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Ph.D. in Business Economics

Darcio Genicolo Martins

Essays on Public Procurement

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Dissertation submitted as a partial requirement to obtain the degree of Ph.D. in Business Economics in the field of research on Strategy, Marketing and Industrial Organization at the Insper Institute of Education and Research.

Supervisor: Paulo Furquim de Azevedo

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"I keep falling, maybe half the time, maybe half the time..."

Interpol, "All the Rage Back Home" (2014)

Abstract

This dissertation investigates factors that could undermine the performance of public tenders. It is organized into three different papers that address distinct aspects of public procurement's institutional design. In the first paper, I investigate the impact of health litigation on the efficiency of public procurement. In the second paper, I estimate the costs of implementing a program that incentivizes public buyer units to restrict public tenders to small and medium-sized enterprises (SMEs). Finally, in the third paper, I propose a cartel detection method for public procurement.

Keywords: public procurement, health litigation, enforcement, small and medium-sized enterprises, frequent losers

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1 INTRODUCTION

Public Procurement accounts for nearly 12% of GDP and 29% government expenditure in OECD member countries. Governments are expected to carry it out efficiently and with high standards of conduct to ensure a high quality of service delivery and safeguard the public interest. This dissertation investigates factors that could undermine the performance of public tenders. The dissertation is organized into three different papers that address distinct aspects of public procurement's institutional design.

In the first paper, I investigate the impact of health litigation on the efficiency of public procurement. Public health procurement is shaped not only by administrative choices but also by judicial decisions that enforce the law on public buyer units. Judicial enforcement is costly for two reasons. First, as mandatory purchases are invariably urgent, judicial enforcement undermines procurement planning. Second, as judicial sanctions for noncompliance are severe, auctioneers have higher incentives to maximize tender success at the expense of higher prices, which we call the "under the gun" effect.

Unique data on health litigation and procurement of prescription and nonprescription drugs allow us to estimate the overall enforcement costs and the "under the gun" effect. Judicial enforcement implies (i) higher negotiated prices (from 30.73% to 44.37%), (ii) fewer participant firms (from 28.63% to 32.21%), (iii) fewer bids (from 39.40% to 45.93%), and (iv) a lower probability of success (from 38.56% to 48.66%) in urgent tenders in comparison with ordinary tenders. To estimate the "under the gun" effect, we utilize urgent administrative tenders that are not subject to judicial sanctions. We estimate that judicial sanctions increase prices between 8.83% and 9.97%.

Thus, judicial enforcement compels the executive branch to carry out the purchases, which generates high costs to the public budget. These results suggest that judges should consider the social costs associated with the enforcement of court decisions when the judiciary acts as a policymaker.

In the second paper, I estimate the costs of implementing a program that incentivizes public buyer units to restrict public tenders to small and medium-sized enterprises (SMEs). While there are numerous examples of policies that benefit small

and medium-sized enterprises (SMEs) worldwide, research offers little direct evidence on the benefits of such policies for the economy. Additionally, assessments of the costs of implementing such policies are practically ignored in the literature.

This second paper exploits a quasi-experimental variation from a program incentivizing the restriction of public tenders to SMEs in Sao Paulo, Brazil, to estimate this policy's costs. The way that this institutional change occurred allows me to assess those costs only indirectly. Using detailed data on public procurement and a variation of the standard DiD method (difference-in-differences in reverse), I estimate the pre-intervention effects of the policy shift. I find that before the policy shift, for group 65 (the 'switched' group) in comparison with other groups (the 'always treated' group): (i) the negotiated prices were lower (between 4.58% and 8.08%); (ii) the number of participants was approximately 22% higher; and (iii) the number of valid bids was approximately 25% higher.

These results suggest that the policy of incentivizing the restriction of public tenders to SMEs may severely undermine the quality and efficiency of the public procurement process. Finally, before the policy change, sellers who won tenders for group 65 were more distant from the public buyer units (approximately 4 km). This result may indicate that the policy change has successfully induced more local suppliers to win more bids for this group of items.

Finally, in the third paper, I propose a cartel detection method for public procurement. The systematic loss by firms of public tenders in which they participate for long periods and several times may indicate a cartel. This paper proposes a screening method to detect cartels in public tenders by considering frequent losers. Using data on public procurement in Sao Paulo State, Brazil, from 2009 and 2019, we estimate that frequent losers are associated with 10% higher prices, 32% more participants, and 29% more bids.

These results are consistent with the behavior of a cartel (higher prices) that tries to avoid detection by manipulating variables that signal competition (number of players and bids). The proposed method can address two limitations of traditional screening methods: (i) the ability to distinguish between tacit collusion and explicit collusion and (ii) the identification of a possible cartel before the conclusion of public tender processes.

2 BITTER PILLS TO SWALLOW: ENFORCEMENT COSTS OF HEALTH LITIGATION[1]

Judicial enforcement is a central feature of public policy for several countries. In some areas, such as healthcare and social security in Brazil, judicial review is pervasive enough to completely modify the policy as originally formulated by the executive. This phenomenon has received attention from a wide range of scholars and policy makers to understand its features and how judicial review shape public policy (BARREIRO and FURTADO, 2015; BIEHL, SOCAL and AMON, 2016; CNJ/INSPER, 2019; FERRAZ, 2009; WANG, 2015). Nevertheless, although recognized as a relevant subject, the enforcement costs associated to judicial review of public policy has been largely neglected by the literature. The governmental bodies that have to comply with judicial decisions also incur in additional costs related to enforcement, due to both unplanned purchases and distortion in incentives to avoid judicial sanctions. This paper estimates the public procurement waste generated by judicial litigation in healthcare in Brazil.

Healthcare litigation is arguably the most relevant case of judicial review of public policies in Brazil (FERRAZ, 2009). The Brazilian Constitution states that all citizens have the "right to life," and the state has the explicit public health objective of "providing universal coverage" for everyone. Available or potential budget resources must be considered across time for these objectives to be materialized and sustainable in the long run.

The Unified Health System (SUS) is precisely the materialization of this statement: a coordinated set of financially viable actions, public programs, and infrastructure, aiming to achieve the objectives established in the Constitution. Based on aggregate social preferences, the government chooses priorities and implements public policies subject to budget restrictions.

However, the judiciary has a strict interpretation of the Constitution that generally ignores the budgetary dimension. This means that in Brazil, it is possible to obtain any medication or medical procedure through litigation regardless of the costs

involved. Court orders have granted a range, for example, from acetylsalicylic acid (aspirin or similar) to galsulfase, indicated for treating rare and severe joint disease (mucopolysaccharidosis type VI). Individual treatment with galsulfase has an estimated annual cost of US$400 thousand[2].

This rigid interpretation of law leads to significant distortions in implementing health policies, such as public procurement of prescription and nonprescription drugs. Court decisions are enforced as preliminary injunctions that require the government to make purchases within one-third of the time planned acquisitions are made, hampering all public buying processes.

The way the planning procedures for the acquisition of these goods are carried out may substantially affect the procurement conditions or outcomes and ultimately might influence the results of public policies. Public bureaus should have the appropriate time to identify all needs and ends, analyze market conditions, and set relevant tender parameters (item specifications, quantities, and reference prices, for instance).

Favorable planning circumstances may increase the likelihood of achieving public policy goals efficiently and effectively. On the other hand, under unfavorable planning conditions, purchases might be inadequate to meet public needs and more expensive, undermining public policies' final impact.

There is a vast literature on the waste of resources in public services, including public procurement. A prominent approach separates the causes of waste into two primary sources: corruption and mismanagement (BANDIERA; PRAT; VALLETTI, 2009).

The involvement of officials in corruption (i.e., active waste), such as favoring private firms in public tenders in exchange for bribery, has received much attention in the literature and from policymakers for its impact on public procurement efficiency (BASHEKA, 2011; MIRONOV; ZHURAVSKAYA, 2016).

On the other hand, mismanagement (passive waste) might lead to higher prices for various other reasons, such as inadequate civil servant skills (BEST; HJORT;

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[2] See
https://www.ncbi.nlm.nih.gov/books/NBK409825/#:~:text=The%20annual%20acquisition%20cost%20of,recommended%20dosing%20regimen%20is%20%24399%2C100 for additional information. Access in: 08 Nov. 2020.

