

The Value of Revolving Doors in Public Procurement*

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Abstract

This paper investigates the impact of revolving door movements on public procurement outcomes. We combine 10 years of procurement contracts in the Brazilian health sector with a comprehensive employer-employee dataset tracing individual job experience and characteristics to identify how movements of individuals between public administrations and private providers affect the total number of contracts, quantities, and acquisition prices. We analyze career changes in both directions between public bodies and private suppliers, and provide evidence of significant direct effects, spillovers to other firms and administrations, impact on workers' remuneration, and on aggregate spending. We uncover positive and negative effects of revolving door on the efficiency of procurement, which are, respectively, consistent with reward for high-skill workers' signaling competence and collusive behavior. In particular, we find that effects of administration-to-supplier connections are beneficial to public bodies, while effects of supplier-to-administration ones are detrimental. Their aggregate impacts on spending are, respectively, -3% and $+2\%$ of total procurement outlays. These results point to specific and unexpected policy implications related to the tolerance of revolving door practices.

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“The availability of jobs in industry can have a subtle, but debilitating effect on an officer’s performance during his tour of duty in procurement management assignment. If he takes too strong a hand in controlling contractor activity, he might be damaging his opportunity for a second career following retirement. Positions are offered to those officers who have demonstrated their appreciation for industry’s particular problems and commitments.”

J. Ronald Fox (Former Assistant of the Secretary of Defense, U.S.)
[in Laffont and Tirole (1993, pp. 476)]

“If, in fact, the revolving doors are closed, those who have skills and competency that can only be used fully through postagency employment in the private sector may find the public sector less attractive and decide not to enter. This concern is shared by the U.S. Government (1989): [Restrictive limitations] will necessarily reduce the number of qualified persons who would be otherwise willing to enter into federal employment.”

[in Che (1995, pp. 393)]

1 Introduction

Revolving doors between public sector positions in agencies in charge of policy or regulation and the private firms these institutions deal with are commonly found in sectors such as insurance, banking, and lobbying.¹ The existence of personnel’s movement between public agencies and private firms raises a natural question: what are the potential social benefits and costs of revolving doors?

The two quotes above summarize the 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, collusion and corruption (Eckert, 1981). On the other hand, post-administration opportunities may be necessary to attract talents to the public sector. This would be compounded by the fact that zealous officials may 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).

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 US (Mishak, 2016), or the recent movements of high-ranking EU officials to (former head of EU commission José Manuel Barroso; The Guardian, July 8, 2016) or from (Mario Draghi becoming head of the European Central Bank; NYT, June 24, 2011) the investment banking group Goldman Sachs.

Similarly, when considering private-to-public movements, potential conflicting incentives involving either collusion or increased efficiency may arise. Given those contrasting theoretical predictions, the determination of revolving door effects remains an open empirical matter.

The empirical identification of revolving door effects is a challenging task. It requires observation of standardized outcomes that account for the relationship between public agencies and private firms in the presence and absence (counterfactual) of personnel movements. In this paper we investigate the impact of revolving door movements on public procurement. Public procurement provides a fertile ground to study the effects of revolving doors for a number of reasons. First, identical and similar products are recurrently transacted between firms and administrations, and the outcomes of those procurement transactions (acquisition price, contract size and award value) are comparable between firm-administration pairs and within pairs over time. Second, given the high degree of specific knowledge and expertise involved in procurement transactions, it is natural to expect workers moving from administrations to firms, and vice-versa. Last but not least, uncovering the revolving door effects is particularly important in the context of public procurement, which involves large amounts of public money and discretionary decisions by public officials.

This paper shows that revolving doors are pervasive in the public procurement sector, and analyzes their relative importance by studying the link between public officials' career path and outcomes in the Brazilian public procurement process. Brazil is a perfect testing ground for this issue, because of the availability of detailed and 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 identify how career paths of individuals working as public administrators or as private providers determine procurement outcomes: total amount of contracts, transacted volumes, and acquisition prices.

We match these two datasets to 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. When analyzing contractual outcomes at a given date, we consider both past and future movements. After combining the procurement contracts and the employer-employee datasets from Brazil, we investigate how movements of individuals between public administrations and private providers (i.e., revolving door movements) affect procurement outcomes. We identify revolving door effects by comparing the temporal variation of the outcome variables for firm-administration

pairs which experienced some personnel movements (the revolving door group), with those pairs which did not experience such movements (the counterfactual group), in a difference-in-differences framework that accounts for product characteristics. In addition, we distinguish revolving door worker by type of position (permanent civil servants versus appointees) and hierarchical level (directors versus other employees).

The results show that the movements of procurement officials significantly affect procurement outcomes. Interestingly, we uncover both positive and negative effects of revolving door individuals on these outcomes. On the one hand, 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 lower prices. In addition, once this particular public official moves to the private provider, the latter sells more at lower prices to that public entity. This effect holds specifically for civil servants and directors, but not for political appointees. The main channel appears to be public sector workers attempting to signal competence and special skills to potential post agency employers by doing their job thoroughly, hence improving procurement efficiency. Then, later on, when working for a private provider, these workers use their knowledge and expertise, resulting in better performance of the supplier.

On the other hand, supplier-to-administration movements appear to be detrimental, with public agencies facing higher prices. Our estimations show that a private provider employing a worker who in the future will move to a public administration sells its products to the latter at higher prices. Yet, we note that when that particular private worker moves to the public administration, the latter also buys more at higher prices from the original private provider. The evidence points to movements based on already established connections, bringing about worse procurement outcomes, which is consistent with a story of collusive behavior between public officials and private providers that have established a long-term relationship. Contrary to the previous case, this negative effect is now driven by civil servants, suggesting a negative selection effect that the mid-career civil servant hiring process into the public administration fails to address properly.

In addition to these direct impacts, we also uncover spillover effects of revolving door relationships on outcomes involving third parties, reinforcing our previous conclusions on the channels at work. In particular, we find that before moving to a private firm, revolving-door civil servants and directors tend to obtain lower prices from all the firms they buy from and that this effect disappears when they leave, supporting the idea that they are indeed doing

their job efficiently. Nevertheless, revolving-door public appointees buy and sell at higher prices to third parties in both stages of their movements, consistent with an appointee-firm collusion story. For firm-to-administration movements, we find spillover evidence supporting a collusive story between public officials and private providers that have built a long-term relationship. We observe that a private provider employing a worker who in the future will move to a public administration sells its products to all other public administrations (those without revolving door connections) at lower prices. We also find that when that particular private worker moves to a public sector entity, the latter starts to buy relatively less from other private providers than from its original firm.

We then exploit the employee-employer structure of our dataset to 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' characteristics and type of contracts. In particular, the premium is larger for older, more educated individuals, but also for men. In terms of categories, directors, and to a lesser extent appointees, get the largest premium. Finally, based on our findings, we perform back-of-the-envelope estimates of the aggregate impact on public sector procurement spending of revolving door practices. They show that administration-to-firm movements lead to savings of a bit more than 3% of total spending, while firm-to-administration movements increase spending by 2%.

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; Section 6 presents the main econometric results and discusses the channels; Section 7 presents the spillover results; Section 8 derives the impact on worker compensation; Section 9 summarizes the aggregate costs and benefits; Section 10 addresses policy implications; and Section 11 concludes. Additional material is in the Supplementary Section.

2 Related Literature and Contribution

Our findings reflect the theoretical literature that has pointed out the potential social benefits and costs of the existence of a revolving door between the public and the private sectors. Che (1995), in particular, builds a regulation model in which the regulator has revolving door

concerns affecting his performance incentives. He concludes that stronger monitoring effort by public 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 quasi regulated industries (credit rating agencies) and regulatory agencies, respectively, to banks, and show that when regulators 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. Bond and Glode (2013), in particular, show that young regulators accumulate human capital and the best ones switch to banking in mid-career. Our estimations show that acquisition prices decrease when workers move from administrations to firms. Combined with the evidence that moving public officials are mid-career workers (36 years old on average), who obtain a wage premium that is increasing with their level of education, this can be interpreted as evidence that talented individuals seek higher payoffs and move when opportunities arise. Hence, in the Brazilian procurement context, an open revolving door policy that allows public officials to move from public agencies to private firms seems to be beneficial to the government, private firms, and workers.²

Empirically, 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. These contributions have provided indirect evidence of the relevance of connections versus ability of revolving individuals. Looking at the lobbying industry, both Blanes i Vidal, Draca, and Fons-Rosen (2012) and Bertrand, Bombardini and Trebbi (2014) argue that relational capital is the main asset of these individuals. Cornaggia, Cornaggia, and Xia (2016) investigate credit analysts that leave rating agencies to work at firms they rate. They find that transitioning analysts award inflated ratings to their future employers before switching jobs.

On the other hand, Lucca, Seru and Trebbi (2014) conclude that the learning and ability channel prevails in the finance industry. Kempf (2017), looking at private-to-private revolving doors for credit analysts moving from rating agencies to investment banks, finds that movers 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, to our knowledge this is the first paper to

²Other relevant theoretical references include career concerns models, such as Holmstrom (1982), 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.

show 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 revolving door evidence for a large emerging country, using large-scale administrative data.

Third, thanks to the information on prices and wages, we can effectively measure the gains and losses created by revolving door movements for public bodies and workers. 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. Fifth, we show evidence of spillover effects of revolving door connections to other transactions, involving the revolving door individuals and third parties, allowing us both to strengthen the interpretation of the channels for the effects we estimate, and to put a comprehensive tag on the aggregate effects on public sector spending.

In addition, this paper has a close connection with the literature on public procurement. Several channels for wrongdoing have been studied in this literature including bid-rigging, collusion and different types of red tape and waste.³ 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 impact on procurement outcomes has not yet been documented empirically.

Contributions that have dealt specifically with corruption in public procurement include Di Tella and Schargrotsky (2003), Bandiera, Prat and Valletti (2009), and Auriol, Straub and Flochel (2016), to mention only a few. Particularly relevant are recent papers that look at the effect of political connections on the allocation of procurement contracts.⁴ Goldman, Rocholl and So (2013), for instance, investigate whether political connections of publicly traded corporations in the United States, through the participation on their boards of former public officials or politicians, affect the allocation of government procurement contracts. Straub (2014) looks at how a major political change in Paraguay in 2008 affected the volume of contracts going to firms connected to the previous regime. Boas, Hidalgo and Richardson (2014), and Arvate, Barbosa and Fuzitani (2016) study the allocation of government contracts to companies that

³Dimitri, Piga and Spagnolo (2006) provide an early review of the literature on procurement practices.

⁴More 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). Luechinger and Moser (2014) analyze stock market reactions to announcements of political appointments from the private sector and corporate appointments of former government officials in the U.S. Their results suggest that concerns over conflicts of interest created by the revolving door seem justified, even in a country with strong institutions.

contributed to legislators' electoral campaigns in Brazil.

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 transfer of workers in charge of procurement between supplier firms and public offices. Moreover, it analyzes the impact on a richer set of outcomes, including prices of standardized products.

Finally, a few recent papers, including Best, Hjort and Szakonyi (2017), Coviello and Gagliarducci (2011), Decarolis, Giuffrida, Iossa, Mollisi and Spagnolo (2016), and Lacetera, Larsen, Pope and Sydnor (2016), have shown that the characteristics of workers involved in the procurement process, such as their tenure or the incentives they face, significantly affects outcomes. More generally there is growing interest in how public servants' behavior maps into the performance of public services and how internal policies may be framed to make the best of the conflicting interests faced by officials (Finan, Olken and Pande, 2015; Cameron, de Figueiredo and Lewis, 2016). Our findings add to that emerging body of knowledge by documenting how workers' characteristics and efforts, i.e., both adverse selection and moral hazard issues specifically related to their career path and concerns, affect procurement outcomes.

