are directly negotiated between the administration and the supplier. Direct Purchase can be used to award contracts with a value lower than or equal to 8,000 Brazilian Reals, to acquire goods and standardized

auctions can be used to purchase standardized goods and services of any value.

While in electronic reverse auctions lowest bid is the only criterion for selection of suppliers, public administrations may use other selection criteria than price-based auction mechanisms when running physical auctions. For instance, they can base their selection decision on best technique (precision, safety, and durability, i.e., quality), or best technique and price.

Public Officials' and Private Workers' Careers. *Public Sector Workers:* Selection for civil servant positions is via competitive examination. Job applicants present academic and professional credentials, and take a formal civil service examination, which is job-specific and consists of a combination of written and oral tests. The Brazilian legislation establishes clear and transparent requirements for the selection of civil servants. They acquire tenure after three years of service, after which they can only be fired for reasons of misconduct through a judicial decision.

Public workers can also be hired without passing the civil service examination for two other categories of public sector positions: appointees (*cargos comissionados*) and temporary jobs (*empregos temporários*). Hiring of appointees is limited to high-level positions (including directors, managers, supervisors, and advisors). The legislation gives discretion to politicians to select people for those leadership roles.⁴² Temporary public servants are hired to meet temporary and exceptional needs of public administrations, defined by politicians or high-level public officials. In these cases, no civil service exam is required and the selection process can be based on the analysis of applicants' résumés, without other formal objective criteria. The legislation describes the instances that fall under temporary jobs, and the recruiters can be prosecuted in case they contract temporary workers without accurate justification.

Private Sector Workers: A worker is formally employed in the Brazilian private labor market when he/she signs an official labor contract with an employer, and it is registered in the worker's labor record booklet (*carteira de trabalho*), which records the worker's entire employment history in the formal sector. This labor contract implies that the employment is in compliance with labor taxes and regulations. Formal employment gives the worker access to benefits that include unemployment insurance and severance payments. Not all labor contracts are formal. When an employer and a worker agree to a labor contract but decide not to formally sign it and not to include it in the worker's booklet, the worker's employment is

services, and 15,000 Brazilian Reals, for complex engineering services and construction. Ineligibility can be used to award contracts for products under patent protection and there is no more than one seller of the product in the national market. The terms of the procurement contract awarded through ineligibility are also directly negotiated between the administration and the supplier.

⁴²Regular civil servants can be promoted to positions of trust (*funções de confiança*), which are high-level public posts with similar status, earning and power as appointees.

called informal. The main reason for the existence of informal contracts is employer informality. Although the informal sector amounts to 45% of all employee-employer labor agreements in Brazil (Amorim and Corseuil, 2016), it is not an important issue when studying the effect of worker movement between administrations and firms on public procurement outcomes since only formal firms do business with federal government entities.

The Revolving Door Legislation: Movement of individuals between public administrations and private organizations in Brazil is regulated by revolving door rules (Provisional Measure 2,216-37/2001, Decree 4,187/2002, Decree 4,405/2002 and Law 12,813/2013), which basically impose time constraints on the ability of a particular set of high-level public officials to move from their offices to the private sector. Cabinet ministers, directors of regulatory agencies, commissioners of the Brazilian Competition Authority (CADE), governors and directors of the Central Bank of Brazil, and presidents of state-owned companies are prohibited from working for private organizations during a six-month cooling-off period.⁴³ Noncompliance with the regulations can bring severe sanctions and penalties, including fines. While the legislation imposes restrictions on revolving door of high-level public workers, it generally does not restrict workers' movements between public administrations (including their procurement offices) and suppliers. Such lack of restriction allows public officials' movements to suppliers, and movements of supplier workers to public administrations.

Supplementary Material: Data Sources and Descriptive Statistics

RAIS Data on Workers' Occupations and type of Positions. In RAIS, every worker is assigned an occupation, specific to his/her current job, which is categorized according to the CBO (Classificação Brasileira de Ocupações). Those occupational categories allow us to classify workers according to their hierarchical level in public administrations and firms (directors/managers versus other employees). Additionally, RAIS employment contract detail data contain for every worker information about hiring and firing reasons and dates, type of work contract (regular, temporary, short-term, apprenticeship), and more importantly, information on how a worker was hired in the public sector: as a permanent civil servant or an appointee.

We are particularly interested in understanding the difference between appointees and civil servants, to shed light on how different public sector appointment processes and career-related incentives affect the performance of the procurement process. Civil servants in the Brazilian

⁴³In 2013, Law 12,813 established that high-level appointees are also subject to the same restrictions.

federal government are hired through a competitive selection process (civil service examination), for which a large pool of qualified candidates is attracted by the high salaries and job security offered. This allows the federal government to recruit relatively higher skilled public officials than other public institutions (but also generates lax job performance due to tenure rules). Appointees are usually appointed by politicians without any civil service examination, based either on their competence or on their ability to fulfill politicians' objectives inside public administrations. They generally occupy high-level management positions and are paid more than civil servants.

Directors/managers play important role in public administrations.⁴⁴ They formulate and implement organizational strategies that positively impact the performance of their administrations as a whole (Kelman and Meyers, 2011). In the context of this paper, top managers are in charge of managing and supervising internal procurement policies. For this reason, we also look at the effect of directors/managers movements vis-à-vis those of other workers.

Construction of the Revolving Door Dummy Variables. The first dummy variable $Admin - Firm - Pre_{jkt}$ identifies connections through workers' movements from an administration to a supplier. At the contracting time t , these workers are still employed by the administration. It is defined as:

$$Admin - Firm - Pre_{jkt} = \begin{cases} 1 & \text{if there is at least one individual employed in administration } k \\ & \text{at time } t \text{ who will later work for firm } j. \\ 0 & \text{otherwise.} \end{cases}$$

The second dummy variable identifies connections through workers' movements from an administration to a supplier. At the contracting time t , these workers have already moved to the firm. This variable, named $Admin - Firm - Post_{jkt}$, is defined as follows:

$$Admin - Firm - Post_{jkt} = \begin{cases} 1 & \text{if there is at least one individual employed in firm } j \text{ at time } t \\ & \text{who has worked for administration } k \text{ before.} \\ 0 & \text{otherwise.} \end{cases}$$

The third dummy variable identifies connections through workers' movement from a firm to an administration. At the contracting time t , these workers are still employed by the firm.