SZAKONYI, 2017), lack of incentives to minimize costs (ASHRAF, BANDIERA, LEE, 2016; BANDIERA *et al.*, 2017; CULLEN *et al.*, 2016) or improper management practices (BLOOM *et al.*, 2015; KVASNIČKA; STANĚK; KRČÁL, 2015; LEWIS-FAUPEL *et al.*, 2016; RASUL; ROGGER, 2018; RASUL; ROGGER; WILLIAMS, 2018), which may increase the probability of collusion or bid rigging (CLARK *et al.*, 2018; MOORE, 2012).

Mismanagement and corruption are often associated mainly with internal aspects of public administration. However, the external dimension is quite relevant to understanding the functioning and distortions of the procurement process. Restrictions imposed and behaviors shown by control agencies and other stakeholders acting as watchdogs might strongly influence public officials' decisions and, as a result, undermine efficiency (BREWER; WALKER, 2010).

Accordingly, this paper contributes to the vast literature on public procurement efficiency (ASHRAF; BANDIERA; LEE, 2016; BANDIERA; PRAT; VALLETTI, 2009; LEWIS-FAUPEL *et al.*, 2016) by providing evidence that external shocks may affect procurement outcomes by harming the *ex ante* process of planning. Notably, this policy experiment allows the inefficiency due to the judicial review of public procurement to be estimated.

Health litigation and administrative requests are exogenous shocks that affect how the government buys prescription and over-the-counter drugs. Thus, those shocks can be separated into *urgent* (litigated and administrative requests) and *ordinary* (standard procedure) types of purchases, treatments, and control groups, respectively.

I estimate the impact of health litigation and administrative requests (planning and executing a tender) on public procurement efficiency, comparing urgent and ordinary purchases. The objective is to assess the effects of those court orders' enforcement costs and administrative demands on public tender efficiency.

Additionally, I compare litigated and administrative purchases to identify the "under the gun" effect. Administrative and litigated purchases are similar in all adverse planning and execution conditions. However, if the government fails to comply with a court order to purchase medicines, public bureaus are subject to severe punishment. Thus, the "under the gun" effect is an attempt to isolate the possibility of severe penalties as an additional cost to the government.

I construct unique administrative data on bid-level public procurement transactions of litigated, administrative, and ordinary health-related item purchases in the state of Sao Paulo, Brazil, from January 2009 to December 2019.

The main findings indicate higher reference prices for urgent than ordinary purchases (from 60.4% to 68.93% higher). This result suggests that unfavorable conditions for compliance with court orders or administrative requests (shorter delivery time, lower quantities, and the threat of punishment) significantly increase expectations regarding acquisition costs.

Moreover, the (over)enforcement costs consist of (i) higher negotiated prices (from 30.73% to 44.37% higher), (ii) fewer participant firms (from 28.63% to 32.21% fewer), (iii) fewer bids (from 39.40% to 45.93% fewer), and (iv) a lower probability of success (from 38.56% to 48.66% less probable) in urgent tenders than in ordinary purchases.

Finally, I estimate the "under the gun" effect: a litigated purchase is between 8.83% and 9.97% more expensive than an administrative request, a difference attributed to the possibility of a judicial punishment of government members in the first and not in the second case.

In summary, judicial decisions compel the executive branch to carry out purchases that generate high public budget costs.

The remainder of the paper is organized as follows. Section 2 characterizes the institutional background of health litigation, administrative requests, public procurement, and the policy experiment in Sao Paulo, Brazil. Section 3 describes the relevant datasets and sample definitions. Section 4 presents the empirical analysis. Section 5 concludes the paper.

2.1 Institutional Background

This section provides a brief institutional background on litigation related to prescription drugs in the context of public tenders in Brazil.

First, I briefly introduce some relevant elements of Brazil's health litigation issue

and its direct impacts on the public budget. I focus on the impacts of judicial decisions and administrative requests on the planning process of public tenders. Finally, I briefly describe the bidding process for prescription drugs, underlining the bidding negotiations' difficulties resulting from court orders and administrative demands.

2.1.1 Health: "Right of All and a Duty of the State"

To promote universal health coverage, the 1988 Brazilian Federal Constitution created Brazil's Unified Public Health System (SUS), which consists of a massive set of actions and programs jointly subsidized and implemented by the federal government, states, and municipalities. Although the SUS still has some issues and distortions, in general, it has brought excellent results for public health in Brazil (CASTRO *et al.*, 2019; SOARES, 2019).

One of the SUS's main goals is to facilitate access to prescription and nonprescription drugs and other health items. However, this objective must meet public budget constraints, especially in emerging economies with a chronic fiscal deficit such as Brazil. In that respect, the SUS provides a list of procedures, medicines, and other health-related products that the government is committed to offering the population through its programs.

The SUS list works as a "social contract." It is how Brazilian society deals with the trade-off between universal health coverage and public budget costs. Periodically, the SUS list is updated to keep up with technological changes in the health area and treatments of new and known diseases. The ultimate goal is to serve as many people as possible as long as the government maximizes new therapies' cost-efficacy.

However, judges in Brazil tend to interpret the constitutional text literally and disregard costs in their analyses and decisions. Among many articles in the Constitution is a specific one (Article 196) that states:

> Health is a right of all and a duty of the state and shall be guaranteed utilizing social and economic policies aimed at reducing the risk of illness and other hazards and at the universal and equal access to actions and services for its

promotion, protection, and recovery. [3]

This article is a general article that gives rise to a wide range of interpretations that bring significant distortions to the health system and proper public resources use.

Since mid-2000, the common understanding of judges has been that the government must provide all health items and procedures for the population at any time. This strict interpretation creates a detrimental scheme of incentives for different groups of agents. Individuals often sue the Brazilian state "[…] claiming that they have the right to receive the treatment they need or to be funded by the public health system" (WANG, 2015), whether or not the treatment is on the SUS list.

It is relatively easy and inexpensive to access the legal system in this context: individuals need only a prescription for the desired drugs and a private lawyer or public defender. In addition, the success rate of health litigation is very high: in the state of Sao Paulo, for example, approximately 85% of first-instance claims prosper (CONSELHO NACIONAL DE JUSTIÇA-INSPER, 2019), and the rates in superior courts are even higher.

The combination of the low cost of accessing the legal system and high success rates leads to strong incentives to obtain medicines through the courts. There has been a steady upward trend in judicial claims for health-related products in Brazil in recent years; first instances of this type of court order totaled almost 96,000 in 2017, increasing almost 130% over 2008 (CONSELHO NACIONAL DE JUSTIÇA-INSPER, 2019). In the same period, the growth in the total number of lawsuits in the lower courts was only approximately 50%.

In the state of Sao Paulo, the growth pattern was even higher. An approximate increase of 913% occurred between 2008 and 2017, increasing from 2,317 to 23,465 yearly lawsuits for health products (CONSELHO NACIONAL DE JUSTIÇA-INSPER, 2019).

The lawsuits occur in many municipalities with wide dispersion throughout the state of Sao Paulo (Figure 1). A higher concentration of cases occurs in the most populous municipalities in absolute terms.

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[3] BRASIL. Constitution (1988). Constitution of the Federative Republic of Brazil. Brasília, DF, 1988. Available at: http://english.tse.jus.br/arquivos/federal-constitution. Access in: 08 Nov. 2020.

Figure 1 - Distribution of Health Litigation Cases – Municipalities in the State of Sao Paulo (2008-2019)
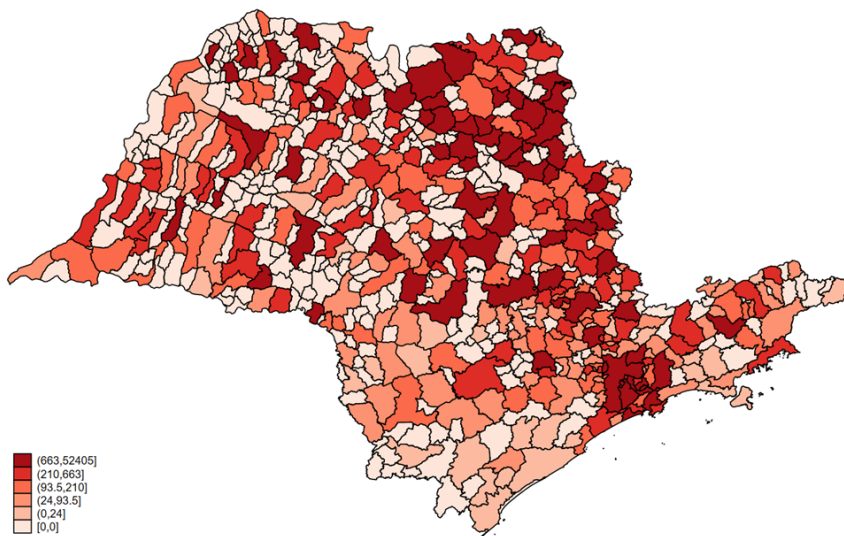
Source: S-CODES (SES/SP) and (CNJ-INSPER, 2019).