3 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.⁵ 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.

⁵The 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.

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.⁶ 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.⁷

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.⁸ Electronic 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.

This combination of the 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.

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. Brazilian legislation establishes clear and transparent requirements for the selection of civil servants. They acquire tenure after three

⁶The 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.

⁷Dimitri (2012) argues 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.

⁸Public 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 services, and 15,000 Brazilian Reals, for complex engineering services and construction. Inegibility 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 inegibility are also directly negotiated between the administration and the supplier.

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 temporário*). 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.⁹ 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 include it in the worker's booklet, the worker's employment is called informal. The main correlate of 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

⁹Regular civil servants can be promoted to positions of trust (*funções de confiança*), which are high-level public posts with similar status, earning and power to appointees.

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 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.

4 Data

In order to generate a systematic set of revolving door variables to be included in the procurement dataset ComprasNet Data Warehouse, we matched it 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. Table S1 in the supplementary material presents all variables used in the paper, along with their definitions and sources.

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 is an important feature of the data which allows us to compare identical products transacted between firm-administration pairs with and without revolving door connection. 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,¹¹ between 50,481 firms and 977 administrations.¹²

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

¹¹The product space is highly skewed, with a relatively limited number of standard products representing a large share of the total. The 20 most common products represent 1.78% of the total number of contracts awarded between 2000 and 2009, or close to an average of 3,000 contracts each.

¹²The 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.

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. For the subset of the federal procurement contracts that were awarded using ComprasNet, the Brazilian eProcurement System, we also observe all the bidders and bids of each contract awarded, which allows us to obtain the number of suppliers competing for the provision of the product.

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 similar products when buying from different suppliers and using different award mechanisms.¹³

RAIS. It is a comprehensive longitudinal matched employer-employee administrative dataset obtained from an annual census of all formal workers in Brazil (Menezes-Filho, Muendler and Ramey, 2008). RAIS (Relação Anual de Informações Sociais) is a database assembled from mandatory reporting by firms and has been managed by the Brazilian Ministry of Labor every year 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. It is widely recognized as a high-quality Census of the Brazilian formal labor market (Dix-Carneiro, 2014). RAIS covers almost 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.¹⁴ Importantly, when analyzing worker movement between administrations and firms we are excluding movements of elected politicians, thereby focusing on the revolving door movements of regular and not self-employed workers.

Workers have incentive to be accurately reported in RAIS in order to be eligible to receive

¹³In 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 language within different spheres of the Brazilian government.

¹⁴Because 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.

the government benefits they are entitled to.¹⁵ 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 workers' information via RAIS.

The data consist 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 firms/administrations. Since some workers have multiple jobs in a given year, we use all possible job entries to identify a worker's movement between administrations and firms. In the regressions performed to estimate the value of revolving door relationships for workers, we keep only one observation per worker per year, selecting the main job of the individual (defined as the job with highest working hours) to construct a panel of workers and follow them and their job characteristics over time and across employers. In order to have at least two years of pre-data for the analysis of the effect of worker movements between administrations and firms in public procurement, we make use of the RAIS database for the period between 1998 and 2009.

RAIS also comprises a set of variables which are particularly important for our investigation: individual specific data on occupation and employment contract details. 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. Those pieces of information make it possible to distinguish the effect of revolving doors on public procurement contracts by hierarchical level (directors versus other employees) and type of position (permanent civil servants versus appointees).¹⁶

Matching process. To merge the data on procurement with those on worker 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

¹⁵For 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 time the 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.

¹⁶The RAIS employment contract detail data does not allow one to distinguish between civil servants that are occupying or not positions of trusts (*funções de confiança*).

data. This is done by matching firm and public administration CNPJ number between the two datasets,¹⁷ and yields a subset of 10,050,913 workers.

We then identify among these individuals those who moved from a public to a private entity in our sample, and/or the reverse, and create dummy variables capturing those movements. These “revolving door” variables are described next.

4.2 Revolving Door Measures

We construct four different measures of movement of workers between administrations (public bodies/buyers) and firms (suppliers/sellers). All variables are contract level ones, and time t corresponds to the period in which the contract becomes effective. For each contract within an administration-firm pair, and all individuals identified through the matching process described above as being linked to both parties in this pair, the construction is the following.

The first dummy variable identifies the movement of an official that worked for an administration before contracting time t and then moved to a supplier. It means that from the contract point of view at time t , this movement already happened. This variable, named $Admin - Firm - Past_{ijkt}$, is precisely defined as follows:

$$Admin - Firm - Past_{ijkt} = \begin{cases} 1 & \text{if individual } i \text{ employed in firm } j \text{ at time } t \\ & \text{has worked for administration } k \text{ before time } t. \\ 0 & \text{otherwise.} \end{cases}$$

The second dummy variable $Admin - Firm - Future_{ijkt}$ similarly identifies an official’s movement from an administration to a supplier. It differs however in that it identifies movements happening in a period posterior to the contracting time. It is defined as:

$$Admin - Firm - Future_{ijkt} = \begin{cases} 1 & \text{if individual } i \text{ employed in administration } k \text{ at time } t \\ & \text{becomes a worker for firm } j \text{ after time } t. \\ 0 & \text{otherwise.} \end{cases}$$

The third dummy variable, $Firm - Admin - Past_{ijkt}$, identifies the movement of an official that worked for a supplier before contracting time t and then moved to an administration. It

¹⁷The 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.

is defined as:

$$Firm - Admin - Past_{ijkt} = \begin{cases} 1 & \text{if individual } i \text{ employed in administration } k \text{ at time } t \\ & \text{has worked for firm } j \text{ before time } t. \\ 0 & \text{otherwise.} \end{cases}$$

Finally, the fourth dummy variable also identifies the movement of a worker from a firm to an administration, but one happening after the procurement transaction is signed between the contracting partners. Formally, this variable, named $Firm - Admin - Future_{ijkt}$, is defined as follows:

$$Firm - Admin - Future_{ijkt} = \begin{cases} 1 & \text{if individual } i \text{ employed in firm } j \text{ at time } t \\ & \text{becomes a worker for administration } k \text{ after time } t. \\ 0 & \text{otherwise.} \end{cases}$$

Three aspects are worth noting. First, distinguishing the future versus past part of the revolving door relationship is important because the theory predicts that the incentives and resulting behavior of workers may differ across these stages. Second, when identifying revolving door workers, we initially focus on all the individuals active in the firms and administrations, as it is not always possible to define who has a say in the procurement process. Third, we also consider that the impact of revolving door movements on public-private procurement transactions is likely to depend on the hierarchical position of the moving individuals during their tour of duty in the administration. To investigate the revolving door effects according to this dimension, 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 in public administrations.

We are particularly interested in understanding the movement effect of appointees versus civil servants, since the nature of their hiring process and their career concerns are different. Civil servants in the Brazilian 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 equally or higher paid than civil servants. By comparing the revolving door

effects for those two categories of public workers, we shed some light on how different public sector appointment processes and career-related incentives affect the performance of the procurement process.

Directors/managers play important role in public administrations.¹⁸ 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.

After constructing all those individual revolving door dummies, we aggregate them at the administration-firm pair level, by coding as 1 a pair that has at least one individual level connection. To be precise, the pairs revolving door dummies (RD 's) are derived from the contract-level ones defined above in the following way: $RD_{jkt} = \max_i \{RD_{ijkt}\}$. So for example, $Admin - Firm - Past_{jkt}$ is a dummy equal to 1 if firm j employs at time t at least one individual, who has been previously employed by administration k . In our main estimations below, we use an “any time” version of these dummies. This means for example that $Admin - Firm - Past_{jkt}$ takes value 1 if firm j employs at time t some individual who has worked for administration j at least in one time period before t . Figure 1 provides a summary view of these four categories of revolving door variables, by reference to the contracting timeline.

In addition, by summing variables $Admin - Firm - Past_{jkt}$ and $Admin - Firm - Future_{jkt}$, we obtain a dummy variable that captures both past and future movements from an administration to a firm, i.e., is equal to one for a given administration-firm pair in all periods where one or more “admin-to-firm types” revolving door workers are active in one of the contracting parties. This variable is named $Admin - Firm_{jkt}$.

Similarly, by adding $Firm - Admin - Past_{jkt}$ and $Firm - Admin - Future_{jkt}$, we obtain a dummy variable that captures all movements from a firm to an administration. We name this variable $Firm - Admin_{jkt}$.

4.3 Descriptive Statistics

Table 1 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

¹⁸The 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.

the period of analysis. Table 2 contains descriptive statistics of some of the key procurement outcomes that we investigate in this paper: contract size (volume), acquisition price, contract value, and yearly amount of contracts in Panel A, award procedures in Panel B, and other procurement variables in Panel C. As can be seen there, only around 30% of our observations are electronic auctions and close to 45% are direct purchases.¹⁹

Table 3 then shows that over 2% of all contracts involve some revolving door connection, representing 5.4% of the value transacted for health products over the period. It 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.²⁰ The fact that many administration-firm pairs experience these different types of connection simultaneously has implications for our empirical strategy that are discussed below.

At the worker level, in our sample 3,639 individuals completed a movement from an administration to a firm, and 5,164 moved in the other direction (Table 4). 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. We exploit this heterogeneity in our analysis below by distinguishing revolving door worker by type of position (permanent civil servants and appointees versus temporary workers) and hierarchical level (directors versus other employees).

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 (2017) study, respectively, 179 and 33 credit analysts that left rating agencies to work at firms they rate.

¹⁹The 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.

²⁰This explains why the numbers are higher when looking at the breakdown by types of movements.

5 Empirical Strategy

To identify how worker movements affect procurement outcomes (acquisition prices, transacted volumes, and contract value) we use the contract-level dataset, where an observation is a purchase agreement for a good l , between administration k and firm j , at time t .

We estimate the following equation:

$$\ln y_{ljk t} = \alpha_l + \kappa_t + \tau_{jk} + \beta RD_{jkt} + X'_{jt} \gamma + W'_{kt} \delta + u_{ljk t}, \quad (1)$$

where $y_{ljk t}$ is a procurement outcome variable. On the right-hand side α_l , κ_t and τ_{jk} are product, time, and administration-firm pair fixed effects respectively, X_{jt} and W_{kt} are vectors of time variant observable characteristics of firms and administrations respectively, and $u_{ljk t}$ is an error term, which is assumed to have expectation zero, a product-specific variance, denoted by σ_l^2 , and to be uncorrelated with other regressors in equation (1).^{21,22}

In addition, we also collapse the data at the firm-administration-year level and estimate the impact of revolving doors on the total amount and number of contracts, using the following model:²³

$$\ln y_{jkt} = \kappa_t + \tau_{jk} + \beta RD_{jkt} + X'_{jt} \gamma + W'_{kt} \delta + \nu_{jkt}, \quad (2)$$

In equation (2), the error term ν_{jkt} is assumed to have expectation zero, an administration-firm pair-specific variance, denoted by σ_{jk}^2 , and to be uncorrelated with other regressors. In these two specifications, the coefficient β accounts for the effect of revolving door dummies on the outcome of interest.

Identification. The inclusion of firm-administration pair fixed effects implies that 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 revolving door connections are established or lost.²⁴

Such value switch can occur for two reasons: first, a revolving door worker enters or exits the pair; second, this worker moves from one member to the other. These two cases and the

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 means. See the supplementary material for details on how equations (1) and (2) are estimated.

²²The results are robust to standard errors clustered at firm-administration-product level, denoted by σ_{ljk}^2 .

²³This panel is unbalanced, since a supplier-administration pair does not necessarily transact every year.

²⁴This 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.

identification strategy are illustrated in a simple example in Figure 2.