⁴⁴The behavior and the role of top managers vis-à-vis middle ones in public administrations, and the management and leadership techniques associated with the successful achievement of goals, are central questions in public management. See Kelman (2005), and Brown, Potoski and Van Slyke (2006, 2013) for surveys of this literature.

Formally, this variable, named $Firm - Admin - Pre_{jkt}$, is defined as follows:

$$Firm-Admin-Pre_{jkt} = \begin{cases} 1 & \text{if there is at least one individual employed in firm } j \text{ at time } t \\ & \text{who will later work for administration } k \\ 0 & \text{otherwise.} \end{cases}$$

Finally, the fourth dummy variable, $Firm - Admin - Post_{jkt}$, identifies the movement of an official that worked for a supplier before contracting time t and then moved to an administration. It is defined as:

$$Firm-Admin-Post_{jkt} = \begin{cases} 1 & \text{if there is at least one individual employed in administration } k \\ & \text{at time } t \text{ who has worked for firm } j \text{ before.} \\ 0 & \text{otherwise.} \end{cases}$$

Description of the Variables, Structure of the Data, and Descriptive Statistics.

Table S1 lists the variables used in the paper, their description and sources.

Table S2 details the structure of the data, describing the period that each of our datasets covers, the number of procurement transactions, products, suppliers, administrations, as well as the number of workers that have worked for the suppliers or administrations in our dataset during the period of analysis.

Table S3 contains descriptive statistics of some of the key procurement outcomes that we investigate in this paper: yearly amount of contracts, acquisition price, volume (contract size), and contract value in Panel A; award procedures in Panel B, and other procurement variables in Panel C. As can be seen there, around 30% of our observations are electronic auctions and close to 45% are direct purchases.⁴⁵

⁴⁵The paper by Ferraz, Finan and Szerman (2016) documents the effect of winning procurement contracts in electronic auctions on Brazilian firms' growth. Note that our paper relies on a larger set of award mechanisms, as electronic auctions represent less than one-third of our sample.

Table S1: Variables and Sources

Variable	Description	Source
Panel A - Procurement Variables		
<i>Procurement Outcomes:</i>		
Yearly Amount of Contracts	It corresponds to the total amount of contracts of health products (prescription drugs, medical supplies, hospital equipments and services) per firm-administration pair in a given year, in Brazilian Reals of 2000 (divided by 100).	DW
Price (P)	Price paid by an administration to a firm for a specific/standardized product in a given procurement contract, in Brazilian Reals of 2000. Health products (prescription drugs, medical supplies, hospital equipments and services) procured by the federal government bodies are standardized and codified by the Ministry of Health.	DW
Volume (Q)	Quantity purchased by an administration from a firm for a specific/standardized product in a given procurement contract, in physical units.	DW
Contract Value (PQ)	Total amount paid by an administration to a firm for a certain number of a specific/standardized product units in a given procurement contract. It corresponds to Price (P) multiplied by Volume (Q), in Brazilian Reals of 2000 (divided by 100).	DW
<i>Awarding Procedures:</i>		
Direct Purchase	Dummy variable equal to one if direct purchase (<i>dispensa de licitação</i>) is the method used to award the procurement contract, and zero, otherwise. The terms of the procurement contract awarded through direct purchase are directly negotiated between the administration and the supplier. No tender is needed to select the supplier. Direct Purchase can be used to award contracts with a value lower than or equal to 8,000 Brazilian Reals, to acquire goods and standardized services, and 15,000 Brazilian Reals, for complex engineering services and construction.	DW
Ineligibilities	Dummy variable equal to one if ineligibilities (<i>inegibilidade</i>) is the method used to award the procurement contract, and zero, otherwise. The terms of the procurement contract awarded through ineligibilities are directly negotiated between the administration and the supplier. No tender is needed to select the supplier. Ineligibilities can be used to award contracts for products under patent protection and there is no more than one seller of the product in the national market.	DW
Open Auction	Dummy variable equal to one if open auction (<i>concorrência</i>) is the method used to award the procurement contract, and zero, otherwise. In open auctions any firm can participate in the tender, and the winner is selected through first-price sealed-bid auction. An Open Auction must be used to award contracts with a value higher than or equal to 650,000 Brazilian Reals, to acquire goods and standardized services, and 1,500,000 Brazilian Reals, for complex engineering services and construction.	DW
International Open Auction	Dummy variable equal to one if international open auction (<i>concorrência internacional</i>) is the method used to award the procurement contract, and zero, otherwise. The rules that guide this procedure are similar to the ones that governs open auctions. The only difference between open auction and international open auction is that under the latter international bidders can submit their offer for a procurement contract without having their companies registered with the national tax authority.	DW

Table S1: Variables and Sources (continued)