In addition to wide spatial dispersion, court orders consist of a massive variety of different items across time, including differences in dosages and drug presentations. Between 2009 and 2018, approximately 2,760 different items were ordered at least once a year on average.

The large and increasing number of successful judicial requests strongly affects the public health budget. The state government of Sao Paulo has a total annual budget of $58 billion, of which approximately 10% ($5.9 billion) goes to funding the Public Health System in the state. In 2018, public spending only for litigated health items was nearly 5% of the annual budget (US$300 million) of the Department of Public Health of Sao Paulo state (SES/SP).

The SES/SP is responsible for managing public resources and implementing policies and programs to promote public health in the state of Sao Paulo. It consists of 99 decentralized public buyer units (PBUs) distributed throughout the state (Figure 2). Every year, each PBU receives funds directly from the SES/SP headquarters and can manage its budget with a high degree of autonomy.

Figure 2 - Public Buyer Units (SES/SP)
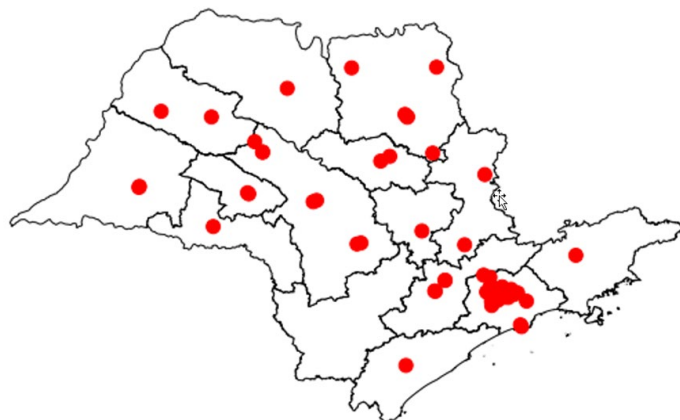
Source: S-CODES (SES/SP) and BEC-SP.

Most of the SES/SP's annual budget goes to purchase common goods and services, especially prescription drugs and other health-related items, to support all public health programs in Sao Paulo state[4]. PBUs are directly responsible for planning and making those purchases.

The purchase process is greatly affected when there is a court order to acquire a specific item. The court order obliges PBUs to buy quickly, with massive restrictions on the planning process and heavy sanctions against public officials if they do not comply with the judicial order.

2.1.2 Planning under Pressure: Judicial Decisions and Administrative Requests as Restrictions for Planning

As in many other countries, Brazilian law establishes as a general rule that all purchases, services, and works hired by the public administration are subject to a public tender. Federal Law 8,666/1993[5] institutes the general framework applicable to all public bids in the country, which must be observed by all three government branches.

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[4] The state of Sao Paulo is the wealthiest state among the 26 states of Brazil, with a population of approximately 44 million people.

[5] Entities directly or indirectly controlled by the federal, state, or municipal governments (PBUs), such as federal, state and municipal governments; autonomous government entities; public foundations; regulatory agencies; state-owned companies; and mixed capital companies controlled by the government, must comply with the government procurement rules.

According to Law 8,666/1993, a public purchase comprises three distinct, mandatory, and subsequent phases: (i) the *internal phase* (planning and publication of the notice), (ii) the *external phase* (negotiation between purchasing units and suppliers, and (iii) *delivery of items*.

The *internal phase* of an ordinary purchase consists of the public administration carrying out careful procurement preparation and planning. At this stage, PBUs first identify their needs and select what types of goods or services might be appropriate to meet those demands. Guided by the SES/SP headquarters, the purchases made by each PBU take into account local and regional demands. However, the most important requirement is that the SES/SP exclusively purchase items that appear on the SUS list.

The tender preparation commission then creates a purchase order defining the main parameters of the bidding process. These parameters consist of the number of items to be purchased and their specifications, the bidding schedule for all participants, the bidding procedure[6], the auctioneer in charge, quantities, reference prices[7], delivery addresses, and minimum bidder requirements for participation, payment method, and possible fines. These parameters, except reference prices, are brought together in a document called a public notice[8].

Choosing suitable bid parameters, such as quantities and reference prices, increases the chances of an efficient purchase. PBUs need enough time to accurately organize a proposal and take advantage of the government's ability to buy items on a large scale at better prices. Nonetheless, in some situations, planning time is scarce.

When court decisions reach the government, they force PBUs to buy items in very adverse conditions. First, these healthcare-related court decisions are almost exclusively enforced through injunctions (99.94% of all court decisions). The injunctions' application makes the deadlines for planning purchases and delivery of items very tight (between 1 and 10 days) compared to the deadlines for *ordinary* purchases (from 30 to 180 days). Consequently, the *internal phase* of *litigated purchases* is accomplished, on average, in one-third of the time of *ordinary* purchases,

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[6] In Brazil, different types of competitive tendering formats are available to procurers, such as invitation (sealed-bid tendering) and reverse auction.
[7] The maximum price a PBU is willing to pay for the item. It is private information.
[8] The notice must be published in the Official Gazette.

which undermines the process of setting the essential tender parameters.

Additionally, court orders have specific features that bring difficult and unpredictable elements to the purchase planning process. For example, since PBUs generally do not buy items that are not on the SUS list, they have less experience planning the purchase of these items. Most litigated products (almost 75%), mainly high-cost products and those intended for severe or rare diseases, such as cancer and amyotrophic lateral sclerosis (ALS), are not listed in the SUS.

However, the courts also order prescription drugs that are on the SUS list. Most court orders require the whole treatment of a specific disease for an individual: a set or package of different prescription drugs. Almost 65% of claims consist of items on the SUS list ordered along with non-SUS items. Although some of these items are on the SUS list, they also have a material impact on the public budget and purchase planning: litigated purchases use resources that would have been used for other purposes or were outside the initially planned budget.

Other relevant reasons for litigation are "off-label" uses of SUS-list items (approximately 20%) and "jumping the line"[9] in public programs (nearly 11%). Additionally, judges heed complementary justifications such as individuals' insufficient financial resources and imminent risk of death without requiring detailed evidence of these conditions in their decisions. Only 4% of judicial claims are due to lack of stock or inability to provide service. Thus, this situation indicates that the "litigation shock" is poorly correlated with a possible unobservable characteristic of PBUs, such as mismanagement.

Only in rare cases can the government execute a court order using existing stock since (i) planning is performed to meet the demands of existing programs, and (ii) it is challenging to maintain and manage strategic stocks due to drugs' high degree of perishability and the massive variety of items. For these reasons, health litigation acts as an exogenous shock, a severe restriction to be addressed in the planning process. It is impossible to precisely anticipate where, when, what, and what quantities the SES/SP might have to purchase. PBUs have little control over planning under these conditions. Additionally, health litigation has very little to do with the quality of the public

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[9] Cases in which the individual is entitled to receive the medication through a public program but does not want to wait to undergo the standard procedures to obtain it.

policies implemented.

There are also other costs to the government resulting from the judiciary monitoring and actively participating in public purchases. Penalties are extremely severe for public officials if they do not comply with a court order. This potential threat constitutes an additional restrictive element to tenders generated by court orders. The primary forms of punishment for noncompliance are (i) fines (sometimes reaching significant and disproportionate amounts); (ii) administrative, civil and criminal liability; and (iii) blocking and "hijacking" public funds.

Since 2009, the SES/SP has tried to mitigate the monitoring and punishment costs generated by court orders. The mechanism used is negotiating an item's supply directly with an individual before a court order occurs. This procedure is known as an *administrative* request.