Consider, in the upper part of Figure 2, a pair jk , which has no worker in common for the first two periods (2000-2001), then a revolving door worker in common between 2002 and 2009. This individual works for the administration k in 2002 and 2003, and then for the firm j in 2004-2009. Assuming this pair transacts in all periods, the *Admin – Firm – Future* dummy, which refers to the first stage of the relationship, when the worker is in the administration, will take value 1 in 2002 and 2003, and 0 in all other periods. On the other hand, the *Admin – Firm – Past* dummy, which corresponds to the second stage when the worker moved to the firm, takes value 1 from 2004 onwards. Finally, summing the two, the *Admin – Firm* dummy takes value 1 from 2002 to 2009, i.e., in all periods in which the person works for any of the pair members. The transition from 2001 to 2002 corresponds to the worker entering the pair, while the one from 2003 to 2004 is a movement within the pair. Note that the *Admin – Firm – Future* variable refers to the first stage of the relationship, when the worker is in the administration, while *Admin – Firm – Past* one corresponds to the second stage, when the worker has moved to the firm.

Following the difference and difference approach, we identify the effect of revolving doors by comparing the temporal variation of the outcome variables for pairs which experienced some “movement”, the revolving door group (upper part of Figure 2), with those pairs which did not experience “movement”, the counterfactual group (bottom part of that figure), controlling for product fixed effects, and observable time variant firm and administration characteristics.

We start by pooling the 2002-2003 and the 2004-2009 period and look at the effect of the *Admin – Firm* dummy. The point estimate basically compares the 2002-2009 period, in which there is a connection, with the previous one (2000-2001), in which there is none, and therefore provides the average treatment effect over the whole lifecycle of the revolving door relationship with respect to the counterfactual group. This is meaningful if the impact of connections on outcomes is likely to occur over both stages of the relationship, something we cannot discard a priori.

Including the *Admin – Firm – Future* dummy alone would identify its effect at the within firm-admin pair level out of the difference between 2002-2003 and both the previous “unconnected” period 2000-2001, and the later 2004-2009 “connected” period, in which the worker has moved to the firm. Similarly, the *Admin – Firm – Past* dummy alone would provide an estimate comparing the 2004-2009 period to the previous one (2000-2003), in which there was first no link (2000-2001), and then a period in which the worker was in the administration (2002-2003).

To address this issue, we include both *Admin – Firm – Future* and *Admin – Firm – Past*

simultaneously. In this way, *Admin – Firm – Future* for example is identified out of the comparison with the previous periods (2000-01 in our example) only. The same applies to *Admin – Firm – Past*, which is purged of the effect of *Admin – Firm – Future*. The interpretation of the coefficients is straightforward. Since the dependent variables are logged, they capture the percentage change in outcomes when a connection becomes active compared to the benchmark when there is no connection.

Threats to Identification. The main issue in our setting relates to firm or administration-level unobserved attributes that may affect both our outcomes of interest and the likelihood of a revolving door connection in a given pair. Our within-pair estimates already control for any time invariant determinants that can have such an effect.

In addition, we control for a number of time variant observable characteristics. These include year-on-year administration budgets, firm sales, contract-specific award procedures, as well as product-specific prices. Because 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.²⁵ We also systematically present results with and without these controls.²⁶

An additional source of time variant controls is provided by the inclusion of other revolving door dummies. For example, when estimating the effect of *Admin–Firm* dummies, we include *Firm – Admin* dummies as well.

Finally, the spillover estimates described in Section 7 below reinforce our confidence in the results, as they show that revolving door movements also affect unrelated firms and administrations in predictable ways, hence weakening the case that the effects we find are driven by unobserved attributes of the pairs. Overall, this leads us to think that whatever the reasons driving worker movements, we obtain unbiased estimates of revolving door movements on outcomes.

A more generic caveat can be made regarding our benchmark, namely pairs that do not experience revolving door connections in our sample. Such pairs may of course be using other channels to collude or support long term relationships, for example through side payments and bribes, or shareholder-level connections for example. We cannot address this with the data at hand, absent specific information on other channels, but note that this limitation of

²⁵By including the yearly supplier procurement revenue in the regressions, we are controlling for changes in time variant firm characteristics (e.g., productivity) which may affect sales to the federal government. Similarly, by controlling for yearly administration procurement expenditure, we are accounting for administration budget cuts or expansions that may affect the acquisition of goods and services.

²⁶We 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.

course applies broadly to the empirical political connections and corruption literature.

Revolving Door Effects by Type of Workers. We take advantage of the large number of observations, by differencing along an additional dimension of heterogeneity, namely revolving door corresponding to different types of workers according to their roles in the public sector: appointees, civil servants, and directors/managers.²⁷ Calling the worker type dummies D_w , the estimating equation becomes:

$$\ln y_{ljk t} = \alpha_l + \kappa_t + \tau_{jk} + RD'_{jkt}\beta + (RD'_{jkt} * D_w)\rho + X'_{jt}\gamma + W'_{kt}\delta + u_{ljk t}. \quad (3)$$

6 Main Results

Generic connections. We start by looking at the overall impact of revolving door connections. A firm-administration pair is coded as being connected in a given time period if any of the four revolving door dummies defined above is equal to 1 in that period. We call this variable *Any Revolving Door*.

As can be seen in Table 5, connected pairs receive significantly larger total amounts of contracts in years where some connection is active. The point estimate, which is stable to inclusion of time variant controls, indicates that connections increase this amount by close to 20%.

Looking at the contract level outcomes, columns 3 to 8 show that connected pairs are characterized by significantly lower prices and higher volume (quantity), which results in smaller contract values. Taking the estimates with time-varying controls included, average effects are a 15% drop in prices, a 25% increase in contract size, and a 4% decrease in contract value.

Together, these results indicate that pairs with generic revolving door connections transact more, and this takes place through more, smaller contracts, at reduced prices. 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.

Administration to Firm Movements. Looking first at the pooled *Admin – to – Firm* movements, measured by the variable *Admin – Firm*, the results in Table 6 are consistent with those found above, again with a positive and significant effect on yearly amounts of

²⁷In the estimations of the effect of revolving doors for appointees and civil servants, the baseline group consists of temporary workers. When we estimate revolving door effects for directors/managers, the baseline group is composed of all other workers.

contracts, and negative contract-level effects on prices, quantities, and contract values.²⁸

The results reveal that a public administration employing a public official, who in the future will work for a public provider acquires products from the latter at lower prices (17%-21%, with respect to the counterfactual group). In addition, we observe that when that particular public official moves to a private provider, the latter starts to sell more (53%-55%) at lower price (19%-22%) to that public entity, with respect to the counterfactual group.²⁹

Contrasting the *Admin – Firm – Future* and *Admin – Firm – Past* parts of the relationship yields some additional insights into the dynamic of this type of revolving door relationship. At the contract level, prices and contract value decrease slightly more, and quantities decrease less in the second period of the relationship when the worker moves to the firm, but the differences are small. The most striking contrast, however, is in the evolution of the yearly amount of transactions, which is stable in the first period and shoots up by more than 50% in the second period, once the worker is with the firm.

In Table 7, we further interact the *Admin – to – Firm* dummies with indicators of the type of position the public officials hold, namely whether they are regular civil servants or political appointees. The bottom panel shows the net effects by categories of workers, together with tests of the significance of the sum of coefficients. The results show that the effects uncovered above are entirely due to the category of regular civil servants, while they are indistinguishable from zero for appointees.³⁰

In Table 8, we show interactions of the *Admin – to – Firm* revolving door dummies with a dummy taking value one if workers have a director rank. The results show that the effects are even larger for this category, in particular with strongly negative impacts on prices.³¹

Our interpretation of these 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 and quantities 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

²⁸When we estimate the effect of the Admin-Firm variable, Admin-Firm-Past and Admin-Firm-Future dummies are excluded from the regression, and the Firm-Admin variable is the only other revolving door dummy included. Similarly, we exclude the Admin-Firm variable when we estimate the effect of Admin-Firm-Past and Admin-Firm-Future dummies, and Firm-Admin-Past and Firm-Admin-Future variables are the only other revolving door dummies included.

²⁹This and the following interpretations of the estimated effects of revolving doors are framed in the context of a single worker's movement. When more than one worker move within a pair, the interpretations hold for the movement of the set of workers.

³⁰It is possible, however, that the concentration of effects on civil servants simply reflects the fact that they represent the overwhelming majority of revolving door workers.

³¹The revolving door effects by type of position (permanent civil servants versus appointees) and hierarchical level (directors versus other employees) of workers were estimated in different regressions. The results are similar if these effects are estimated in the same regression.

to the period he was in public office, the firm manages greater quantities and, above all, more contracts.

Overall, these gains support a benign, efficiency-enhancing view of revolving door, in which it creates incentives for public officials to perform while they work in the administration, especially so at higher hierarchical levels.

Our results on different outcomes 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. This story, however, is not compatible with the finding that quantities also decrease for the target firm in the first period of the relationship. We return below, when looking at spillovers, to the nature of this first period relationship, and in particular discuss whether the official's effort in the first period are generic, directed at all firms, or targeted only at his future employer.

The other one 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 seems again not to be the right story because we also observe a drop in prices after the former public officer moves to the private provider.

Firm to Administration Movements. In Table 9 the *Firm-to-Admin* dummy displays a positive and significant impact on the yearly amount of contract in the second period of the relationship (29%-30%), when the worker has moved from the firm to the administration.

At the contract level, this is mirrored by positive and significant effects on contract size (i.e., volume increases by 37%-40% for Firm-Admin-Future and 21%-46% for Firm-Admin-Past) and overall value in both periods (19%-25% for Firm-Admin-Future and 11%-28% for Firm-Admin-Past), and a weakly positive effect on prices (7.5%) depending on the controls. These results reveal that when a private provider hires a worker, who in the future will become a public administration employee, it sells its products to the latter at weakly higher prices. When that particular private worker moves to a public entity, the latter starts to buy more from that private provider at weakly higher prices. So, connected firms appear to be getting more numerous and larger contracts, at prices that are equal or higher than for unconnected ones.

In contrast to admin-to-firm movements, movements of workers from the private to the public sector appear to be detrimental to public buyers, which end up buying more at a higher price. A potential interpretation is that while in the private sector, connected workers take advantage of their relationships to obtain favorable contracts for their private employer. Having later secured a job in the administration, they gain greater control over the procurement process, and continue to have privileged relationships with their former private sector employer, explaining the surge in the amount of contracts in the second period. Note that in this case, the specific relationship is established from the start, so the negative effects kick in immediately in the first period of the relationship.

The results in Table 10 show that the effect of Firm-to-Admin movements are different for appointees and civil servants. The price- and quantity-increasing effects concentrate on civil servants, while there is some evidence of negative effects on price and contract value related to appointee movements, which do not translate into an effect on yearly amount of transactions at the pair level. So, contrary to public-to-private movements, negative effects are now driven by civil servants and positive ones by movements of appointees.

Interestingly, the estimated coefficients displayed in Table 11 show that directors also exhibit a price-decreasing effect. This, combined with the one shown in the previous section, reveals an interesting result: movements of directors (i.e., top managers) in both directions (public-to-private and private-to-public) seem to be beneficial, and in the worst case neutral, to the public sector. This is an important finding because directors are usually the ones restricted by revolving door rules and regulations on working for private organizations during certain cooling-off periods. Our results show that those kinds of regulations can actually be detrimental to the public sector. We discuss this further when addressing policy implications in Section 10 below.

The fact that civil servants are driving this effect supports a selection story, and raises the issue that the mid-career hiring process in the public sector may fail to separate good recruits from bad ones. This is further supported by the fact that we find beneficial effects for appointees and directors, both categories for which specific public administrations may enjoy greater discretion in the hiring process, contrary to the case of civil servants.