Variable	Description	Source
Open Score Auction	Dummy variable equal to one if open score auction (<i>concorrência com técnica e preço</i>) is the method used to award the procurement contract, and zero, otherwise. In open score auctions any firm can participate in the tender, and bidders submit a price and a technical proposal. Based on the rules of the tender, price and technical proposals gets different weights to compose the final score of each bidder. Bidder achieving the highest total score wins the contract. A Open Score Auction must be used to award contracts with a value higher than or equal to 650,000 Brazilian Reals, to acquire goods and standardized services, and 1,500,000 Brazilian Reals, for complex engineering services and construction, when quality of the technical proposal is a relevant dimension of the project.	DW
Invited Bidding	Dummy variable equal to one if invited bidding (<i>convite</i>) is the method used to award the procurement contract, and zero, otherwise. In invited bidding auctions only firms invited to participant in a tender can submit a bid, and the winner is selected through first-price sealed-bid auction. A minimum of 3 bidders is required to start a tender. Invited bidding can be used to award contracts with a value lower than or equal to 80,000 Brazilian Reals, to acquire goods and standardized services, and 150,000 Brazilian Reals, for complex engineering services and construction.	DW
Electronic Auction	Dummy variable equal to one if electronic auction (<i>pregão eletrônico</i>) is the method used to award the procurement contract, and zero, otherwise. In electronic auctions any firm can submit their bids electronically through the Brazilian eProcurement Platform (<i>Compras Net</i>), and the selection of the winner is based on an auction-based mechanism. The bidder that offers the lowest price wins the contract. Electronic auction can be used to acquire goods and standardized services of any value.	DW
Two Stage Auction	Dummy variable equal to one if two stage auction (<i>pregão presencial</i>) is the method used to award the procurement contract, and zero, otherwise. In two stage auctions any firm can participate in the tender, and the winner is selected through a two stage auction mechanism. The bidder that offers the lowest price wins the contract. Two stage auction can be used to acquire goods and standardized services of any value.	DW
Restricted Bidding	Dummy variable equal to one if restricted bidding (<i>tomada de preço</i>) is the method used to award the procurement contract, and zero, otherwise. In restricted bidding auctions only firms invited to participate in a tender can submit a bid, and the winner is selected through first-price sealed-bid auction. A minimum of 3 bidders is required to start a tender. Restricted bidding can be used to award contracts with a value lower than or equal to 650,000 Brazilian Reals, to acquire goods and standardized services, and 1,500,000 Brazilian Reals, for complex engineering services and construction.	DW
Price Registration System	Dummy variable equal to one if Price Registration System (<i>registro de preço</i>) is the method used to award the procurement contract, and zero, otherwise. Price registration system can be used to acquire goods and standardized services of any value.	DW
<i>Other Procurement Variables:</i>		
Yearly Administration Procurement Expenditure	Total amount of contracts of health products (prescription drugs, medical supplies, hospital equipments and services) awarded by an administration in a given year, in Brazilian Reals of 2000 (divided by 100).	DW

Continue on the next page.

Table S1: Variables and Sources (continued)

Variable	Description	Source
Yearly Supplier Procurement Revenue	Total amount of contracts of health products (prescription drugs, medical supplies, hospital equipments and services) supplied by a firm to federal administrations in a given year, in Brazilian Reals of 2000 (divided by 100).	DW
Panel B - Labor Market Variables		
Appointee	Dummy variable equal to one if the worker of a public administration is an appointee as described in Section 3, and zero, otherwise.	R
Civil Servant	Dummy variable equal to one if the worker of a public administration is a regular civil servant as described in Section 3, and zero, otherwise.	R
Other Workers	Dummy variable equal to one if the worker of a public administration is neither a civil servant nor an appointee, and zero, otherwise. Temporary workers, apprentices and directors of state-own companies are the typical Other Workers.	R
Director	Dummy variable equal to one if the worker of a public administration is classified, according to the CBO (Classificação Brasileira de Ocupações), as a director/manager of the institution that he/she works for, and zero, otherwise.	R
Non-Director	Dummy variable equal to one if the worker of a public administration is not classified as a director/manager of the institution that he/she works for, and zero, otherwise.	R
Panel C - Revolving Door Variables		
Any Revolving Door	Dummy variable equal to one if at least one of the dummy variables Admin-Firm or Firm-Admin are equal to one, and zero, otherwise.	M
Admin-Firm	Dummy variable equal to one if at least one of the dummy variables Admin-Firm-Past or Admin-Firm-Future are equal to one, and zero, otherwise.	M
Admin-Firm-Pre	Dummy variable equal to one for all procurement contracts of a firm-administration pair jk at time t , where administration k employs an individual at time t who will work for firm j after time t . Otherwise, this variable is equal to zero.	M
Admin-Firm-Post	Dummy variable equal to one for all procurement contracts of a firm-administration pair jk at time t , where administration k has employed an individual before time t who works for firm j at time t . Otherwise, this variable is equal to zero.	M
Firm-Admin	Dummy variable equal to one if at least one of the dummy variables Firm-Admin-Past or Firm-Admin-Future are equal to one, and zero, otherwise.	M
Firm-Admin-Pre	Dummy variable equal to one for all procurement contracts of a firm-administration pair jk at time t , where firm j employs an individual at time t who will work for administration k after time t . Otherwise, this variable is equal to zero.	M
Firm-Admin-Post	Dummy variable equal to one for all procurement contracts of a firm-administration pair jk at time t , where firm j employed an individual before time t who works for administration k at time t . Otherwise, this variable is equal to zero.	M

This table lists the variables used in the paper, their description and sources. Data sources: DW=ComprasNet's Data Warehouse, R=RAIS, M=Merger of RAIS and ComprasNet's Data Warehouse.

Table S2: Descriptive Statistics - Procurement Transactions and Workers

Panel A - Data Sets	
Data Set	Period
Procurement Data (DW ComprasNet)	2000-2009
Worker's Data (RAIS)	1998-2009

Panel B - Characteristics: Procurement and Workers' Data	
Variable	Number of Observations
Procurement Transactions	2 299 786
Products	1 942 210
Firms	50 481
Administrations	977
Firm-Administration pairs	154 673
Workers	10 050 913

Notes: This table details the structure of the data that we use in the paper. Panel A presents the different data sources that we put together to construct our final data set, and describes the period that each of our data sets covers. Panel B provides information on the number of procurement transactions, products, firms (suppliers), administrations (buyers), firm-administration pairs, and the number of individual (workers) that have worked for the firms or administrations in our data during the period of analysis.