Administrative requests are evaluated by a scientific committee that can judge whether a request is valid. This commission uses the scientific literature with a healthy level of evidence, using evidence-based medicine criteria and protocols recognized by the medical community.

One main difference between a judicial and an administrative request is that the latter undergoes a scientific examination and tends to represent a better use of the resource and the drug. As it is a more rigid and scientific process, it tends to be less sought after and generate fewer purchasing processes. The purchases generated by administrative orders totaled 9,700 between 2009 and 2019, representing approximately 6.5% of the total purchases from court orders.

Administrative requests bring another benefit to public administration. There are no penalties for the public officials involved in the event of a failure in the requested item's purchase process. Nevertheless, there is no difference between a court order and an administrative request regarding planning purchases. Like a court order, an administrative request generates a purchase order with immediate delivery and using budget resources not designated for this purpose.

In general, purchases of prescription and nonprescription drugs can be classified into three groups: (i) ordinary, (ii) administrative, and (iii) litigated. Table 1 summarizes the types of purchases and their characteristics.

Table 1 – Types of Purchases

Features	Type of purchase		
	Ordinary	**Administrative**	**Litigated**
Source of funds	Planned budget	Extra-budget	Extra-budget
Quantity	Higher quantity	Lower quantity	Lower quantity
Delivery time	Usually from 30 to 180 days	From 1 to 10 days	From 1 to 10 days
Threat of punishment	No punishment	No punishment	Potential punishment

Source: Prepared by the author.

Health litigation and administrative requests significantly impair the public procurement process, forcing public administration to respond to these demands without proper planning promptly. The purchase and negotiation process itself is severely hampered.

2.1.3 Buying under Pressure: Urgent Purchases as Public Information

The *external phase* covers the time lapse between the publication of the public notice and the contractual signature. This phase involves interaction between the government and firms through a previously chosen competitive tendering procedure and other parameters defined in the *internal phase*.

The main objective of a bidding process conducted by a PBU is to seek the best possible contract for the government, taking into account the parameters defined in the planning phase. The public official responsible for negotiating with suppliers cannot change any previously defined parameters such as quantities, delivery time, reference prices, and tendering procedures.

The way the *internal phase* routines are performed may substantially affect the bidding process results. Given that urgent purchases (litigated or administrative purchases) are planned under very restrictive conditions, they can make negotiations very difficult. Therefore, these urgent purchases' expected outcomes tend to be much worse than the outcomes when purchases are made under ordinary planning

conditions.

In addition, informing all that a tender is an urgent purchase can amplify these effects. It is mandatory by law to provide information in the public notice that the purchase originated from a court order or administrative request; this is public information[10]. For example, participating suppliers know that the SES/SP and its officers responsible for the bidding may be punished if negotiation for a litigated purchase is unsuccessful. Thus, making this situation, public information can be a relevant imbalance factor in the bargaining process between the government and firms.

Despite the differences in planning conditions, ordinary and urgent purchases are made through the state e-platform under the same operational conditions. Each PBU purchases in a decentralized way through the Bolsa Eletronica de Compras (BEC), the e-procurement platform of Sao Paulo state. Since 2007, it has been mandatory to use the BEC to purchase common goods and services in Sao Paulo state, including all 99 SES/SP units.

The BEC figures of SES/SP buying are expressive. In 2018, approximately US$1.7 billion were traded, and since 2009, the electronic platform has handled more than R$7.4 billion in SES/SP negotiations (approximately 34% of all state purchases). Almost 55,000 item purchase offers were negotiated, comprehending approximately 6,350 different traded items. The BEC has an extensive catalog of standardized items and services that are described in great detail[11].

The SES/SP uses the same two types of competitive tendering procedures available at the BEC to make *ordinary* and *urgent* (litigated and administrative) purchases: (i) sealed-bid tendering (*convite*) and (ii) multiround descending auctions (*pregão*).

In sealed bids, firms send their proposals to the government by a specific date specified in the notice. At a later date, the proposals and participants become public information when the auctioneer "opens" the envelopes. The winning firm is the one among those with appropriate documentation that submitted the lowest bid. *Convite* is allowed up to the purchase value limit of R$176,000 (approximately US$35,200).

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[10] See Appendix A for examples of public notices containing explicit disclaimers for urgent purchases.
[11] See details in section 3.1.

Pregão has no limit on the purchase value. This mode is a combination of a modified sealed-bid tender and reverse auction. In this case, PBUs rank the qualified proposals only under the conditions set out in the sealed-bid phase's notice. Then, the auctioneer publicly reveals all valid proposals, keeping firms' identities anonymous.

Next, the descending auction begins: for 20 minutes, each qualified firm submits its bids, knowing the current lowest valid bid. If there is a valid bid between 16 and 20 minutes, the auction will be extended for another 4 minutes. It ends only if 4 minutes passed with no valid bid. The final criterion[12] for winning the tender is presenting the lowest bid price, which must be lower than the reference price.

One of the main differences between the *convite* and *pregão* modes is that the latter allows for a negotiation phase after the reverse auction during which companies and the government can negotiate the lowest final price previously obtained. On the other hand, since *convite* has a single phase, it tends to be a more straightforward procedure to perform and monitor.

Planning and executing tenders consist of a very costly public administration process that demands relevant financial and human resources. An acquisition made by *pregão* or *convite* can have administrative costs from US$500 to US$5,200[13], depending on the bid complexity. Thus, if a public tender fails to obtain a supplier, it creates relevant waste for the government.

2.2 Data and Sample Definition

This section describes each data source and details the sample characteristics used in the empirical section. First, I present the bidding-level data on common goods and services purchased by the Sao Paulo state government through the BEC with a particular interest in what health-related products the SES/SP purchased and how from 2009 to 2019.

Second, I describe the dataset at the individual level for all lawsuits associated

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[12] "Best price" criterion.

[13] For more information, see: https://www.cgu.gov.br/noticias/2017/07/cgu-divulga-estudo-sobre-eficiencia-dos-pregoes-realizados-pelo-governo-federal/nota-tecnica-no-1-081-2017-cgplag-dg-sfc.pdf/view. Access in: 08 Nov. 2020.

with requests for free health-related products that occurred in the state courts of Sao Paulo during this period. This dataset includes information on individual court requests and judges' decision texts.

I utilize a unique combination of administrative databases in public procurement bidding processes, health litigation registers, and judicial decision texts in Sao Paulo, Brazil, from January 2009 to December 2019.

2.2.1 Public Procurement Data: Health-Related Products

I use administrative data on bidding-level public procurement tenders of common goods and services in the state of Sao Paulo, Brazil, from January 2009 to December 2019. These transactions took place under the BEC electronic procurement platform, which is available to all PBUs across the state. The Department of Finance of Sao Paulo state (SEFAZ/SP) is responsible for BEC bidding data's operational management and centralization.

In total, 1,344 PBUs make regular purchases through the BEC, including state-level executive, legislative, and judiciary bureaus in the state of Sao Paulo as well as other affiliated entities, such as some municipalities located in the state of Sao Paulo and a group of private organizations. PBUs purchased 169,607 different types of items (goods and services), totaling 3,866,407 transactions from 19,007 distinct firms in this period.

The BEC has a very detailed catalog of standardized goods and services organized in three levels: group, class, and item. For instance, health items are classified as group 65 (Medical, dental and hospital equipment and supplies). Thus, the item coded 110639 is the drug "Furosemide 40 milligrams, coated tablets, units," belonging to class 6531 (Medicines prescribed with or without ANVISA notification/registration) and group 65.

Table 2 - Descriptive Statistics: Public Tenders

Variable	Obs	Mean	Std. Dev.	Min	Max
urgent	59708	.3	.46	0	1
quantity	59708	4062184.9	9.822e+08	1	2.400e+11
reference price	59708	68.14	778.24	.01	96843.23
negotiated price	59708	38.44	421.38	0	17065.03
#firms	45007	3.22	2.42	1	18
#bids	45007	9.91	14.56	1	655
distance	38440	305.05	296.89	.01	2479.06
firm age	38440	189.58	150.48	2	750
convite	59708	.19	.39	0	1

Source: BEC-SP.

Data are organized by purchase offer (PO), the electronic document issued by the PBU that identifies and quantifies the goods and services that will be purchased. A PO is defined by a 22-character code and may contain one or more listed items, but each item has its own purchase process. Thus, the purchase of an item is uniquely identified by the combination of the PO and the purchased item codes (POI).