Next we turn to evidence of spillovers to complement our interpretations.

7 Revolving Door Spillovers

While revolving door workers are expected to have an impact on the history of transactions of the entities they work for, they also incidentally deal with other firms when buying on behalf

of the administration side of the pair, and with other public entities when selling on behalf of the private counterpart. As a result, it is likely that the specific incentives they face may also affect the terms of the exchanges with these outside parties, in a way that can help shed light on the nature of these incentives.

To analyze these spillover effects, we estimate the following specification:

$$\ln y_{ljk t} = \alpha_l + \kappa_t + \tau_{jk} + RD'_{jkt}\beta + RD'_{-j,kt}\rho + RD'_{j,-k,t}\sigma + X'_{jt}\gamma + W'_{kt}\delta + u_{ljk t}. \quad (4)$$

In this equation, RD_{jkt} denotes our regular revolving door dummies, taking value 1 if the firm-administration jk has a revolving door worker active in one of the parties when contracting at time t , and $RD_{-j,kt}$ and $RD_{j,-k,t}$ are spillover dummy variables equal to 1 for pairs having contracts in the same period and formed, respectively, by administration k and firms other than j , and by firm j and administrations other than k .

Figure 3 illustrates the logic behind this estimation. Spillovers are identified out of changes within “spillover pairs”, namely pairs involving one of the revolving door partners and an outside counterpart. Here, the connected pair is *Administration 3 – Firm 3*, and it trades in period t . In the same period, *Administration 3* also buys from *Firm 2*, but has no revolving door connection with it. Similar to our main estimation, the spillover effects of revolving doors on *Administration 3 – Firm 2* outcomes are identified within pairs, i.e., out of the changes in *Administration 3* and *Firm 2* trade between periods with no active revolving door connection involving *Administration 3*, and periods in which these connections are active. Other connections, between *Administrations 1, 2, and 4*, and *Firms 1, 2, 4, and 5*, for example, represent our counterfactual.

The results from estimating equation (4) for *admin – to – firm* movements are in Table 12. Note that from our point of view, the relevant relationships are those involving a “contemporaneous” revolving door worker. Hence, when looking at the first period of the *admin – to – firm* connection (i.e., *admin – firm – future*), we are interested in estimating the spillover from the individual in the administration on other firms he is dealing with, while for the second period of the relationship (i.e., *admin – firm – past*), we are interested in the spillovers on other administrations dealing with the firm he has moved to. The upper panel shows results for the simple interactions, while the bottom one shows the triple interactions with worker categories.³²

The results show that the direct effects found above are also found in a qualitatively

³²To make tables easier to read, only the net effects for appointees, civil servants, and directors are shown, with the corresponding p-value test. Remember that Admin-Firm-Future variables refer to the first stage of the relationship, when the worker is in the administration, while Admin-Firm-Past ones correspond to the second stage, when the worker has moved to the firm.

similar way in the incidental relationships of revolving door workers. Focusing on prices, in the *admin – to – firm* relationships, we find that in the first period the administration employing the worker is buying at lower prices from non-connected firms. The effects by categories of workers are shown in the bottom panel. For civil servants, and especially for directors, who were shown in the previous section to drive the effects on price, there are significant spillovers that translate into lower prices, while effects are reversed for appointees.³³

After the move, in turn, the effect are also quite heterogeneous. While firms employing former appointees sell at higher prices to other administrations, those employing former civil servants do not show any systematic pattern, and those employing directors still get lower prices.

Overall, this is consistent with an efficiency story, but also with a specific interpretation of the signaling story. In the first period, public officials (specifically civil servants and directors) do their job efficiently, reducing prices paid to all providers, not only their future employers. On the other hand, the appointee effect once they have moved to a firm can be interpreted as a confirmation that this category, contrary to civil servants, entertains connections, consistently with the positive effects on prices at both stages of the relationship.

The estimates for *firm – to – admin* movement spillovers in Table 13 again tell a different story. The firm where the worker initiates his revolving door trajectory gets lower prices from other administrations, in sharp contrast with the fact that it sells at significantly higher prices to the administration where the worker will eventually move. On the other hand, after the move the target administration buys at higher prices, even from non-connected firms. Note that, when that particular private worker moves to a public entity, the latter increases its purchases from the other private providers less (20%) than from the firm that hired that former public official in the first place (50%). As shown in the lower panel, these effects are again driven by civil servants, and especially directors.

This case seems inconsistent with an efficiency story, but fits a scenario in which the worker diverts the effort of the firm where he works in the first period towards a specific administration he has connection with, to the detriment of other potential buyers. In addition, it indicates that the worker's presence in the firm hurts its ability to gain contracts from non-connected administrations. One possibility is that there is a collusive agreement between the main pair, which hurts other firms. After moving to this specific administration, this institution buys larger amounts at higher prices from other firms as well, which is again compatible with a bribe-taking behavior.

There are two main takeaways from these results. First, they allow us to confirm the

³³Controlling for administration total budgets, effects on quantities should be complementary to the direct ones shown above, so we do not provide a separate interpretation.

interpretation of the main effects put forward in the previous section. Second, and this is a very important point, they show that the potential effects of revolving doors go beyond the players directly involved in the relationship, and in fact also have an impact on the transactions that these players conduct with all other parties. Given the complex web of buyer-seller relationships that exist in procurement systems, this cannot simply be disregarded. We come back to this point below when estimating the aggregate impact of revolving doors on procurement expenses.

8 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:

$$y_{ijt} = \theta_i + \xi_j + X'_{it}\beta + \nu_{ijt}, \quad (5)$$

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 attributes such as gender, age, and education level, as well as employment contract type at the time of the movement.

The follow-up estimating equation is given by:

$$\hat{\theta}_i = u'_i\gamma + \alpha_i, \quad (6)$$

where $\hat{\theta}_i$ is the predicted worker i fixed effect from (5), 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 (5) are in the upper panel of Table 14. 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.³⁴

The lower panel of Table 14 then presents the results from estimating equation (6) on a set of 7.8 million workers for whom there is enough time variation, based on the worker fixed effects estimated with (5). 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.³⁵

Finally, Table 15 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 14) on revolving door dummies and their interactions with either workers' gender, age and education level, or type of public positions held.

The values are computed assuming an age equal to the sample average (36).³⁶ The results are striking. A gap equal to between 25 and 30% of the average sample wage separates premiums for men from women. As a result, men in both the secondary school and higher education brackets earn a positive premium, while this is only the case for women with higher education. Overall, large premiums are only found for workers with higher education.

Looking at the categories of employment also reveals significant differences. 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.³⁷ 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, an aspect that we come back to below when discussing the policy implications of our results.

Note finally that although it is known from the literature (e.g., Finan, Olken and Pande,

³⁴Simpler specifications omitting occupation and type of contract fixed effects yield almost identical results for both (5) and (6).

³⁵The average sample wage corresponds to R\$ 1,450 at 2000 value.

³⁶Each additional year of age at the time of movement adds a 2% to the premium.

³⁷It is worth mentioning that these differences across categories may also drive the gender results above, as fewer women hold director positions. This is the subject of separate ongoing research.

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.

9 Aggregate Impact

Based on the estimates in Tables 6 and 9, we can 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:

$$S = \sum_{i \in RD} p_i q_i + \sum_{i \in SRD} p_i q_i + \sum_{i \in NRD} p_i q_i, \quad (7)$$

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, SRD and NRD, which are, respectively, the subsets of transactions with revolving doors, with spillover of revolving doors, and without any 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.

Given β_{pq}^{RD} and β_{pq}^{SRD} , which are the estimated semi-elasticities of contract value corresponding to the main revolving door and the spillover effects respectively, for contracts of observed value $p_i q_i$ in sets RD and SRD, the predicted values from shutting down the revolving door are $p_i \bar{q}_i = \frac{p_i q_i}{1 + \beta_{pq}^{RD}}$ and $p_i \bar{q}_i = \frac{p_i q_i}{1 + \beta_{pq}^{SRD}}$ respectively.³⁸

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

$$\bar{S} = \sum_{i \in RD} \frac{p_i q_i}{1 + \beta_{pq}^{RD}} + \sum_{i \in SRD} \frac{p_i q_i}{1 + \beta_{pq}^{SRD}} + \sum_{i \in NRD} p_i q_i. \quad (8)$$

In Table 16 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, and for the direct and indirect effects.³⁹

First, the beneficial effects of admin-to-firm revolving doors are not negligible. Shutting down this channel would imply a 3.1% increase in spending, of which 2.8% corresponds to

³⁸The derivations that follow are largely unchanged if using instead separate elasticities for price and volume (contract size), so we stick to contract value throughout.

³⁹We use estimates from Column 8, upper panels of Tables 12 and 13.

direct effects, and 0.3% to the indirect ones.

The detrimental effects of firm-to-admin effects are slightly smaller, at 1.9%. Again, the direct effects represent the bulk, at 1.6%, while the indirect effects sum to 0.3%.⁴⁰

The values are also significant. Health procurement contracts in our ten-year sample amount to R\$ 2.1 billion and admin-to-firm revolving door savings to R\$ 685 million, while firm-to-admin losses represent R\$ 426 million. Extrapolating our revolving door results to a total amount of procurement equal to the OECD estimate of 10% of GDP (mentioned in the introduction) leads to gains and losses of around 0.3% and 0.2% of GDP respectively.

We must 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 be considered a beneficial outcome.

Second, there could be general equilibrium effects affecting other firms and the level of overall competition for example, although given the size of direct spillovers, these are likely to be limited. 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 for our results in the next section.

10 Policy Implications

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,⁴¹ 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

⁴⁰Note that these are lower bounds on indirect effects, as they are computed lumping together effects at each stage of the revolving door relationships that sometimes cancel each other.

⁴¹See Transparency International (2010).

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. 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.

Second, the fact that we detect significant spillovers means that just regulating dealings with former employers may not suffice to prevent detrimental effects. In this case, 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.

Finally, different workers categories appear to warrant differential treatment. On the one hand, we find mostly positive impacts of directors' movements. Focusing the bulk of revolving door regulations on this category might be counterproductive in the context of Brazilian public procurement.

On the other hand, in the case of post-public employment, our results show a clear difference between career civil servants, where 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.

11 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-supplier connections, consistent with signaling by high-skill workers, and negative effects of supplier-to-administration ones, possibly related to collusion. Revolving doors in procurement jobs have important monetary consequences. Workers obtain significant wage benefits, and we estimate on overall impact of between -3% and $+2\%$ of total spending.

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.