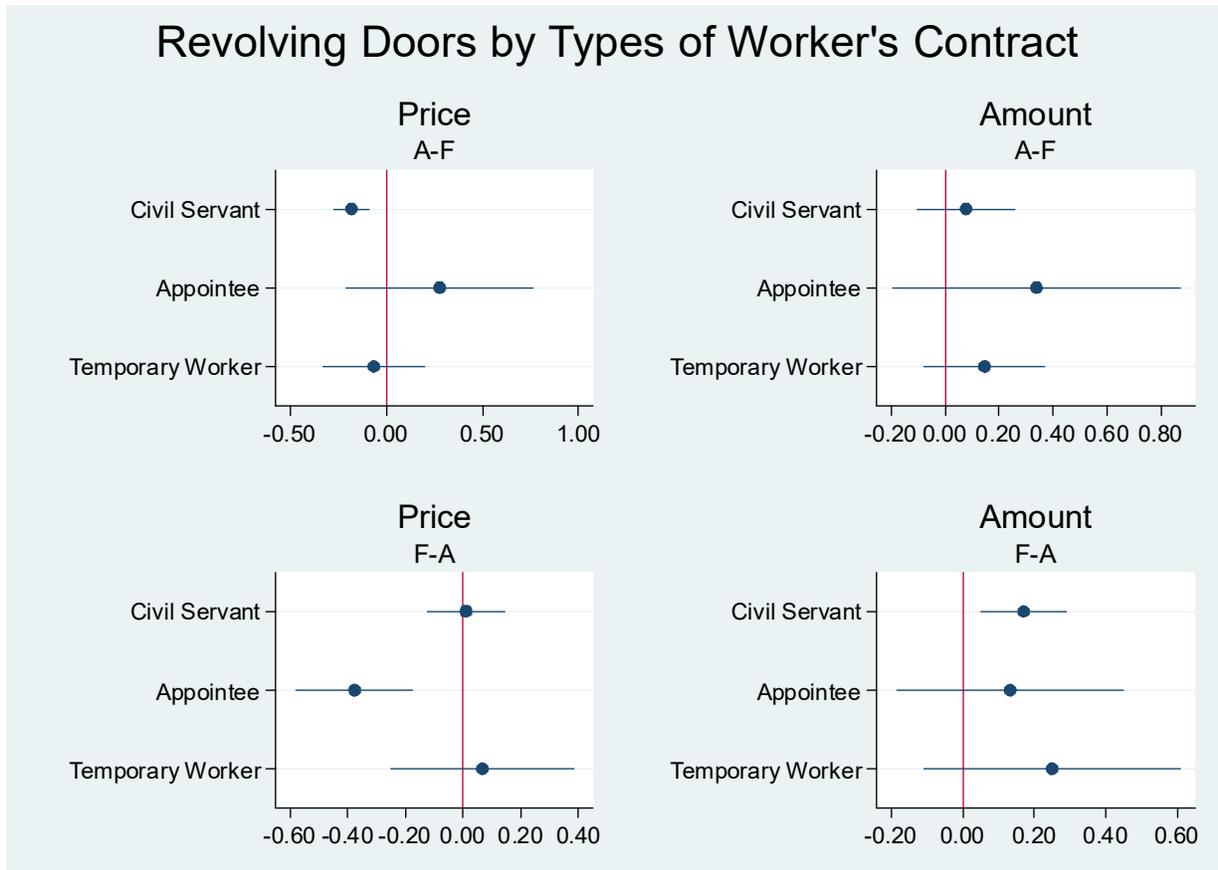
Table S3: Descriptive Statistics - Procurement Outcomes and Characteristics

Panel A - Procurement Outcomes					
	Obs	Mean	St.Dev.	Min	Max
Yearly Amount of Contracts	216 698	3 432	995 401	0	463 000 000
Price (P)	2 299 786	6 637	7 637 249	0	11 600 000 000
Volume (Q)	2 299 786	4 596	749 157	1	1 000 000 000
Contract Value (PQ)	2 299 786	108.71	76 406.06	0.00	116 000 000
Panel B - Awarding Procedure					
	Obs	Mean	St.Dev.	Min	Max
Direct Purchase	2 299 786	0.4419	0.4966	0	1
Ineligibilities	2 299 786	0.0159	0.1249	0	1
Open Auction	2 299 786	0.0410	0.1983	0	1
International Open Auction	2 299 786	0.0003	0.0179	0	1
Open Score Auction	2 299 786	0.0000	0.0009	0	1
Invited Bidding	2 299 786	0.1325	0.3390	0	1
Electronic Auction	2 299 786	0.2913	0.4544	0	1
Two Stage Auction	2 299 786	0.0228	0.1494	0	1
Restricted Bidding	2 299 786	0.0542	0.2265	0	1
Price Registration System	2 299 786	0.1697	0.3754	0	1
Panel C - Other Variables					
	Obs	Mean	St.Dev.	Min	Max
Yearly Administration Procurement Expenditure	7 784	43 297	1 387 272	0.0029	118 000 000
Yearly Supplier Procurement Revenue	106 657	3 159.89	355 909	0.0000	116 000 000

Notes: This table reports summary statistics of the variables used in the paper. Panel A contains descriptive statistics on the procurement outcomes that we investigate in the paper: yearly amount of contract per firm-administration pair, acquisition price (price), volume (contract size), contract value. Panel B reports the fraction of each awarding procedure used to allocate the procurement contracts in our data. Panel C shows summary statistics for yearly procurement expenditure per administration and yearly federal procurement revenue per supplier. Price is in Brazilian Reals of 2000. Yearly amount of contracts, Contract value, yearly administration procurement expenditure and yearly supplier procurement revenue are in Brazilian Reals of 2000 (divided by 100). Volume is in units of the standardized product. All variables were constructed as described in Table S1.

Supplementary Material: Figures and Tables

Figure S1: Results by Types of Workers



Notes: This figure displays the estimated impact of revolving door movements (Admin-Firm, A-F; and Firm-Admin; F-A) on procurement prices and yearly amounts, by workers type, and their respective 95% confidence intervals. These estimations correspond to estimated effects reported in Column 3, for prices, and Column 6, for amounts, of Table S5.