Each POI provides information about the internal phase parameters, such as item quantities and reference prices, and external phase outcomes, such as bid prices (winners and losers), number of participant firms, number of bids, whether the public tender was successful or not, and the identification of the PBU and the auctioneer, among other variables.

In the empirical section, I restrict attention to SES/SP purchases of prescription and nonprescription drugs. It is possible to identify government acquisitions as *ordinary*, *administrative*, and *litigated* purchases using bidding notices.

In the public notice, there is a section called "Object of the Contract" that consists of a description of what is being purchased and the reason for the purchase. I use a regular expression algorithm (REGEX) to process the public notice texts and identify which POIs correspond to litigated purchases[14].

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[14] First, I randomly selected 1,203 purchase orders, separating expressions that could identify the type of bid for each purchase order. Then, I ran an algorithm that checked the "Object of the Contract" field of all POs for the selected expressions, creating a binary variable for each type of bid.

2.2.2 Health Litigation Data

Data about health litigation come from two sources: the S-CODES database and texts of court decisions.

Managed by the SES/SP, S-CODES is an administrative database that contains a detailed record of all health claims against the state of Sao Paulo from 2009 to 2019.

The main variables that I derive from the S-CODES database for each litigated item are[15] (i) the *SUS list*: a dummy variable with the value of 1 if the item belongs to the SUS list and 0 otherwise; (iii) the *Package*, with a value of 1 if the item was jointly litigated with other products and 0 otherwise; and (iii) the *Preliminary injunction*, with a value of 1 if the court decision was enforced through a preliminary injunction and 0 otherwise.

Moreover, I use the texts of all court decisions against the state of Sao Paulo about health-related products from 2009 to 2019 to identify two aspects of health litigation: (i) individuals' main reasons for litigating and (ii) the main arguments used by judges to grant or reject a judicial claim. I use a supervised machine learning method to process all text decisions and search for litigation and judges' decision patterns.

2.3 **Empirical Strategy**

The empirical analysis is organized into two distinct parts.

First, to estimate the overall enforcement effect, I compare *ordinary* and *urgent* purchases, using judicial decisions and administrative requests that obligate the government to provide free prescription and nonprescription drugs to individuals. To avoid selection bias due to court orders, the first set of estimations restrict the analysis only to drugs that are regularly purchased by the government, as part of the healthcare public policy; and to the judicial orders that were motivated for reasons uncorrelated with the supply of those drugs.

Second, to estimate the "under the gun" effect, I compare two types of *urgent*

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[15] S-CODES has the same primary key (item code) as the BEC database.

tenders (*litigated* and *administrative* purchases) that differ only with regard the sanctions for non-compliance. As explained in more detail in this section, this comparison is not subject to selection bias since the choice between litigated or administrative urgent purchases is due to claimant's personal features that, although relevant for assessing judicial outcome, are irrelevant in public tenders.

2.3.1 The Enforcement Costs of Health Litigation

As mentioned before, when there is an injunction or an administrative request that forces the government to make an urgent acquisition, the SES/SP has significantly less time to plan it and a lower degree of discretion in setting key procurement parameters than in an *ordinary* purchase. This first estimation aims to illustrate the impact of these exogenous and anomalous requests on the critical parameters of tenders.

First, it is essential to note that both judicial and administrative requests constitute shocks that are not correlated with any unobserved factors in the purchase process. Although a judicial or administrative order's success depends on individuals' characteristics, the order purchase process does not.

The principle of impersonality[16] in public administration makes the planning and execution of the purchase utterly independent of the requesting individual's characteristics. Thus, the purchase results do not depend on who placed the order or who will benefit from it. The tender outcomes depend on the purchase characteristics, such as the items to be purchased, planning, and market conditions.

Who makes the purchase, i.e., public officials of the PBUs, judicial orders, or administrative requests, functions as an exogenous restriction on the way they make purchases. Primarily, in this particular case, the shocks separate the purchases into two types according to planning conditions and required delivery time: ordinary and urgent purchases. Since planning conditions and delivery time are very similar between purchases based on judicial orders and administrative requests, they are classified as

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[16] The principle of impersonality establishes that the public administration must be impartial in defending the public interest in any administrative action. This principle avoids discrimination or privileges for specific individuals. Therefore, bids must be planned and executed regardless of who requests them.

urgent.

Thus, I identify the effects of these exogenous shocks on the tender results, comparing ordinary and urgent purchase types. Differences in reference prices between *urgent* and *ordinary* purchases of purchase order *I*, with a good *g* and in time *t*, for instance, are estimated in the following specification for the log of reference price:

$$\ln Ref\_Price_{igt} = \beta Urgent_{igt} + \alpha_g + \lambda_t + \mathbf{x}\boldsymbol{\delta} + \epsilon_{igt} \tag{1}$$

where α_g and λ_t are item fixed effects and time trend dummies, respectively, and $\mathbf{x}$ is a vector of control variables. The variable $Urgent_{igt}$ has a value of 1 if it is a *litigated* or *administrative purchase* and 0 if it is an *ordinary purchase*.

I use data of all public bids related to SUS-list medicines from January 2009 to December 2019. The data include only items with at least one urgent purchase and at least one ordinary tender. The results are shown in Table 3.

Table 3 - Reference Prices: Urgent vs. Ordinary Purchases

	(1)	(2)	(3)	(4)
	OLS	FE	FE	FE
urgent	.4988***	.5243***	.4967***	.4725***
	(.0379)	(.0383)	(.0377)	(.0373)
type_mgmt	.6535***		.6488***	.553***
	(.0516)		(.051)	(.0521)
sealed-bid				-.1708***
				(.0184)
_cons	.33***	.2554***	-.3851***	-.2307***
	(.0607)	(.0699)	(.0807)	(.0809)
Observations	59708	59708	59708	59708
R-squared	.7767	.0702	.0781	.0816
Item dummies	YES	YES	YES	YES
Year dummies	NO	YES	YES	YES
PBU dummies	YES	NO	YES	YES

Standard errors are in parentheses.

*** $p<.01$, ** $p<.05$, * $p<.1$

It is possible to observe that reference prices are consistently higher in *urgent purchases*, considering all specifications: items are, on average, from 60.40% to 68.93% more expensive than in *ordinary purchases*.

The positive difference in reference prices captures the effects of worse conditions for planning purchases: smaller quantities, shorter delivery times, and the potential risk of punishment. As shown in Table 4, the quantities chosen are indeed lower for urgent purchases.

Table 4 - Quantities: Urgent vs. Ordinary Purchases

	(1) OLS	(2) FE	(3) FE	(4) FE
urgent	-.8128***	-.8811***	-.8272***	-.9402***
	(.0625)	(.0623)	(.0626)	(.0635)
type_mgmt	-1.2808***		-1.2642***	-1.7127***
	(.1076)		(.107)	(.1082)
sealed-bid				-.8***
				(.0428)
_cons	7.412***	6.1144***	7.3626***	8.0859***
	(.1117)	(.1003)	(.1458)	(.1492)
Observations	59708	59708	59708	59708
R-squared	.4141	.1606	.1702	.195
Item dummies	YES	YES	YES	YES
Year dummies	NO	YES	YES	YES
PBU dummies	YES	NO	YES	YES

Standard errors are in parentheses.

*** p<.01, ** p<.05, * p<.1*

Usually, governments seek to buy goods and services from the private sector on a large scale to obtain higher discounts on negotiated prices. This "bulk procurement" effect might be maximized if PBUs could adequately plan the acquisition process of goods and services.

The results suggest the following general mechanism: court orders or administrative orders create worse conditions for planning a given public tender. This shock impacts the capacity to define the amount to be purchased, and the maximum prices PBUs are willing to pay.

Given that budgetary resources are scarce, especially for urgent orders, PBUs choose smaller quantities and pay higher prices to comply with court orders at the proper time. Thus, PBUs lose bargaining power and the possibility of substantial bulk discounts.

The effective fulfillment of court orders or administrative requests occurs in the external phase, consisting of the negotiation itself. Compliance with these external requests directly impacts the total amount of public spending. Unplanned, extrabudgetary resources are used to meet these external requests.