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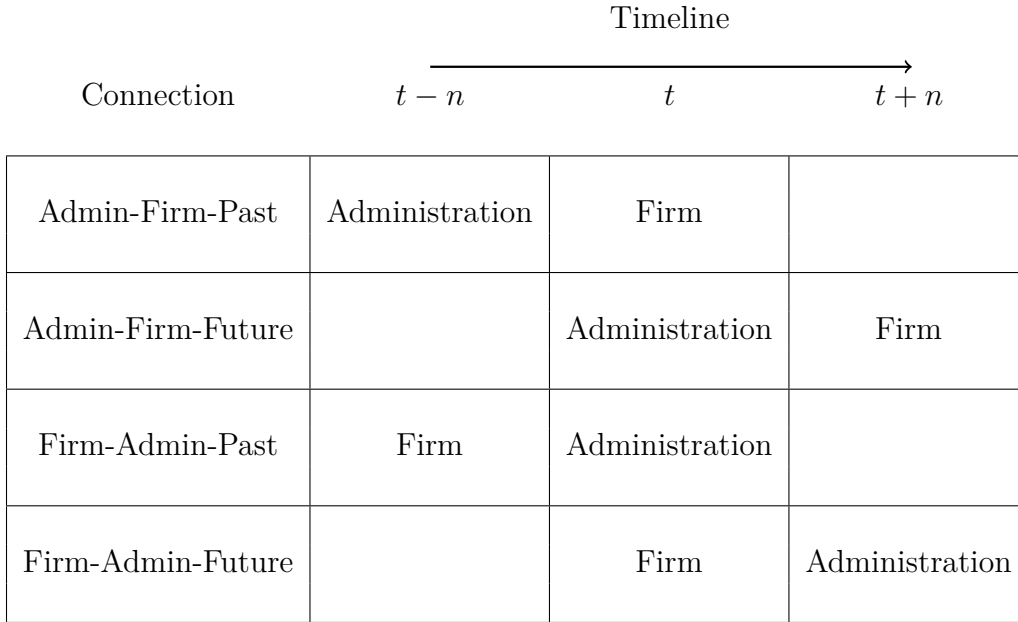
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Appendix

Figure 1: Revolving Doors Dummies



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. The dummy variable *Admin – Firm – Past* diagnoses the movement of an official that worked for an administration before contracting time t and then moved to a firm/supplier. *Admin – Firm – Future* identifies an official’s movement from an administration to a firm after contracting time t . *Firm – Admin – Past* establishes the movement of an official that worked for firm before contracting time t and then moved to an administration. *Firm – Admin – Future* identifies a worker’s movement from a firm to an administration after contracting time t .

Figure 2: Identification Strategy: An Illustrative Example

Revolving Door Group:

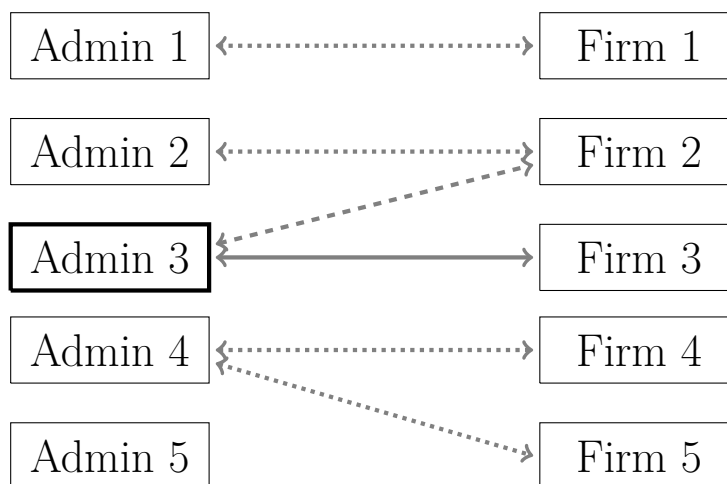
Worker i location	None	None	A_k	A_k	F_j	F_j	F_j	F_j	F_j	F_j
t	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Admin-Firm-Future $_{jkt}$	0	0	1	1	0	0	0	0	0	0
Admin-Firm-Past $_{jkt}$	0	0	0	0	1	1	1	1	1	1
Admin-Firm $_{jkt}$	0	0	1	1	1	1	1	1	1	1

Counterfactual Group:

t	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Admin-Firm-Future $_{j'k't}$	0	0	0	0	0	0	0	0	0	0
Admin-Firm-Past $_{j'k't}$	0	0	0	0	0	0	0	0	0	0
Admin-Firm $_{j'k't}$	0	0	0	0	0	0	0	0	0	0

Notes: This figure illustrates the identification strategy used in this paper to estimate the effect of revolving doors on procurement outcomes. It is based on a hypothetical situation of a worker i that did not work for any administration or supplier in 2000 and 2001, worked for the administration k (A_k) in 2002 and 2003, and then moved to the firm j (F_j) in 2004-2009. Revolving door variables $Admin - Firm - Past$ and $Admin - Firm - Future$ are constructed for firm-administration pairs, which had and did not have a worker in common during his/her lifetime, respectively pair jk (revolving door group) and pair $j'k'$ (counterfactual group), assuming that the pairs jk and $j'k'$ transact every period. The description of how the revolving door variables $Admin - Firm - Past$ and $Admin - Firm - Future$ are constructed is in Section 4.2. The variable $Admin - Firm$ dummy takes value 1 in period t if at least one of the “admin-to-firm” variables (past and future) are equal to 1 for a firm-administration pair in period t .

Figure 3: Revolving Door Spillovers



Notes: This figure displays a diagrammatic representation of revolving door, spillover and pure counterfactual pairs, and illustrates how they are identified in the data. Revolving door pairs refer to administrations and firms that trade and have a worker in common during his/her lifetime (here Admin 3-Firm 3). Spillover pairs are the ones formed by one of the revolving door partners and an outside administration / firm (here Admin 3-Firm 2). The other pairs are pure counterfactual ones. The revolving door and the spillover pairs are connected, respectively, by solid and dashed lines. The other pairs are linked by dotted lines.

Table 1: 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 2: 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. Contract value, yearly amount of contracts, yearly administration procurement expenditure and yearly supplier procurement revenue are in Brazilian Reals of 2000 (divided by 100). All variables were constructed as described in Table S1 in the supplementary material.

Table 3: Descriptive Statistics - Revolving Door Workers

	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-Past	2 299 786	13 710	0.60%	1.86%
Admin-Firm-Future	1 968 618	12 169	0.62%	1.85%
Firm-Admin	1 968 618	26 835	1.38%	5.01%
Firm-Admin-Past	2 299 786	19 050	0.83%	4.19%
Firm-Admin-Future	1 968 618	16 585	0.85%	4.46%

Notes: This table describes summary statistics of revolving door variables described in Table S1 in the supplementary material. Column 1 reports the total number of contracts that we use to compute each revolving door variable. The fact that “Future” variables have less observations is due to the fact that we are unable to compute them for the last year in our sample (2009). Column 2 shows the number of contracts that involves a revolving door connection. Column 3 and 4 display, respectively, the share of the number of contracts and the share of the total value transacted of contracts involving a revolving door connection.

Table 4: 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 5: Generic Revolving Doors

	Yearly Amount	Yearly Amount	Price	Price	Volume	Volume	Contract Value	Contract Value
	1	2	3	4	5	6	7	8
Any Revolving Door	0.18687** (0.0749)	0.1991*** (0.0748)	-0.1800*** (0.0165)	-0.1464*** (0.0163)	0.2556*** (0.0224)	0.2501*** (0.0218)	-0.0626*** (0.0194)	-0.0366* (0.0188)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Firm-Admin Pair F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product F.E.	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	156 894	156 894	1 968 618	1 968 618	1 968 618	1 968 618	1 968 618	1 968 618

Notes: This table reports the estimated effect of a generic revolving door movement (i.e., Any Revolving Door) on procurement outcomes. In columns 1 and 2, the estimated equation is (2), and the dependent variable is yearly amount of contract per firm-administration pair (Yearly Amount). In columns 3 to 8, the estimated equation is (1). In columns 3 and 4, the dependent variable is acquisition price (Price). In columns 5 and 6, the dependent variable is quantity (Volume). In columns 7 and 8, the dependent variable is price x quantity (Contract Value). All regressions include firm-administration pair and year fixed effects. In columns 3 to 8, we also control for product fixed-effects. Regressions in columns 1, 3, 5 and 7 do not use additional controls. Regressions in columns 2, 4, 6 and 8 control for previous year administration procurement expenditure and previous year supplier procurement revenue. In columns 4, 6 and 8, we also control for the awarding procedure used to allocate the procurement contract and price registration system dummy. Robust standard errors clustered at the product level are in parentheses: *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table 6: Admin-to-Firm Revolving Doors

	Yearly Amount	Yearly Amount	Price	Price	Volume	Volume	Contract Value	Contract Value
	1	2	3	4	5	6	7	8
Admin-Firm	0.19366* (0.1091)	0.2435** (0.1135)	-0.2980*** (0.0215)	-0.2473*** (0.0211)	-0.2683*** (0.0292)	-0.1130*** (0.0283)	-0.4204*** (0.0253)	-0.2961*** (0.0245)
Admin-Firm-Future	-0.0417 (0.1271)	0.0102 (0.1270)	-0.2125*** (0.0283)	-0.1697*** (0.0279)	-0.3202*** (0.0385)	-0.1573*** (0.0374)	-0.3590*** (0.0334)	-0.2382*** (0.0323)
Admin-Firm-Past	0.5335*** (0.1137)	0.5554*** (0.0969)	-0.2171*** (0.0252)	-0.1941*** (0.0248)	-0.2190*** (0.0342)	-0.1344*** (0.0332)	-0.3168*** (0.0297)	-0.2524*** (0.0287)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Firm-Admin Pair F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product F.E.	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	156 894	156 894	1 968 618	1 968 618	1 968 618	1 968 618	1 968 618	1 968 618

Notes: This table reports the estimated effect of Admin-Firm, Admin-Firm-Future and Admin-Firm-Past dummy variables on procurement outcomes. In columns 1 and 2, the estimated equation is (2), and the dependent variable is yearly amount of contract per firm-administration pair (Yearly Amount). In columns 3 to 8, the estimated equation is (1). In columns 3 and 4, the dependent variable is acquisition price (Price). In columns 5 and 6, the dependent variable is quantity (Volume). In columns 7 and 8, the dependent variable is price x quantity (Contract Value). When we estimate the effect of Admin-Firm variable on a procurement outcome, Admin-Firm-Past and Admin-Firm-Future dummies are excluded from the regression, and Firm-Admin variable is the only other revolving door dummy included in the regression. Similarly, we exclude Admin-Firm variable from the regression when we estimate the effect of Admin-Firm-Past and Admin-Firm-Future dummies on an outcome variable, and Firm-Admin-Past and Firm-Admin-Future variables are the only other revolving door dummies included in the regression. All regressions include firm-administration pair and year fixed effects. In columns 3 to 8, we also control for product fixed-effects. Regressions in columns 1, 3, 5 and 7 do not use additional controls. Regressions in columns 2, 4, 6 and 8 control for previous year administration procurement expenditure and previous year supplier procurement revenue. In columns 4, 6 and 8, we also control for the awarding procedure used to allocate the procurement contract and price registration system dummy. Robust standard errors clustered at the product level are in parentheses: *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table 7: Admin-to-Firm Revolving Doors by Types of Workers' Position