Table S4: Yearly Amount - Intensive Margin

Variables	(1) Yearly Amount	(2) Yearly Amount	(3) Yearly Amount (ln)	(4) Yearly Amount	(5) Yearly Amount	(6) Yearly Amount	(7) Yearly Amount	(8) Yearly Amount	(9) Yearly Amount
Any Revolving Door	0.187 (0.166)	0.199 (0.164)	0.101 (0.141)						
A-F				0.193 (0.271)	0.244 (0.270)	0.164 (0.231)			
F-A				0.105 (0.151)	0.103 (0.150)	0.021 (0.128)			
A-F-Pre							-0.041 (0.306)	0.010 (0.302)	-0.030 (0.270)
A-F-Post							0.533** (0.272)	0.555** (0.272)	0.395* (0.238)
F-A-Pre							0.028 (0.170)	0.033 (0.164)	-0.004 (0.144)
F-A-Post							0.303** (0.171)	0.293* (0.168)	0.102 (0.142)
Observations	156,325	156,325	142,433	156,325	156,325	142,433	156,325	156,325	142,433
Admin-Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	No	Yes	No	No	Yes	No
Admin-Time FE	No	No	Yes	No	No	Yes	No	No	Yes
Firm-Time FE	No	No	Yes	No	No	Yes	No	No	Yes
Within R ²	0.006	0.008	0.009	0.006	0.008	0.009	0.006	0.009	0.009

Notes: This table reports the estimated effect of revolving door movement on procurement yearly amounts. The estimated equation follows the same specification in equation (2). In columns 2, 5, and 8 controls include previous year administration procurement expenditure and previous year supplier procurement revenue. Robust standard errors clustered at the firm-administration level are in parentheses: *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table S5: Results by Types of Workers

	(1)	(2)	(3)
	Price	Price	Price
A-F: Civil Servant	-0.299*** (0.072)	-0.242*** (0.067)	-0.180*** (0.048)
A-F: Appointee	-0.010 (0.427)	0.043 (0.421)	0.278 (0.249)
A-F: Temporary	-0.226*** (0.087)	-0.292*** (0.106)	-0.065 (0.135)
F-A: Civil Servant	0.053 (0.081)	0.066 (0.088)	0.009 (0.068)
F-A: Appointee	-0.674*** (0.194)	-0.523*** (0.167)	-0.3764*** (0.103)
F-A: Temporary	0.111 (0.203)	0.094 (0.215)	0.066 (0.162)
Observations	958,166	958,166	950,974
Within R-squared	0.352	0.372	0.323
	(4)	(5)	(6)
	Yearly Amount	Yearly Amount	Yearly Amount
A-F: Civil Servant	0.079 (0.092)	0.079 (0.092)	0.077 (0.093)
A-F: Appointee	0.339 (0.266)	0.339 (0.266)	0.338 (0.271)
A-F: Temporary	0.147 (0.112)	0.146 (0.112)	0.147 (0.115)
F-A: Civil Servant	0.162*** (0.060)	0.162*** (0.060)	0.171*** (0.062)
F-A: Appointee	0.133 (0.158)	0.133 (0.158)	0.133 (0.162)
F-A: Temporary	0.245 (0.179)	0.245 (0.179)	0.250 (0.183)
Observations	1,392,057	1,392,057	1,392,057
Within R-squared	0.008	0.008	0.008
Admin-Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Controls	No	Yes	No
Admin-Time FE	No	No	Yes
Firm-Time FE	No	No	Yes

Notes: This table reports the estimated effect of revolving door movement by workers type on procurement prices and yearly amounts. The estimated equation is (1) for prices and (2) for amounts. In columns 2 and 5, controls include previous year administration procurement expenditure and previous year supplier procurement revenue as well as awarding procedures (for price only). Robust standard errors clustered at the firm-administration level are in parentheses: *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table S6: Contract Value

Variables	(1) Contract Value	(2) Contract Value	(3) Contract Value	(4) Contract Value	(5) Contract Value	(6) Contract Value	(7) Contract Value	(8) Contract Value	(9) Contract Value
Any Revolving Door	-0.063 (0.141)	-0.037 (0.121)	-0.073 (0.089)						
A-F				-0.420*** (0.096)	-0.296*** (0.076)	-0.332*** (0.076)			
F-A				0.223 (0.147)	0.194 (0.135)	0.159 (0.098)			
A-F-Pre							-0.359*** (0.108)	-0.238*** (0.090)	-0.327*** (0.087)
A-F-Post							-0.3168*** (0.122)	-0.2524** (0.101)	-0.236** (0.093)
F-A-Pre							0.187** (0.092)	0.2502** (0.105)	0.067 (0.072)
F-A-Post							0.285* (0.148)	0.108 (0.093)	0.217* (0.114)
Observations	958,166	958,166	950,974	958,166	958,166	950,974	958,166	958,166	950,974
Admin-Firm FE	Yes								
Product FE	Yes								
Year FE	Yes								
Controls	No	Yes	No	No	Yes	No	No	Yes	No
Admin-Time FE	No	No	Yes	No	No	Yes	No	No	Yes
Firm-Time FE	No	No	Yes	No	No	Yes	No	No	Yes
Within R ²	0.002	0.063	0.002	0.002	0.064	0.002	0.002	0.064	0.002

Notes: This table reports the estimated effect of revolving door movement on procurement contract value (price x quantity). The estimated equation follows the same specification in equation (1). In columns 2, 5, and 8 controls include previous year administration procurement expenditure and previous year supplier procurement revenue, and the awarding procedure used to allocate the procurement contract. Robust standard errors clustered at the firm-administration level are in parentheses: *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table S7: Spillover Effect on Price of Contracts with other Firms