In urgent purchases, the negotiated quantities are, on average, nearly 53% smaller than in ordinary purchases. Both reference prices and negotiated prices may be affected: the lower the quantities purchased, the higher the prices are.

I use a specification similar to that presented above, as a baseline to model differences in outcomes *y* between *urgent* and *ordinary* purchases of purchase order *i* with good *g* and in time *t*:

$$\ln y_{igt} = \beta Urgent_{igt} + \alpha_g + \lambda_t + \mathbf{z}\boldsymbol{\delta} + \epsilon_{igt} \qquad (2)$$

where $\mathbf{z}$ is a vector of controls, including the purchased quantities defined in the internal phase. This is a way to capture possible bulk discounts. The estimations for negotiated prices are presented in Table 5.

Table 5 - Negotiated Prices: Urgent vs. Ordinary Purchases

| | (1) | (2) | (3) | (4) |
	OLS	FE	FE	FE
urgent	.3672***	.3526***	.3568***	.268***
	(.0414)	(.0429)	(.0417)	(.0432)
lquantity	-.3081***	-.3011***	-.3025***	-.3301***
	(.036)	(.0334)	(.034)	(.034)
type_mgmt	-.1814**		-.1422*	-.4735***
	(.0801)		(.0742)	(.0863)
sealed-bid				-.5403***
				(.0344)
_cons	2.4156***	1.2356***	1.3862***	2.0863***
	(.2934)	(.206)	(.2665)	(.2892)
Observations	38440	38440	38440	38440
R-squared	.879	.3393	.3396	.3798
Item dummies	YES	YES	YES	YES
Year dummies	NO	YES	YES	YES
PBU dummies	YES	NO	YES	YES

Standard errors are in parentheses.

*** p<.01, ** p<.05, * p<.1

As shown, the government buys the same product under different planning situations: *ordinary* and *urgent* conditions. Negotiated prices are consistently higher for *urgent purchases*. On average, items purchased in adverse conditions are from 30.73% to 44.37% more expensive than those purchased in ordinary tenders.

Higher prices for urgent purchases suggest that adverse trading conditions strongly affect government bargaining power. On the other hand, tight deadlines and small quantities can alienate firms potentially interested in selling to the government. Table 6 presents estimations for the number of participant firms in urgent vs. ordinary purchases.

Table 6 - Participant Firms: Urgent vs. Ordinary Purchases

	(1) OLS	(2) FE	(3) FE	(4) FE
urgent	-.3887***	-.3831***	-.3811***	-.3373***
	(.019)	(.0191)	(.0191)	(.02)
lquantity	.148***	.1475***	.1468***	.1604***
	(.0068)	(.0068)	(.0068)	(.0079)
type_mgmt	-.0463*		-.0672**	.096***
	(.0267)		(.0281)	(.0293)
sealed-bid				.2661***
				(.0184)
_cons	-.3167***	-.0293	.0419	-.303***
	(.0632)	(.0563)	(.0701)	(.0841)
Observations	38430	38430	38430	38430
R-squared	.4691	.2645	.2647	.2886
Item dummies	YES	YES	YES	YES
Year dummies	NO	YES	YES	YES
PBU dummies	YES	NO	YES	YES

Standard errors are in parentheses.

*** p<.01, ** p<.05, * p<.1

There is a consistent drop in firms that participate in urgent purchases, varying from 28.63% to 32.21%, compared to ordinary ones. This result may indicate that the screening process is impaired in urgent purchases, as PBUs are not able to attract as many suppliers as usual.

A possible consequence of attracting a smaller number of interested suppliers is less competitive bidding. Few companies do not necessarily mean less competition. For instance, very few companies offer certain specific medicines, but they consist of oligopolies with very competitive dynamics. However, Table 7 supports the first idea in the case of the tenders studied here.

Table 7 - Number of Bids: Urgent vs. Ordinary Purchases

	(1) OLS	(2) FE	(3) FE	(4) FE
urgent	-.509***	-.5009***	-.5166***	-.6148***
	(.0366)	(.0325)	(.0322)	(.0342)
lquantity	.2162***	.2208***	.2261***	.1956***
	(.0158)	(.0134)	(.0137)	(.0127)
type_mgmt	.478***		.5265***	.1602***
	(.0446)		(.0409)	(.04)
sealed-bid				-.5973***
				(.0337)
_cons	-.2387*	-.1271	-.6847***	.0893
	(.1362)	(.1025)	(.1281)	(.1311)
Observations	38430	38430	38430	38430
R-squared	.4232	.2181	.2232	.2703
Item dummies	YES	YES	YES	YES
Year dummies	NO	YES	YES	YES
PBU dummies	YES	NO	YES	YES

Standard errors are in parentheses.

*** p<.01, ** p<.05, * p<.1

Although the number of participants for urgent purchases is approximately 30% lower, the number of bids is even smaller. On average, the number of valid bids falls from 39.40% to 45.93% in urgent purchases compared to ordinary ones.

This firm behavior may reflect the lack of incentives to be more aggressive in the context of urgent purchases. Since there are fewer participating companies and less bargaining power for PBUs, suppliers make less effort to lower prices.

Moreover, adverse conditions for purchasing medicines can generate another problem related to firm screening processes. When conditions are precarious, the bidding process might fail. There may be a lack of interest among suppliers, or the PBUs cannot obtain a reasonable price. Urgent purchases tend to be significantly more likely to fail than ordinary purchases, as shown in Table 8.

Table 8 - Successful Tenders: Urgent vs. Ordinary Purchases

	(1)	(2)	(3)	(4)
	LOGIT	LOGIT	LOGIT	LOGIT
urgent	-.4871***	-.4871***	-.6667***	-.5471***
	(.0252)	(.0252)	(.029)	(.0301)
lquantity	.2378***	.2378***	.2508***	.2803***
	(.006)	(.006)	(.0063)	(.0065)
type_mgmt			.1628**	.756***
			(.0695)	(.073)
sealed-bid				.9603***
				(.0305)
_cons	-1.8201***	-1.8201***	-2.1149***	-2.9174***
	(.3403)	(.3403)	(.3536)	(.3615)
Observations	59672	59672	59672	59672
r2_p	.1238	.1238	.1328	.1572
Item dummies	YES	YES	YES	YES
Year dummies	NO	NO	NO	YES
PBU dummies	NO	NO	YES	YES

Standard errors are in parentheses.

*** p<.01, ** p<.05, * p<.1

Urgent purchases are from 38.56% to 48.66% less likely to succeed than ordinary purchases. Failure to bid has relevant implications in terms of budgetary costs. First, when a court-ordered purchase is not made, it generates relevant punishment costs, such as fines and blocking of budgetary resources for the PBU. In addition, as mentioned in section 2.3, planning and executing a purchase have high costs. Therefore, resources are wasted in case of failure.

2.3.2 The "Under the Gun" Effect

As already mentioned, urgent purchases consist of those arising from court orders and administrative orders. Both litigated and administrative purchases are made under challenging conditions in terms of planning and execution. However, there is a single significant difference between them: a litigated tender likely results in public officials' punishment if they fail to complete the purchase.

Making public the information that a tender is of a litigated type might have an

additional effect on the results of bidding processes. Since all participants learn that the government is under even higher pressure to purchase, firms have additional advantages over PBUs in the bargaining process.

This section's main objective is to estimate this "additional effect"; I call it the *"under the gun" effect*. I use all public bid data, including SUS-list and non-SUS-list medicines, from January 2009 to December 2019.

I restrict the analysis to items with at least one litigated purchase and at least one administrative tender; data on ordinary purchases are excluded from those estimations. The idea is to compare litigated and administrative purchases exclusively. Using the same identification strategy presented in section 4.1, I adopt the following specification as the baseline equation:

$$\ln y_{igt} = \beta Adm_{igt} + \alpha_g + \lambda_t + \mathbf{z}\boldsymbol{\delta} + \epsilon_{igt} \tag{3}$$

where Adm_{igt} has a value of 1 if it is an *administrative purchase* and 0 if it is a *litigated purchase*. Table 9 presents the estimation of the results for negotiated prices. Negotiated prices are lower for *administrative purchases*. On average, administrative tenders are 8.11% to 9.06% less expensive than litigated tenders.