		Yearly Amount	Yearly Amount	Price	Price	Volume	Volume	Contract Value	Contract Value
		1	2	3	4	5	6	7	8
(1)	A-F-Future	-0.8148*	-0.7958	-0.1181	-0.2625**	0.0399	-0.3924**	-0.0998	-0.4345***
		(0.4913)	(0.4907)	(0.1338)	(0.1318)	(0.1821)	(0.1768)	(0.1578)	(0.1529)
(2)	A-F-Future x Appoint.	0.1804	0.1688	0.6253**	0.4878*	0.4881	0.6317*	0.8491***	0.7644**
		(0.5236)	(0.5230)	(0.2810)	(0.2767)	(0.3824)	(0.3710)	(0.3313)	(0.3209)
(3)	A-F-Future x Civ. Serv.	0.8309*	0.8662*	-0.0934	0.0943	-0.3649**	0.2460	-0.2604	0.2026
		(0.4994)	(0.4988)	(0.1346)	(0.1326)	(0.1831)	(0.1777)	(0.1586)	(0.1537)
(4)	A-F-Past	0.5440	0.5414	-0.1669	-0.2387**	0.62530***	0.1654	0.1203	-0.1661
		(0.4097)	(0.4093)	(0.1124)	(0.1108)	(0.1530)	(0.1486)	(0.1326)	(0.1285)
(5)	A-F-Past x Appoint.	-0.8309*	-0.7926*	0.6050***	0.1948	-0.0169	-0.0049	0.5969***	0.1923
		(0.4443)	(0.4437)	(0.1851)	(0.1823)	(0.2519)	(0.2444)	(0.2182)	(0.2114)
(6)	A-F-Past x Civ. Serv.	0.0271	0.0517	-0.0690	0.0306	-0.8475***	-0.2872*	-0.4573***	-0.0948
		(0.4159)	(0.4154)	(0.1132)	(0.1116)	(0.1541)	(0.1496)	(0.1335)	(0.1294)
Net Effects					Appointees				
	(1)+(2)	-0.634	-0.627	0.5072*	0.225	0.528	0.239	0.7493**	0.330
	<i>p</i> -value	0.235	0.240	0.059	0.395	0.149	0.500	0.018	0.283
	(4)+(5)	-0.287	-0.251	0.4381**	-0.044	0.6083**	0.160	0.7172***	0.026
	<i>p</i> -value	0.520	0.572	0.018	0.809	0.015	0.510	0.001	0.901
					Civil Servant				
	(1)+(3)	0.016	0.070	-0.2114***	-0.1681***	-0.3250***	-0.1464***	-0.3601***	-0.2319***
	<i>p</i> -value	0.903	0.591	0.000	0.000	0.000	0.000	0.000	0.000
	(4)+(6)	0.5710***	0.5931***	-0.2358***	-0.2081***	-0.2222***	-0.1218***	-0.3370***	-0.2608***
	<i>p</i> -value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Controls	No	Yes	No	Yes	No	Yes	No	Yes
	Firm-Admin Pair F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Product F.E.	No	No	Yes	Yes	Yes	Yes	Yes	Yes
	Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Obs	156 894	156 894	1 968 618	1 968 618	1 968 618	1 968 618	1 968 618	1 968 618

Notes: This table reports the estimated effect of Admin-Firm movements by type of worker's position in the public sector (civil servants, appointees) on procurement outcomes. In columns 1 and 2, the estimated equation is (2), and the dependent variable is yearly amount of contract per firm-administration pair (Yearly Amount). In columns 3 to 8, the estimated equation is (1). In columns 3 and 4, the dependent variable is acquisition price (Price). In columns 5 and 6, the dependent variable is quantity (Volume). In columns 7 and 8, the dependent variable is price x quantity (Contract Value). All regressions include firm-administration pair and year fixed effects, and Firm-Admin dummies by type of worker's position in the public sector (civil servants, appointees). In columns 3 to 8, we also control for product fixed-effects. Regressions in columns 1, 3, 5 and 7 do not use additional controls. Regressions in columns 2, 4, 6 and 8 control for previous year administration procurement expenditure and previous year supplier procurement revenue. In columns 4, 6 and 8, we also control for the awarding procedure used to allocate the procurement contract and price registration system dummy. The upper part of the table reports the marginal effects by type of position, with robust standard errors clustered at the product level in parentheses. The bottom part reports the net effects of those movements and their respective *p*-values. *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table 8: Admin-to-Firm Revolving Doors - Directors

	Yearly Amount	Yearly Amount	Price	Price	Volume	Volume	Contract Value	Contract Value
	1	2	3	4	5	6	7	8
(1) A-F-Future	-0.0298 (0.1275)	0.0215 (0.1273)	-0.2132*** (0.0283)	-0.1695*** (0.0279)	-0.3210*** (0.0385)	-0.1583*** (0.0374)	-0.36014*** (0.0334)	-0.2385*** (0.0324)
(2) A-F-Future x Direct.	-1.1465** (0.5200)	-1.1095*** (0.5193)	-0.5202* (0.3028)	-1.4910*** (0.2982)	0.5110 (0.4120)	0.5734 (0.3999)	-0.2854 (0.3569)	-1.239*** (0.3459)
(3) A-F-Past	0.5494*** (0.1138)	0.5712*** (0.1137)	-0.2298*** (0.0253)	-0.2081*** (0.0249)	-0.2037*** (0.0344)	-0.1229*** (0.0333)	-0.3226*** (0.0298)	-0.2614*** (0.0288)
(4) A-F-Past x Direct.	-1.1973* (0.6665)	-1.1994*** (0.6657)	-0.5913** (0.2656)	-0.7282*** (0.2615)	0.0091 (0.3614)	-0.1120 (0.3506)	-0.5872* (0.3131)	-0.7773*** (0.3033)
Net Effects				Directors				
(1)+(2)	-1.1763**	-1.0880**	-0.7335**	-1.6605***	0.190	0.415	-0.6455*	-1.478
<i>p</i> -value	0.026	0.039	0.016	0.000	0.646	0.301	0.071	0.000
(3)+(4)	-0.648	-0.628	-0.8212***	-0.9364***	-0.195	-0.235	-0.9099***	-1.039
<i>p</i> -value	0.334	0.348	0.002	0.000	0.591	0.503	0.004	0.001
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Firm-Admin Pair F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product F.E.	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	156 894	156 894	1 968 618	1 968 618	1 968 618	1 968 618	1 968 618	1 968 618

Notes: This table reports the estimated effect of Admin-Firm movements by workers' hierarchical level in the public sector (directors, other employees) on procurement outcomes. In columns 1 and 2, the estimated equation is (2), and the dependent variable is yearly amount of contract per firm-administration pair (Yearly Amount). In columns 3 to 8, the estimated equation is (1). In columns 3 and 4, the dependent variable is acquisition price (Price). In columns 5 and 6, the dependent variable is quantity (Volume). In columns 7 and 8, the dependent variable is price x quantity (Contract Value). All regressions include firm-administration pair and year fixed effects, and Firm-Admin dummies by workers' hierarchical level in the public sector (directors, other employees). In columns 3 to 8, we also control for product fixed-effects. Regressions in columns 1, 3, 5 and 7 do not use additional controls. Regressions in columns 2, 4, 6 and 8 control for previous year administration procurement expenditure and previous year supplier procurement revenue. In columns 4, 6 and 8, we also control for the awarding procedure used to allocate the procurement contract and price registration system dummy. The upper part of the table reports the marginal effects by type of position, with robust standard errors clustered at the product level in parentheses. The bottom part reports the net effects of those movements and their respective *p*-values. *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table 9: Firm-to-Admin Revolving Doors

	Yearly Amount	Yearly Amount	Price	Price	Volume	Volume	Contract Value	Contract Value
	1	2	3	4	5	6	7	8
Firm-Admin	0.1049 (0.0834)	0.1029 (0.0833)	-0.0208 (0.0204)	0.0056 (0.0201)	0.5325*** (0.0277)	0.4309*** (0.0269)	0.2229*** (0.0240)	0.1939*** (0.0233)
Firm-Admin-Future	0.0276 (0.0916)	0.0331 (0.0915)	0.0177 (0.0212)	0.0743*** (0.0209)	0.3687*** (0.0288)	0.4020*** (0.0280)	0.1865*** (0.0250)	0.2502*** (0.0242)
Firm-Admin-Past	0.3025*** (0.0938)	0.2932*** (0.0937)	0.0753*** (0.0221)	0.0191 (0.0218)	0.4586*** (0.0301)	0.2060*** (0.0293)	0.2849*** (0.0261)	0.1083*** (0.0253)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Firm-Admin Pair F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product F.E.	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	156 894	156 894	1 968 618	1 968 618	1 968 618	1 968 618	1 968 618	1 968 618

Notes: This table reports the estimated effect of Firm-Admin, Firm-Admin-Future and Firm-Admin-Past dummy variables on procurement outcomes. In columns 1 and 2, the estimated equation is (2), and the dependent variable is yearly amount of contract per firm-administration pair (Yearly Amount). In columns 3 to 8, the estimated equation is (1). In columns 3 and 4, the dependent variable is acquisition price (Price). In columns 5 and 6, the dependent variable is quantity (Volume). In columns 7 and 8, the dependent variable is price x quantity (Contract Value). When we estimate the effect of Firm-Admin variable on a procurement outcome, Firm-Admin-Past and Firm-Admin-Future dummies are excluded from the regression, and Admin-Firm variable is the only other revolving door dummy included in the regression. Similarly, we exclude Firm-Admin variable from the regression when we estimate the effect of Firm-Admin-Past and Firm-Admin-Future dummies on an outcome variable, and Admin-Firm-Past and Admin-Firm-Future variables are the only other revolving door dummies included in the regression. All regressions include firm-administration pair and year fixed effects. In columns 3 to 8, we also control for product fixed-effects. Regressions in columns 1, 3, 5 and 7 do not use additional controls. Regressions in columns 2, 4, 6 and 8 control for previous year administration procurement expenditure and previous year supplier procurement revenue. In columns 4, 6 and 8, we also control for the awarding procedure used to allocate the procurement contract and price registration system dummy. Robust standard errors clustered at the product level are in parentheses: *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table 10: Firm-to-Admin Revolving Doors by Types of Workers' Contract

	Yearly Amount	Yearly Amount	Price	Price	Volume	Volume	Contract Value	Contract Value
	1	2	3	4	5	6	7	8
(1) F-A-Future (s.e.)	0.5138 (0.3662)	0.4845 (0.3657)	0.5909*** (0.2165)	0.6493*** (0.2131)	0.2820 (0.2945)	0.2653 (0.2858)	0.7195*** (0.2552)	0.7650*** (0.2472)
(2) F-A-Future x Appoint. (s.e.)	-0.0494 (0.3095)	-0.0565 (0.3091)	-1.4281*** (0.2187)	-1.3837*** (0.2153)	0.6419** (0.2976)	0.5776** (0.2887)	-1.1335*** (0.2578)	-1.1303*** (0.2497)
(3) F-A-Future x Civ. Serv. (s.e.)	-0.5048 (0.3698)	-0.4676 (0.3693)	-0.5031** (0.2169)	-0.5077** (0.2136)	0.0400 (0.2951)	0.0966 (0.2864)	-0.4842* (0.2557)	-0.4650* (0.2477)
(4) F-A-Past (s.e.)	-0.2942 (0.3232)	-0.2820 (0.3228)	0.1529 (0.1365)	0.1051 (0.1344)	0.0516 (0.1858)	0.0604 (0.1803)	0.1768 (0.1609)	0.1318 (0.1559)
(5) F-A-Past x Appoint. (s.e.)	0.2003 (0.3101)	0.1944 (0.3098)	-0.5717*** (0.1469)	-0.3666** (0.1447)	-0.0932 (0.1999)	-0.2382 (0.1940)	-0.6145*** (0.1732)	-0.4711*** (0.1678)
(6) F-A-Past x Civ. Serv. (s.e.)	0.6507** (0.3283)	0.6274* (0.3279)	-0.0300 (0.1380)	-0.0628 (0.1358)	0.4767** (0.1877)	0.1988 (0.1821)	0.1874 (0.1626)	0.0231 (0.1575)
Net Effects				Appointees				
(1)+(2) <i>p</i> -value	0.464 0.196	0.428 0.233	-0.8371*** 0.000	-0.7343*** 0.000	0.9239*** 0.000	0.8429*** 0.000	-0.4140*** 0.000	-0.3652*** 0.000
(4)+(5) <i>p</i> -value	-0.094 0.730	-0.088 0.747	-0.4188*** 0.000	-0.2615*** 0.000	-0.042 0.655	-0.1778** 0.049	-0.4377*** 0.000	-0.3394*** 0.000
				Civil Servant				
(1)+(3) <i>p</i> -value	0.009 0.925	0.017 0.859	0.087*** 0.000	0.1416*** 0.000	0.3220*** 0.000	0.3618*** 0.000	0.2352*** 0.000	0.2999*** 0.000
(4)+(6) <i>p</i> -value	0.3565*** 0.000	0.3455*** 0.001	0.1228*** 0.000	0.0423* 0.068	0.5284*** 0.000	0.25913*** 0.000	0.3642*** 0.000	0.1548*** 0.000
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Firm-Admin Pair F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product F.E.	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	156 894	156 894	1 968 618	1 968 618	1 968 618	1 968 618	1 968 618	1 968 618