	Overall Spillover		
	(1) Price	(2) Price	(3) Price
A-F-Pre Spillover	-0.006 (0.014)	-0.005 (0.014)	0.002 (0.012)
Observations	958,166	958,166	950,974
Within R-squared	0.352	0.372	0.323
	Spillover By Types of Workers		
	(4) Price	(5) Price	(6) Price
A-F-Pre Spillover: Civil Servant	-0.008 (0.016)	-0.015 (0.016)	0.002 (0.013)
A-F-Pre Spillover: Appointee	-0.006 (0.045)	-0.003 (0.042)	0.004 (0.037)
A-F-Pre Spillover: Temporary	-0.002 (0.038)	-0.049 (0.036)	0.021 (0.032)
Observations	958,166	958,166	950,974
Within R-squared	0.3530	0.373	0.323
	Spillover By Worker's Hierarchy		
	(7) Price	(8) Price	(9) Price
A-F-Pre Spillover: Directors	-0.108*** (0.031)	-0.052* (0.030)	-0.059** (0.027)
A-F-Pre Spillover: Non-Directors	0.004 (0.015)	-0.001 (0.015)	0.010 (0.013)
Observations	958,166	958,166	950,974
Within R-squared	0.353	0.373	0.323
Admin-Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Controls	No	Yes	No
Admin-Time FE	No	No	Yes
Firm-Time FE	No	No	Yes

Notes: This table reports the spillover estimated effect of A-F-Pre revolving door movement (when an employee is currently working for the administration and will move to the firm later on) on the price at which the administration buys from other firms. The estimated equation is (1). In columns 2, 5 and 8, controls include previous year administration procurement expenditure and previous year supplier procurement revenue as well as awarding procedures. Robust standard errors clustered at the firm-administration level are in parentheses: *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table S8: Awarding Procedures

Variables	(1) Direct Purchase	(2) Invited Bidding	(3) Open Auction Mechanisms
A-F-Pre	0.123 (0.081)	-0.040 (0.050)	-0.018 (0.017)
A-F-Post	0.120 (0.074)	-0.017 (0.054)	-0.008 (0.017)
F-A-Pre	0.031 (0.032)	-0.003 (0.015)	-0.008 (0.056)
F-A-Post	-0.078 (0.073)	-0.012 (0.029)	-0.045 (0.055)
Observations	950,974	950,974	950,974
Admin-Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Controls	No	No	No
Admin-Time FE	Yes	Yes	Yes
Firm-Time FE	Yes	Yes	Yes
Within R ²	0.011	0.007	0.007

Notes: This table reports the estimated effect of revolving door on the likelihood of Direct Purchase, Invited Bidding and Open Auction Mechanisms being the awarding procedure for a public procurement contract. A linear probability model following the specification in equation (1) is estimated. Column 1 shows the effect of revolving doors on the probability of Direct Purchase, and column 2 on Invited Bidding. Column 3 reports the revolving doors effect on the probability of Open Auction Mechanisms. Open Auctions, International Open Auctions, Open Score Auctions, Electronic Auctions and Two Stage Auctions are Open Auction Mechanisms. Detailed information on the different awarding procedure can be found in Table S1. Robust standard errors clustered at the firm-administration level are in parentheses: *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Supplementary Material: Estimation Method

Estimation of effect of revolving door movements on procurement contract outcomes. Equation (1) in the paper estimates the effects officials' movement from public to private (and the reserve) on procurement prices (and on contract value, in Section 7, Table S6). Due to the large number of firms (50,481), administrations (977), firm-administration pairs (154,673) and products (1,942,210) in the our data set, the usual statistical softwares (e.g., STATA) cannot estimate equation (1).

In order to make the estimation of equation (1) possible, we transform the original variables into deviations from firm-administration means. From there, we can derive an econometric specification that can be estimated using STATA.

To show how we implement the econometric transformation, consider the estimated equation (1) below:

$$\ln p_{ljk} = \alpha_l + \kappa_t + \tau_{jk} + RD'_{jkt}\beta + \gamma q_{ljk} + \delta_{jt} + \eta_{kt} + u_{ljk}. \quad (S1)$$

Now, consider the between firm-administration regression model of equation (S1):

$$\overline{\ln p}_{jk} = \overline{\alpha}_l + \overline{\kappa}_t + \overline{\tau}_{jk} + \overline{RD}'_{jk}\beta + \gamma \overline{q}_{jk} + \overline{\delta}_j + \overline{\eta}_k + \overline{u}_{jk}, \quad (S2)$$

where

$$\overline{\ln p}_{jk} = \frac{1}{LT} \sum_{t=1}^T \sum_{l=1}^L \ln p_{ljk}; \quad \overline{q}_{jk} = \frac{1}{LT} \sum_{t=1}^T \sum_{l=1}^L q_{ljk}; \quad \overline{u}_{jk} = \frac{1}{LT} \sum_{t=1}^T \sum_{l=1}^L u_{ljk};$$

$$\overline{RD}_{jk} = \frac{1}{LT} \sum_{t=1}^T \sum_{l=1}^L RD_{jkt}; \quad \overline{\alpha}_l = \frac{1}{LT} \sum_{t=1}^T \sum_{l=1}^L \alpha_l$$

$$\overline{\kappa}_t = \frac{1}{LT} \sum_{t=1}^T \sum_{l=1}^L \kappa_t; \quad \overline{\tau}_{jk} = \frac{1}{LT} \sum_{t=1}^T \sum_{l=1}^L \tau_{jk}.$$

$$\overline{\delta}_j = \frac{1}{LT} \sum_{t=1}^T \sum_{l=1}^L \delta_{jt}; \quad \overline{\eta}_k = \frac{1}{LT} \sum_{t=1}^T \sum_{l=1}^L \eta_{kt}.$$

Note that

$$\overline{\alpha}_l = \alpha^*; \quad \overline{\kappa}_t = \kappa^*; \quad \overline{\tau}_{jk} = \tau_{jk}; \quad \overline{\delta}_j = \delta^*; \quad \overline{\eta}_k = \eta^*.$$

Replacing them in equation (S2), we can write the between firm-administration regression

as follows:

$$\overline{\ln p_{jk}} = \alpha^* + \kappa^* + \tau_{jk} + \overline{RD}'_{jk}\beta + \gamma\overline{q_{jk}} + \delta^* + \eta^* + \overline{u_{jk}}. \quad (\text{S3})$$

Now consider the deviations from firm-administration means model, which can be derived by taking the difference between (S1) and (S3):

$$(\ln p_{l_{jkt}} - \overline{\ln p_{jk}}) = (\alpha_l - \alpha^*) + (\kappa_t - \kappa^*) + (RD'_{l_{jkt}} - \overline{RD}'_{jk})\beta + \gamma(q_{l_{jkt}} - \overline{q_{jk}}) + (\delta_{jt} - \delta^*) + (\eta_{kt} - \eta^*) + (u_{l_{jkt}} - \overline{u_{jk}}). \quad (\text{S4})$$

This econometric specification can be estimated using STATA because the firm, administration, and firm-administration pair fixed effects were removed from the estimated equation (S4).