Table 9 - Negotiating Prices: The "Under the Gun" Effect, Litigated vs. Administrative Tenders

	(1) OLS	(2) FE	(3) FE	(4) FE
administrative	-.095***	-.0859***	-.0859***	-.0846***
	(.0238)	(.0243)	(.0243)	(.0242)
lquantity	-.4003***	-.3942***	-.3942***	-.3981***
	(.0233)	(.0236)	(.0236)	(.0234)
type_mgmt	-.1564		-.184	-.4322*
	(.181)		(.1879)	(.2519)
sealed-bid				-.5173***
				(.0401)
_cons	2.4521***	3.9031***	4.0871***	4.5326***
	(.2431)	(.1344)	(.2391)	(.3013)
Observations	51013	51013	51013	51013
R-squared	.9293	.3718	.3718	.3837
Item dummies	YES	YES	YES	YES
Year dummies	NO	YES	YES	YES
PBU dummies	YES	NO	YES	YES

Standard errors are in parentheses.

*** p<.01, ** p<.05, * p<.1

In other words, litigated purchases are between 8.83% and 9.97% more expensive than administrative purchases. This difference is the "*under the gun*" effect. With similar planning and execution conditions between administrative and litigated purchases, the estimated price difference can be attributed exclusively to the possible punishment of PBUs in case of failure to purchase.

2.4 **Conclusion**

Implementing public policies demands various types of resources, such as common goods and services. It is crucial that the process of purchasing these goods and services be well planned and executed so that the government may use its budget efficiently and achieve public policy goals effectively.

This paper investigates the enforcement costs of health litigation and administrative requests for the public budget. I evaluate the government waste

generated when the judiciary directly affects public policy. In this case, health litigation imposes multifold restrictions on the public procurement process, harming tender outcomes.

From a policy perspective, this research indicates that judges should consider the public budget implications and administrative costs of purchasing health items under pressure in their decisions. An institutional arrangement integrating the judiciary and the executive branches, enabling joint actions, might mitigate waste in the health litigation context.

2.5 **Further Steps**

There are two main ways to advance this paper. The first is developing a theoretical model that explains the mechanisms of the "under the gun" effect, focusing on the behavior of the auctioneer responsible for public purchases.

A second way is to explore potential heterogeneities in the "under the gun" effect among auctioneers. The idea is to open the "black box" of the fixed effects related to those auctioneers, relating academic backgrounds, capabilities, tenure, among other characteristics, with differences in effects on the waste generated in litigated purchases.

3 SMES AND PUBLIC PROCUREMENT: THE COSTS OF RESTRICTING TENDERS

Small and medium-sized enterprises are extremely important for employment and production worldwide. In Europe, for instance, SMEs represent nearly 99.8% of all registered companies, accounting for more than half of the European GDP and two-thirds of all jobs in the private sector (PWC, 2014). Similar figures can be observed in Brazil, where approximately 97% of all firms are SMEs[17], representing approximately 50% of Brazil's formal jobs (BASTOS *et al.*, 2018).

In recent years, governments worldwide have implemented public policies that favor SMEs based on the potential or actual benefits these policies can bring to the economy.

The literature widely acknowledges that SMEs have massive potential for job creation, local development, and innovation (SIGMA, 2016). However, there is limited evidence on the social costs of such policies since most research and case studies do not address this point. This paper exploits a quasi-experimental variation from a public SME-related program to estimate the costs of incentivizing restricted public tenders to SMEs in Sao Paulo, Brazil.

The use of public procurement as a policy tool has been a major trend worldwide (THAI, 2017). Policies that favor sustainable or '*green*' procurement[18] or utilize social criteria to restrict bids to a target group of sellers[19] are prime examples of public procurement policies that aim to achieve social and economic outcomes.

One of the most widespread practices to promote local development through public procurement is the restriction of public tenders to SMEs. The significant presence of SMEs in the economy suggests that these companies are an essential channel through which to infuse economic development (FREEDMAN, 2013; MEL; MCKENZIE; WOODRUFF, 2008), although there is evidence that the effectiveness of

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[17] This terminology varies slightly from country to country. In Brazil, the term most widely used to refer to these companies is 'small and micro enterprises', which is equivalent to the term SMEs in the international literature.

[18] Public tenders with environmentally oriented procurement goals. See also (LUNDBERG; MARKLUND, 2018).

[19] 'Social' public procurement refers to policies that favor specific social groups in public tenders, such as woman-owned companies or companies with minimum labor standards. See also (MCCRUDDEN, 2007).

this mechanism depends on the quality of management practices (MCKENZIE; WOODRUFF, 2015) or how capital is provided through investment in SMEs (FAFCHAMPS *et al.*, 2014).

The primary justifications for implementing policies that favor SMEs in public procurement are related to the various entry barriers to public tender that SMEs face (HOEKMAN; TAS, 2020; LOADER, 2015; OECD, 2018). Better access to the public procurement market might catalyze SMEs' productive potential, especially in contexts with demand constraints (CARDOZA *et al.*, 2016; FERRAZ; FINAN; SZERMAN, 2015). It may expand government networks of goods and services providers, thus enhancing the competition among firms and enabling public acquisitions at more competitive prices (LOADER, 2013).

Despite the potential positive effects generated by favoring SMEs in public tenders, such a policy may undermine the quality and efficiency of the public procurement process (NAKABAYASHI, 2013). First, it may lead to smaller-scale purchases per bid because SMEs generally cannot handle large orders.

Second, restricting public bid participation may harm firms' screening process and increase the likelihood of selecting fewer, less efficient firms or no firms at all (LOADER, 2013; NAKABAYASHI, 2013). Thus, either negotiated prices may be higher than usual, or there may be a waste of public resources since planning and executing a bid is costly. However, there is evidence that the costs of negotiating and executing public contracts may be mitigated by public managers' contract management capabilities and private sellers' contract execution capabilities (CABRAL, 2017).

Additionally, depending on the characteristics of their sector, SMEs may not reach competitive price-cost levels when providing a good or service to the government (NAKABAYASHI, 2013). Thus, organizing an unsuccessful tender means wasting resources; the government may incur severe costs with few results for SMEs or the local economy.

While there are numerous examples of policies favoring SMEs in public tenders, there is little direct evidence of the impacts of such policies on firms' performance. Additionally, the costs of implementing such a policy are practically ignored in the literature.

Estimating the public costs of favoring SMEs in public procurement is a

complicated issue to assess empirically because doing so requires establishing an appropriate counterfactual (HOEKMAN; TAS, 2020). I utilize a policy experiment in the state of Sao Paulo, Brazil, to estimate the costs of favoring SMEs in public procurement. I exploit the timing of a change in a policy of restricted SME tenders (March 2018) that affect only a specific group of items (group 65). The identification strategy simultaneously uses time and cross-sectional variations to estimate the effects of this policy shift.

However, in this paper, examining how institutional change occurred allows the costs of the SME policy to be assessed only indirectly. Instead of using a standard difference-in-differences (DiD) method, it is necessary to use a variation of this method known as difference-in-differences in reverse (DiDiR), or 'time-reversed DiD' (KIM; LEE, 2019). In the DiD method, there is a control group that is never treated and a treatment group that is treated at some point in time. In the DiDiR method, the control group is always treated (instead of always untreated), and the other group is the 'switched group,' subject to the change in policy.

In Sao Paulo state, PBUs can procure goods in public tenders exclusive to SMEs. Between August 2014 and February 2018, the government's *default choice* consisted of executing SME-only tenders for all items with a value less than or equal to R$80,000, except for a group of items identified as code 65, for which open tenders were mandatory.

PBUs can avoid restricted tenders for SMEs provided that they incur in a costly process of justification to its watchdogs. In case of any irregularity or failure to comply strictly with the law, public officers can be punished. From March 2018 on, after a change in the law's interpretation, group 65 became subject to the general rule just like any other group of purchased items. Thus, the 'always treated' group here consists of all groups of items but group 65, comprising the switched group.

Notably, DiDiR identifies pre-switch-period effects; i.e., it estimates effects for the past (KIM; LEE, 2019), assessing the policy switch costs indirectly. I estimate this pre-switch-period effect on the switched group, comparing the observed outcomes for group 65 before the shift in policy and the outcomes that would have occurred for this group if there had been opt-out costs before March 2018.

Thus, the DiDiR method reveals that the negotiated prices are, on average,

between 4.58% and 8.08% lower for group 65 than other groups before March 2008. Moreover, in the *pre*-period, the number of participants in group 65 is approximately 22% higher than that in other groups of items.