Notes: This table reports the estimated effect of Firm-Admin movements by type of workers' position in the public sector (civil servants, appointees) on procurement outcomes. In columns 1 and 2, the estimated equation is (2), and the dependent variable is yearly amount of contract per firm-administration pair (Yearly Amount). In columns 3 to 8, the estimated equation is (1). In columns 3 and 4, the dependent variable is acquisition price (Price). In columns 5 and 6, the dependent variable is quantity (Volume). In columns 7 and 8, the dependent variable is price x quantity (Contract Value). All regressions include firm-administration pair and year fixed effects, and Admin-Firm dummies by type of workers' position in the public sector (civil servants, appointees). In columns 3 to 8, we also control for product fixed-effects. Regressions in columns 1, 3, 5 and 7 do not use additional controls. Regressions in columns 2, 4, 6 and 8 control for previous year administration procurement expenditure and previous year supplier procurement revenue. In columns 4, 6 and 8, we also control for the awarding procedure used to allocate the procurement contract and price registration system dummy. The upper part of the table reports the marginal effects by type of position, with robust standard errors clustered at the product level in parentheses. The bottom part reports the net effects of those movements and their respective *p*-values. *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table 11: Firm-to-Admin Revolving Doors - Directors

	Yearly Amount	Yearly Amount	Price	Price	Volume	Volume	Contract Value	Contract Value
	1	2	3	4	5	6	7	8
(1) F-A-Future	0.0155 (0.0931)	0.0207 (0.0930)	0.0729*** (0.0220)	0.1349*** (0.0217)	0.3082*** (0.0300)	0.3584*** (0.0291)	0.2141*** (0.0260)	0.2918*** (0.0252)
(2) F-A-Future x Direct.	0.3951 (0.3283)	0.4059 (0.3279)	-0.6467*** (0.0726)	-0.6890*** (0.0715)	0.7567*** (0.0988)	0.5499*** (0.0959)	-0.3002*** (0.0856)	-0.4484*** (0.0830)
(3) F-A-Past	0.2893*** (0.0948)	0.2791*** (0.0947)	0.0710*** (0.0224)	0.0086 (0.0221)	0.4543*** (0.0305)	0.2033*** (0.0297)	0.2787*** (0.0264)	0.0967*** (0.0257)
(4) F-A-Past x Direct.	0.4015 (0.3457)	0.4253 (0.3453)	-0.0960 (0.0666)	0.0128 (0.0656)	0.2883*** (0.0906)	0.2012** (0.0880)	0.0367 (0.0785)	0.1013 (0.0761)
Net Effects				Directors				
(1)+(2)	0.411	0.427	-0.5737***	-0.5541***	1.0650***	0.9084***	-0.086	-0.157
<i>p</i> -value	0.207	0.189	0.000	0.000	0.000	0.000	0.297	0.050
(3)+(4)	0.6908**	0.7044**	-0.025	0.021	0.7427***	0.4045***	0.3153***	0.198
<i>p</i> -value	0.045	0.041	0.710	0.746	0.000	0.000	0.000	0.010
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Firm-Admin Pair F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product F.E.	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	156 894	156 894	1 968 618	1 968 618	1 968 618	1 968 618	1 968 618	1 968 618

Notes: This table reports the estimated effect of Firm-Admin movements by workers' hierarchical level in the public sector (directors, other employees) on procurement outcomes. In columns 1 and 2, the estimated equation is (2), and the dependent variable is yearly amount of contract per firm-administration pair (Yearly Amount). In columns 3 to 8, the estimated equation is (1). In columns 3 and 4, the dependent variable is acquisition price (Price). In columns 5 and 6, the dependent variable is quantity (Volume). In columns 7 and 8, the dependent variable is price x quantity (Contract Value). All regressions include firm-administration pair and year fixed effects, and Admin-Firm dummies by workers' hierarchical level in the public sector (directors, other employees). In columns 3 to 8, we also control for product fixed-effects. Regressions in columns 1, 3, 5 and 7 do not use additional controls. Regressions in columns 2, 4, 6 and 8 control for previous year administration procurement expenditure and previous year supplier procurement revenue. In columns 4, 6 and 8, we also control for the awarding procedure used to allocate the procurement contract and price registration system dummy. The upper part of the table reports the marginal effects by type of position, with robust standard errors clustered at the product level in parentheses. The bottom part reports the net effects of those movements and their respective *p*-values. *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table 12: Admin-to-Firm Revolving Door Spillovers

	Yearly Amount	Yearly Amount	Price	Price	Volume	Volume	Contract Value	Contract Value
	1	2	3	4	5	6	7	8
Panel A - Main Spillover Effects								
Admin-Firm-Future	-0.0166 (0.1278)	0.0339 (0.1277)	-0.2233*** (0.0287)	-0.1854*** (0.0283)	-0.3015*** (0.0390)	-0.1492*** (0.0379)	-0.3613*** (0.0338)	-0.2505*** (0.0328)
A-F-Future Spillover on contracts with other Firms	-0.0316* (0.0170)	-0.0307* (0.0170)	-0.0058 (0.0061)	-0.0049 (0.0060)	-0.017** (0.0083)	-0.0101 (0.0081)	-0.0138* (0.0072)	-0.0095 (0.0070)
Admin-Firm-Past	0.5728*** (0.1145)	0.5895*** (0.1144)	-0.2198*** (0.026)	-0.1873*** (0.025)	-0.2144*** (0.0350)	-0.1196*** (0.0340)	-0.3172*** (0.0304)	-0.2389*** (0.0294)
A-F-Past Spillover on contracts with other Admins	0.2629*** (0.0356)	0.2414*** (0.0356)	0.0111 (0.0098)	-0.02** (0.0097)	0.1111*** (0.0133)	-0.0118 (0.0130)	0.0622*** (0.0115)	-0.0251** (0.0112)
Panel B - Spillovers by Types of Workers' Contract and Director								
Net Effects								
A-F-Future Spill x Appoint. on contracts with other Firms	-0.0895 [0.126]	-0.0892 [0.127]	0.1057*** [0.000]	0.0893*** [0.000]	-0.3224*** [0.000]	-0.2647*** [0.000]	-0.0419* [0.099]	-0.0264 [0.284]
A-F-Future Spill x Civ. Serv. on contracts with other Firms	0.0358* [0.060]	0.0365* [0.056]	-0.0126* [0.057]	-0.0192*** [0.003]	0.0462*** [0.000]	0.0264*** [0.003]	0.0085 [0.278]	-0.0078 [0.303]
A-F-Future Spill x Direct. on contracts with other Firms	0.1263* [0.051]	0.1286** [0.047]	-0.1913*** [0.000]	-0.2090*** [0.000]	0.3277*** [0.000]	0.2099*** [0.000]	-0.0416 [0.142]	-0.1176*** [0.000]

Continue on the next page.

Table 12 Admin-to-Firm Revolving Door Spillovers (continued)

	Yearly Amount	Yearly Amount	Price	Price	Volume	Volume	Contract Value	Contract Value
	1	2	3	4	5	6	7	8
Panel B - Spillovers by Types of Workers' Contract and Director (<i>continued</i>)								
Net Effects								
A-F-Past Spill x Appoint. on contracts with other Admins	0.7260*** [0.000]	0.644*** [0.001]	0.8448*** [0.000]	0.6062*** [0.000]	-0.2491** [0.016]	-0.8620*** [0.000]	0.7297*** [0.000]	0.2270*** [0.009]
A-F-Past Spill x Civ. Serv. on contracts with other Admins	0.2507*** [0.000]	0.2197*** [0.000]	0.0464*** [0.000]	0.0076 [0.456]	0.0873*** [0.000]	-0.0021 [0.878]	0.0866*** [0.000]	0.0067 [0.570]
A-F-Past Spill x Direct. on contracts with other Admins	-0.9007*** [0.010]	-0.7138** [0.041]	-0.9131*** [0.000]	-0.7455*** [0.000]	0.0939 [0.709]	0.2878 [0.238]	-0.8683*** [0.000]	-0.6173*** [0.004]
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Firm-Admin Pair F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product F.E.	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	156 894	156 894	1 968 618	1 968 618	1 968 618	1 968 618	1 968 618	1 968 618

Notes: This table reports the estimated spillover effects of Admin-Firm movements on procurement outcomes. The estimated regression is equation (4). Panel A shows the effects of Admin-Firm-Future and Admin-Firm-Past and their spillovers on contracts with other firms and on contracts with other administrations, respectively. Panel B displays the effects of Admin-Firm-Future Spillovers on contracts with other firms and Admin-Firm-Past Spillovers on contracts with other administrations for directors, civil servants and appointees. In columns 1 and 2, the estimated equation is (2), and the dependent variable is yearly amount of contract per firm-administration pair (Yearly Amount). In columns 3 to 8, the estimated equation is (1). In columns 3 and 4, the dependent variable is acquisition price (Price). In columns 5 and 6, the dependent variable is quantity (Volume). In columns 7 and 8, the dependent variable is price x quantity (Contract Value). In all regressions we include firm-administration pair and year fixed effects, and also Firm-Admin Future and Firm-Admin Past dummies (and by their spillover, hierarchical level and worker's position) as covariates. In columns 3 to 8, we also control for product fixed-effects. Regressions in columns 1, 3, 5 and 7 do not use additional controls. Regressions in columns 2, 4, 6 and 8 control for previous year administration procurement expenditure and previous year supplier procurement revenue. In columns 4, 6 and 8, we also control for the awarding procedure used to allocate the procurement contract and price registration system dummy. Robust standard errors clustered at the product level are in parentheses. The p -values of the Net Effects are in brackets. *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table 13: Firm-to-Admin Revolving Door Spillovers

	Yearly Amount	Yearly Amount	Price	Price	Volume	Volume	Contract Value	Contract Value
	1	2	3	4	5	6	7	8
Panel A - Main Spillover Effects								
Firm-Admin-Future	-0.0321 (0.0927)	-0.0250 (0.0926)	-0.0150 (0.0221)	0.0656*** (0.0217)	0.2699*** (0.0300)	0.3625*** (0.0291)	0.1084*** (0.0260)	0.2242*** (0.0252)
F-A-Future Spillover on contracts with other Admins	0.076** (0.0373)	0.0825** (0.0373)	-0.0636*** (0.0100)	-0.0499*** (0.0098)	-0.0314** (0.0136)	-0.0352*** (0.0132)	-0.0778*** (0.0118)	-0.0653*** (0.0114)
Firm-Admin-Past	0.5048*** (0.0947)	0.493*** (0.0946)	0.1028*** (0.0230)	0.018 (0.0227)	0.5357*** (0.0312)	0.2316*** (0.0304)	0.3477*** (0.0271)	0.1181*** (0.0263)
F-A-Past Spillover on contracts with other Firms	0.2003*** (0.0163)	0.1991*** (0.0162)	0.0378*** (0.0062)	0.0207*** (0.0061)	0.0426*** (0.0084)	-0.0018 (0.0082)	0.0574*** (0.0073)	0.0199*** (0.0071)
Panel B - Spillovers by Types of Workers' Contract and Director								
Net Effects								
F-A-Future Spill x Appoint. on contracts with other Admins	-0.4518*** [0.001]	-0.4735*** [0.000]	-0.0904**** [0.008]	-0.0494 [0.144]	0.0294 [0.529]	0.0819* [0.071]	-0.0764* [0.059]	-0.0130 [0.740]
F-A-Future Spill x Civ. Serv. on contracts with other Admins	0.0534 [0.185]	0.0714* [0.076]	-0.0861*** [0.000]	-0.0755*** [0.000]	0.0127 [0.398]	-0.0102 [0.485]	-0.0800*** [0.000]	-0.0797*** [0.000]
F-A-Future Spill x Direct. on contracts with other Admins	1.2390*** [0.000]	1.2395*** [0.000]	-0.0773 [0.259]	-0.2362*** [0.001]	-0.0229 [0.806]	-0.1757* [0.052]	-0.0886 [0.272]	-0.3141*** [0.000]

Continue on the next page.