Estimation of effect of revolving door movements on yearly amount of contracts.

Similarly, to estimate equation (2), we proceed as in the previous section, transforming the original variables into deviations from firm-administration means. The transformation is not identical to the previous one, since we now use the yearly amount of contracts data.

In order to make the estimation of equation (2) possible, we have to transform the original variables into deviations from firm-administration means. From there, we can derive an econometric specification that can be estimated using STATA.

To show how we implement the econometric transformation, consider the following linear probability model for equation (2) that can be estimated as follows:

$$\ln y_{jkt} = \kappa_t + \tau_{jk} + RD'_{jkt}\beta + \delta_{jt} + \eta_{kt} + \nu_{jkt}, \quad (\text{S5})$$

Now, consider the between firm-administration regression model:

$$\overline{\ln y_{jk}} = \overline{\kappa}_t + \overline{\tau}_{jk} + \overline{RD}'_{jk}\beta + \overline{\delta}_j + \overline{\eta}_k + \overline{\nu}_{jk}, \quad (\text{S6})$$

where

$$\begin{aligned} \overline{\ln y_{jk}} &= T^{-1} \sum_{t=1}^T \ln y_{jkt}; & \overline{\nu}_{jk} &= T^{-1} \sum_{t=1}^T \nu_{jkt}; \\ \overline{\kappa}_t &= T^{-1} \sum_{t=1}^T \kappa_t; & \overline{\tau}_{jk} &= T^{-1} \sum_{t=1}^T \tau_{jk}; & \overline{RD}_{jk} &= T^{-1} \sum_{t=1}^T RD_{jkt}. \\ \overline{\delta}_j &= T^{-1} \sum_{t=1}^T \delta_{jt}; & \overline{\eta}_k &= T^{-1} \sum_{t=1}^T \eta_{kt}. \end{aligned}$$

Note that

$$\bar{\kappa}_t = \kappa^*; \quad \bar{\tau}_{jk} = \tau_{jk}; \quad \bar{\delta}_j = \delta^*; \quad \bar{\eta}_k = \eta^*.$$

Replacing them in equation (S6), we can write the between firm-administration regression as follows:

$$\overline{\ln y_{jk}} = \kappa^* + \tau_{jk} + \overline{RD}'_{jk}\beta + \delta^* + \eta^* + \bar{\nu}_{jk}. \quad (\text{S7})$$

Now consider the deviations from firm-administration means model, which can be derived by taking the difference between (S5) and (S7):

$$(\ln y_{jkt} - \overline{\ln y_{jk}}) = (\kappa_t - \kappa^*) + (RD'_{jkt} - \overline{RD}'_{jk})\beta + (\delta_{jt} - \delta^*) + (\eta_{kt} - \eta^*) + (\nu_{jkt} - \bar{\nu}_{jk}). \quad (\text{S8})$$

This econometric specification can be estimated using STATA because the firm, administration, and firm-administration pair fixed effects were removed from the estimated equation (S8).

Supplementary Material: Value for Revolving Door Workers

We have argued that revolving door workers exploit their advantage to move across sectors and secure a position with a counterpart entity in the public or private sector. In this section, we show that these movements generate substantial wage bonuses, but also that these gains are quite heterogeneous across categories of workers.

We follow the seminal approach of Abowd, Kramarz and Margolis (1999), and use the RAIS worker-firm longitudinal data to generate an additive decomposition of observed workers' wages, in terms of a worker fixed effect, an employer fixed effect, and worker-level time-varying controls. Controls include age, length of tenure and education level. Formally, we estimate:

$$y_{ijt} = \theta_i + \xi_j + X'_{it}\beta + \nu_{ijt}, \quad (\text{S9})$$

where y_{ijt} is the wage of worker i in employer j at time t , θ_i is a worker fixed effect, ξ_j is an employer fixed effect, X_{it} is a vector of time variant observable characteristics of workers, and ν_{ijt} is the error term, which is assumed to be uncorrelated with other regressors on the right hand side.

We then retrieve workers' fixed effects and analyze to what extent they are explained by revolving door dummies versus workers' unobservable attributes. In addition, we look at the heterogeneity of these results, by interacting revolving door dummies with the employment contract type at the time of the movement.

The follow-up estimating equation is given by:

$$\hat{\theta}_i = u'_i\gamma + \alpha_i, \quad (\text{S10})$$

where $\hat{\theta}_i$ is the predicted worker i fixed effect from (S9), u_i is a vector of revolving door dummies and their interactions with worker characteristics, and α_i captures the unobserved component of worker i fixed effect.

The results from equation (S9) are in the upper panel of Table S9. Column 1 includes linear controls, while Column 2 includes higher order terms for age and tenure (up to cubic and quadratic terms respectively), following Card, Heining and Kline (2013).

As expected, workers' wages are significantly increasing in education, age, and length of tenure. When worker, employer, time, occupation, and type of employment contract fixed effects are included, these specifications explain over 90% of the variance in wages.⁴⁶

The lower panel of Table S9 then presents the results from estimating equation (S10) on a

⁴⁶Simpler specifications omitting occupation and type of contract fixed effects yield almost identical results for both (S9) and (S10).

set of 7.8 million workers for whom there is enough time variation, based on the worker fixed effects estimated with (S9). As is apparent, revolving door workers earn a significant premium, corresponding to 20.5% of the average sample wage for workers moving from the public to the private sector, and 31.1% for workers going from the private to the public sector.⁴⁷

Finally, Table S10 summarizes results regarding the premium heterogeneity along workers' characteristics, based on regressing the fixed effects from the basic specification without higher order terms (Column 1, Table S9) on revolving door dummies and their interactions with the type of public positions held.

Looking at the categories of employment reveals significant differences.⁴⁸ The post-public employment wage premium is roughly similar for appointees and directors, equal to around half the average sample wage, and roughly three times larger than that of regular civil servants. The difference is larger for post-private employment type of revolving door workers, where the premium for directors is now approximately equal to 100% of the average sample wage, double that of appointees and triple that of civil servants. Clearly, high-level directors going into the public sector after a career in the private sector are in a separate class when it comes to premium.

Note finally that although it is known from the literature (e.g., Finan, Olken and Pande, 2015) that public sector positions have significant additional benefits, such as better health insurance, pensions and potential job stability, our premium measure does not take these into account. It also does not incorporate other potential unobserved sources of benefits from revolving doors, such as shares in private firms' capital or bribes.

⁴⁷The average sample wage corresponds to R\$ 1,450 at 2000 value.

⁴⁸The values are computed assuming an age equal to the sample average (36). Each additional year of age at the time of movement adds a 2% to the premium.

Table S9: AKM Estimates for Revolving Door Workers

Panel A - Worker's Wage Decomposition		
	Wage	Wage
	1	2
Elementary School (Dummy)	-53.1886*** (0.7529)	-52.6660*** (0.7512)
High School (Dummy)	-41.1711*** (0.6341)	-41.8097*** (0.6326)
Higher Education (Dummy)	62.3071*** (0.7995)	56.9950*** (0.7989)
Age	2.4380*** (0.0514)	-4.6816*** (0.2139)
Age (2nd power)		0.6678*** (0.0062)
Age (3rd power)		-0.0079*** (0.0001)
Tenure in Office	6.9515*** (0.0370)	13.3588*** (0.0921)
Tenure in Office (2nd power)		-1.4175*** (0.0083)
Tenure in Office (3rd power)		0.0597*** (0.0003)
Tenure in Office (4th power)		-0.0005*** (0.0000)
Worker F.E.	Yes	Yes
Employer F.E.	Yes	Yes
Time F.E. (Year)	Yes	Yes
Occupation F.E.	Yes	Yes
Employment Contract F.E.	Yes	Yes
R-Square	0.9082	0.9086
Obs	51 718 148	51 718 148

Panel B - RD Worker and Worker's Wage Fixed Effect		
	Worker FE	Worker FE
	1	2
Admin-Firm RD Worker	228.6694*** (17.9235)	238.7237*** (17.5640)
Firm-Admin RD Worker	346.7487*** (15.0566)	348.6128*** (14.7547)
Obs	7 825 407	7 825 407

Notes: This table reports the results from workers' wage decomposition. Panel A shows the results from the wage decomposition in terms workers' fixed effects, age, length of tenure (tenure in office), and education level, following equation (S9). In all columns of Panel A the dependent variable is workers' wage. In all regressions we include worker, employer, occupation, employment contract type and year fixed effects. Panel B reports the effects of Admin-Firm revolving door and Firm-Admin revolving door dummies on predicted workers' fixed effects from equation (S9), following the specification in equation (S10). Robust standard errors clustered at the worker level are in parentheses: *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table S10: Workers' Revolving Door Bonuses by Categories

	Admin-to-Firm RD workers	Firm-to Admin RD workers
Civil Servants	197.3***	316.3***
Appointees	610.0***	586.8***
Directors	505.4***	1114.3***

Notes: This table reports the estimated variation of wage premium according to workers' characteristics at the time of the movement. Those wage premiums are estimated by regressing the workers' fixed effect from the specification in Column 1, Table S9, on revolving door dummies and their interactions with type of public positions held. Robust standard errors are in parentheses: *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

References

- Abowd, J., Kramarz, F., and Margolis, D., 1999. “High-Wage Workers and High-Wage Firms.” *Econometrica*, 67 (2), 251-333.
- Amorim, B., and Corseuil, C., 2016. “Analysis of the Dynamics of the Sectoral Employment from 2014 to 2015.” N.T. 23/2016, IPEA Working Paper Series, Rio de Janeiro, IPEA, 2015 [In Portuguese].
- Barbosa, K., and Fiuza, E., 2011. “Demand Aggregation and Credit Risk Effects in Pooled Procurement: Evidence from the Brazilian Public Purchases of Pharmaceuticals and Medical Supplies.” FGV-EESP C-Micro Working Paper Series.
- Barbosa, K. 2015. “The Brazilian Procurement System of Price Registration”, In *Aperfeiçoando a Qualidade Regulatória*, Eduardo Fiuza and Lucia Helena Salgado, editors, Rio de Janeiro, IPEA, 2015 [In Portuguese].
- Brown, T., Potoski, M., and Slyke, D., 2006. “Managing Public Service Contracts: Aligning Values, Institutions, and Markets.” *Public Administration Review*, 66(3), 323-331.
- Brown, T., Potoski, M., and Slyke, D., 2013. *Complex Contracting: Government Purchasing in the Wake of the US Coast Guard’s Deepwater Program*. Cambridge University Press.
- Card, D., Heining, J., and Kline, P., 2013. “Workplace Heterogeneity and the Rise of West German Wage Inequality.” *Quarterly Journal of Economics*, 128, 967-1015.
- Dimitri, N., Piga, G., and Spagnolo, G., 2006. *Handbook of Procurement*, Cambridge (UK): Cambridge U.P., Cambridge (UK).
- Ferraz, C., Finan, F., and Szerman, D., 2016. “Procuring Firm Growth: The Effects of Government Purchases on Firm Dynamics”, Mimeo.
- Kelman, S., and Meyers, J., 2011. “Successfully Achieving Ambitious Goals in Government: An Empirical Analysis.” *American Review of Public Administration*, 41(3), 235-262.
- Kelman, S., 2005. *Unleashing Change: A Study Of Organizational Renewal In Government*. Brookings Institution Press.