Table 13 Firm-to-Admin Revolving Door Spillovers (continued)

	Yearly Amount	Yearly Amount	Price	Price	Volume	Volume	Contract Value	Contract Value
	1	2	3	4	5	6	7	8
Panel B - Spillovers by Types of Workers' Contract and Director (<i>continued</i>)								
Net Effects								
F-A-Past Spill x Appoint. on contracts with other Firms	-0.2125*** [0.000]	-0.2105*** [0.000]	0.0118 [0.605]	0.0196 [0.382]	0.0143 [0.643]	0.0325 [0.279]	0.0185 [0.489]	0.0339 [0.191]
F-A-Past Spill x Civ. Serv. on contracts with other Firms	0.2254*** [0.000]	0.2241*** [0.000]	0.0323*** [0.000]	0.0134** [0.033]	0.0567*** [0.000]	0.0070 [0.412]	0.0584*** [0.000]	0.0165** [0.025]
F-A-Past Spill x Direct. on contracts with other Firms	-0.0061 [0.927]	-0.0078 [0.908]	0.1107*** [0.000]	0.0834*** [0.003]	-0.1012*** [0.009]	-0.1256*** [0.001]	0.0648* [0.052]	0.0289 [0.373]
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Firm-Admin Pair F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product F.E.	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	156 894	156 894	1 968 618	1 968 618	1 968 618	1 968 618	1 968 618	1 968 618

Notes: This table reports the estimated spillover effects of Firm-Admin movements on procurement outcomes. The estimated regression is equation (4). Panel A shows the effects of Firm-Admin-Future and Firm-Admin-Past and their spillovers on contracts with other administrations and on contracts with other firms, respectively. Panel B displays the effects of Firm-Admin-Future Spillovers on contracts with other administrations and Firm-Admin-Past Spillovers on contracts with other firms for directors, civil servants and appointees. In columns 1 and 2, the estimated equation is (2), and the dependent variable is yearly amount of contract per firm-administration pair (Yearly Amount). In columns 3 to 8, the estimated equation is (1). In columns 3 and 4, the dependent variable is acquisition price (Price). In columns 5 and 6, the dependent variable is quantity (Volume). In columns 7 and 8, the dependent variable is price x quantity (Contract Value). In all regressions we include firm-administration pair and year fixed effects, and also Admin-Firm Future and Admin-Firm Past dummies (and by their spillover, hierarchical level and worker's position) as covariates. In columns 3 to 8, we also control for product fixed-effects. Regressions in columns 1, 3, 5 and 7 do not use additional controls. Regressions in columns 2, 4, 6 and 8 control for previous year administration procurement expenditure and previous year supplier procurement revenue. In columns 4, 6 and 8, we also control for the awarding procedure used to allocate the procurement contract and price registration system dummy. Robust standard errors clustered at the product level are in parentheses. The p -values of the Net Effects are in brackets. *** significant at the 1 percent level, ** significant at the 5 percent level, * significant at the 10 percent level.

Table 14: 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 (5). 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 (5), following the specification in equation (6). 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 15: Workers' Revolving Door Bonuses by Categories

	Admin-to-Firm RD workers	Firm-to Admin RD workers
Female-elementary	-719.6***	-548.3***
Female-high school	-304.4***	-241.8***
Female-higher education	579.3***	551.9***
Male-elementary	-397.7***	-280.7***
Male-high school	17.5***	25.8***
Male-higher education	901.2***	819.5***
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 14, on revolving door dummies and their interactions with either worker's gender, age, education level, or 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.

Table 16: Aggregate Spending Changes from Shutting Down Revolving Door

Panel A - In Million Brazilian Reals of 2000			
	Direct Effect	Indirect Effect	Net Effect
Admin-to-Firm RD	623.2	62.0	685.2
Firm-to-Admin RD	-362.8	-62.8	-425.6
Any Revolving Door	260.4	-0.8	259.6
Panel B - In % of total spending (22.1 billion of Brazilian Reals of 2000)			
	Direct Effect	Indirect Effect	Net Effect
Admin-to-Firm RD	2.8%	0.3%	3.1%
Firm-to-Admin RD	-1.6%	-0.3%	-1.9%
Any Revolving Door	1.2%	0.0%	1.2%

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 (8) and (7), and using the estimates from Column 8, upper panels of Tables 12 and 13. The changes in aggregate procurement spending are broken down in direct, indirect (spillover) and net effects. 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”

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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 a 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
Inegibilities	Dummy variable equal to one if inegibilities (<i>inegibilidade</i>) is the method used to award the procurement contract, and zero, otherwise. The terms of the procurement contract awarded through inegibilities are directly negotiated between the administration and the supplier. No tender is needed to select the supplier. Inegibilities 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
Wage	Average monthly wage that a worker receives from an employee in a given year, in Brazilian Reals of 2000.	R
Elementary School	Dummy variable equal to one if the worker has completed the elementary school, and zero, otherwise.	R
High School	Dummy variable equal to one if the worker has completed the high school, and zero, otherwise.	R
Higher Education	Dummy variable equal to one if the worker's level of education is college or above, and zero, otherwise.	R
Age	Worker's age (in years) at a given point in time.	R
Tenure in Office	Number of years that a individual has been working for an employee at a given point in time.	R
Occupation	Occupation assigned by the employee to the worker based on his/her performing job in the institution. Occupations are standardized and codified job categories established by the CBO (Classificação Brasileira de Ocupações).	R
Employment Contract	Type of work contract that an individual signs with its employee. A public official's work contracts can be of a regular civil servant, appointee, apprentice, or a temporary worker. A private employer's contracts can be of a regular employer, apprentice, or a temporary worker.	R
Panel C - Revolving Door Variables		
Admin-Firm-Past	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

Continue on the next page.

Table S1: Variables and Sources (continued)

Variable	Description	Source
Admin-Firm-Future	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	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
Firm-Admin-Past	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
Firm-Admin-Future	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	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
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-Past Spillover on contract with other Admins	Dummy variable equal to one for all procurement contracts of a firm j with all other administrations, except administration k , 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
Admin-Firm-Future Spillover on contract with other Firms	Dummy variable equal to one for all procurement contracts of an administration k with all firms, except firm j , at time t , where administration k has employs an individual at time t who mwill work for firm j after time t . Otherwise, this variable is equal to zero.	M
Firm-Admin-Past Spillover on contract with other Firms	Dummy variable equal to one for all procurement contracts of a administration k with all other firms, except firm j , at time t , where firm j has employed an individual before time t who works for administration k at time t . Otherwise, this variable is equal to zero.	M
Firm-Admin-Past Spillover on contract with other Admins	Dummy variable equal to one for all procurement contracts of a firm j with all other administrations, except administration k , at time t , where firm j has employed an individual before time t who works for administration k at time t . Otherwise, this variable is equal to zero.	M
Firm-Admin-Future Spillover on contract with other Admins	Dummy variable equal to one for all procurement contracts of a firm j with all other administrations, except administration k , 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
Admin-Firm RD Worker	Dummy variable equal to one if the worker has moved from an administration to a firm, and zero, otherwise.	M
Firm-Admin RD Worker	Dummy variable equal to one if the worker has moved from a firm to an administration, and zero, otherwise.	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.

Supplementary Material: Estimation Method

S.1 Officials career path and procurement contract outcomes

Equation (1) in the paper estimates the effects officials' movement from public to private (and the reserve) on procurement contract outcomes (price, contract size, contract value). 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 equations (1).⁴²

In order to make the estimation of equation (1) 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 reduce notation, let $Z'_{jkt} = [X'_{jt} \ W'_{kt}]$ and $\Theta = [\gamma \ \delta]$.

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

$$\ln y_{l_jkt} = \alpha_l + \kappa_t + \tau_{jk} + \beta RD_{jkt} + Z'_{jkt} \Theta + u_{l_jkt}. \quad (\text{S1})$$

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

$$\overline{\ln y}_{jk} = \bar{\alpha}_l + \bar{\kappa}_t + \bar{\tau}_{jk} + \beta \overline{RD}_{jk} + \bar{Z}'_{jk} \Theta + \bar{u}_{jk}, \quad (\text{S2})$$

where

$$\overline{\ln y}_{jk} = \frac{1}{LT} \sum_{t=1}^T \sum_{l=1}^L \ln y_{l_jkt}; \quad \bar{Z}_{jk}^m = \frac{1}{LT} \sum_{t=1}^T \sum_{l=1}^L Z_{jkt}^m, \quad m = 1, \dots, M; \quad \bar{u}_{jk} = \frac{1}{LT} \sum_{t=1}^T \sum_{l=1}^L u_{l_jkt};$$

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

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

Note that

$$\bar{\alpha}_l = \alpha^*; \quad \bar{\kappa}_t = \kappa^*; \quad \bar{\tau}_{jk} = \tau_{jk}.$$

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

$$\overline{\ln y}_{jk} = \alpha^* + \kappa^* + \tau_{jk} + \beta \overline{RD}_{jk} + \bar{Z}'_{jk} \Theta + \bar{u}_{jk}. \quad (\text{S3})$$

⁴²The same techniques were applied to estimate equation (4).

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

$$(\ln y_{l_{jkt}} - \overline{\ln y_{jk}}) = \alpha_l - \alpha^* + \kappa_t - \kappa^* + \beta(RD_{jkt} - \overline{RD}_{jk}) + (Z_{jkt} - \overline{Z}_{jk})'\Theta + (u_{l_{jkt}} - \bar{u}_{jk}). \quad (\text{S4})$$

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

S.2 Officials career path and the yearly amount of contract that a firm obtains

Similarly, to estimate equation (2), we will 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 reduce notation, let $Z'_{l_{jkt}} = [X'_{jt} \ W'_{kt}]$ and $\Theta = [\gamma \ \delta]$.

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

$$\ln y_{jkt} = \kappa_t + \tau_{jk} + \beta RD_{jkt} + Z'_{jkt}\Theta + \nu_{jkt}, \quad (\text{S5})$$

Now, consider the between firm-administration regression model:

$$\overline{\ln y_{jk}} = \bar{\kappa}_t + \bar{\tau}_{jk} + \beta \overline{RD}_{jk} + \overline{Z}'_{jk}\Theta + \bar{\nu}_{jk}, \quad (\text{S6})$$

where

$$\overline{\ln y_{jk}} = T^{-1} \sum_{t=1}^T y_{jkt}; \quad \overline{Z}_{jk}^m = T^{-1} \sum_{t=1}^T Z_{jkt}^m, \quad m = 1, \dots, M; \quad \bar{\nu}_{jk} = T^{-1} \sum_{t=1}^T \nu_{jkt};$$

$$\bar{\kappa}_t = T^{-1} \sum_{t=1}^T \kappa_t; \quad \bar{\tau}_{jk} = T^{-1} \sum_{t=1}^T \tau_{jk}; \quad \overline{RD}_{jk} = T^{-1} \sum_{t=1}^T RD_{jkt}.$$

Note that

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

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

as follows:

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

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

$$(\ln y_{jkt} - \overline{\ln y_{jk}}) = \kappa_t - \kappa^* + \beta(RD_{jkt} - \overline{RD}_{jk}) + (Z_{jkt} - \overline{Z}_{jk})' \Theta + (\nu_{jkt} - \overline{\nu}_{jk}). \quad (\text{S8})$$

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