The number of valid bids follows the same pattern as the number of participant firms: there were approximately 25% more valid bids in group 65 than in the other groups of items. Finally, before the policy change, sellers that won tenders for items in group 65 were approximately 4 km further away from PBUs than in open tenders.

This paper has five sections, including this introduction. Section 2 provides a brief overview of the institutional background related to SME law and public procurement in Sao Paulo, Brazil, which is relevant to the empirical section. Section 3 describes the datasets and sample definitions. Section 4 presents the empirical analysis. Section 5 concludes the paper.

3.1 Institutional Background

This section provides a brief institutional background on SMEs' participation in the context of public tenders in Sao Paulo, Brazil. I focus on the details that are most pertinent for the empirical analysis.

First, I briefly discuss general aspects of public procurement and the legislation on micro and small businesses in Brazil, highlighting the established criteria for the occurrence of SME-only public tender. Finally, I describe how the state of Sao Paulo applied this law in accordance with its own understanding of exclusive tenders for health-items.

3.1.1 Public Procurement and SME law in Brazil

Public procurement constitutes a relevant part of economies worldwide. In 2016, OECD countries spent approximately 12% of GDP on public procurement, while in Brazil, this proportion was approximately 10% in the same year.

As in many other countries, Brazilian law establishes as a general rule that all

purchases, services, and works hired by the public administration should be subject to a public tender. Federal Law 8,666/1993 institutes a general framework applicable to all public bids in the country, and all three government branches must adhere to this framework.

Entities directly or indirectly controlled by the federal, state, or municipal governments must comply with the government procurement rules. Federal, state and municipal governments, autonomous government entities, public foundations, regulatory agencies, state-owned companies, and mixed capital companies controlled by the government are subject to these rules. These entities are known as PBUs.

Although the public administration may decide to make purchases centrally, in Brazil, almost all acquisitions are decentralized and made by PBUs. A ministry or bureau may consist of many PBUs with budgetary autonomy and make purchases from private companies. PBUs may contract a wide variety of products and services from private companies, including engineering and infrastructure work. This paper focuses on common and standardized goods, as they allow for a cleaner assessment of the effect of the SME law.

The primary purpose of a bidding process conducted by a PBU is to seek the best contract possible for the government. The Brazilian public procurement law provides guidelines on how the procurement process should be organized and executed. In some cases, public tenders for SMEs are subject to different treatment.

The Brazilian federal SME law was created in 2006[20] to regulate favored, simplified and differentiated treatment for this sector, as provided for in the Federal Constitution[21]. This law's explicit goal was to promote SMEs' economic and social development and competitiveness as a strategy for job creation, income distribution, social inclusion, reduced informality, and a strengthened economy.

The Brazilian SME law adopts the following classification for companies, according to their annual gross revenue: (i) microbusiness: annual gross revenue of R$360,000 or less (roughly US$72,000); and (ii) small business: annual gross revenue greater than R$360,000.00 and less than or equal to R$4,800,000 (between

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[20] Federal Law n. 123/2006.
[21] BRASIL. Constitution (1988). Constitution of the Federative Republic of Brazil. Brasília, DF, 1988. Available at: http://english.tse.jus.br/arquivos/federal-constitution. Access in: 08 Nov. 2020.

US$72,000 and US$960,000). In this paper, these companies are referred to as SMEs.

SMEs enjoy many benefits provided by law, including tax benefits and fewer bureaucratic requirements to adhere to. In addition, public tenders held at the federal, state, and municipal levels can grant differentiated and privileged treatment to SMEs to promote economic and social development, increase public policies' efficiency, and stimulate technological innovation[22].

The content of the SME law, in its 2006 version, indicated that the public administration *could* create tenders exclusively for the participation of SMEs in purchases in which the item value was up to R$80,000 (approximately US$16,000.00). Thus, choosing tenders for SMEs only was optional for PBUs.

However, the federal SME law underwent a significant change from SMEs' exclusivity in tenders in 2014[23]. The term *'could'* has been replaced with *'must,'* making it mandatory to execute exclusive public tenders for SMEs up to a value per item of R$80,000, unless the bid's conditions fall within the exceptions provided for in the updated legislation. In short, the law changed PBUs' default choice if the item value fell below the threshold of eighty thousand reais: previously, the default choice was open bids.

PBUs can avoid restricted bids if at least one of the following conditions is met: (i) there are two or fewer potential competing SME suppliers that are locally or regionally based and able to comply with the notice requirements, and (ii) PBUs consider that the differentiated and simplified treatment for SMEs might not be advantageous for the public administration[24]. Thus, PBUs choose whether the public tender is restricted, but they must justify their choices to their watchdogs, such as audit courts or the judiciary.

On the one hand, this discretion provided for by law can be beneficial since PBUs can more efficiently choose the bidding type to be carried out. However, there are costs involved in the process of avoiding bids restricted to SMEs. For each bidding procedure, PBUs must create an extensive report listing in detail the reasons that justify the use of an open bidding process to the detriment of a bidding process

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22 Federal Law n. 123/2006.
23 Federal Law n. 147/2014.
24 Idem.

restricted to SMEs.

Additionally, these PBU justifications are subject to scrutiny by both the audit courts and the judiciary. If these bodies consider the arguments unfounded or insufficient, administrative proceedings and punishments may be brought against the public agents responsible for planning and executing the bid in question. Thus, this discretion brings costs to PBUs. I call these costs associated with avoiding SME-only tenders *opt-out costs*.

3.1.2 SME-only Public Tenders: Group 65 As an Exception

Sao Paulo is the wealthiest and most populous state in Brazil. This state accounts for approximately 23% of the total population and nearly one-third of Brazil's GDP (nearly US$500 billion in 2018). This amount is equivalent to the GDP of countries such as Sweden, Poland, and Belgium and more than twice the GDP of Portugal, Greece, and Finland[25]. The state of Sao Paulo has a diversified economy driven by the automobile, textile, chemical, aeronautical, and computer industries, in addition to services such as finance and agriculture.

Since 2005, all PBUs in the state of Sao Paulo have been required to purchase common goods and services through Bolsa Eletronica de Compras (BEC), an electronic purchasing platform. The BEC figures are revealing: in 2019, approximately R$13 billion (about US$3 billion) in trade was conducted on this e-platform. Since its implementation in 2005, BEC has moved more than R$105 billion (about US$20 billion) in negotiations; 860,000 purchase offers have been made, and approximately 4.8 million items have been sold.

Despite being subject to federal laws, Brazilian states have the prerogative to regulate or interpret these laws' specific elements. The state of Sao Paulo, for example, has a specific interpretation of how to apply SME law in public procurement.

Since BEC's implementation, the Sao Paulo state government has considered

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[25] Source: Brazilian Institute of Geography and Statistics (IGBE). See also https://www.ibge.gov.br/cidades-e-estados/sp.html. Access in: 08 Nov. 2020.

the group of items consisting of health-related products, including medication and hospital supplies (code 65), as a strategic set of items in the public procurement process. For example, bidding procedures related to medication can only be carried out with dynamic reverse auctions (*pregao*) or sealed bidding (*convite*). Direct negotiation (*dispensa de licitacao*), which is very common in purchasing other types of common goods, has always been prohibited for group 65 in Sao Paulo.

Between 2006 and 2014, when the first version of the SME law was enforced, PBUs located in the state of Sao Paulo had the *default choice* to hold open tenders; it was optional to set procedures restricted to SMEs. During this period, following this legal arrangement, there was low adherence to restricted bids; items in these bids accounted for 6 to 13% of the total number of items bid for in the state of Sao Paulo. However, for group 65, there were no bids exclusively for SMEs in this same period. The government had an internal orientation to hold open tenders for group 65, with the explicit agreement of the audit court of the state of Sao Paulo (TCE-SP).

After 2014, with the update of the federal law on SMEs, the *default choice* was to execute SME-only tenders if the item value was less than or equal to R$80,000. In the state of Sao Paulo, if PBUs consider that any item in a bidding process falls within the exceptions provided for by law, they must justify in detail the reasons for the non-execution of an exclusive bid for SMEs through a report sent to TCE-SP.

This justification offered by PBUs to avoid restricted tenders requires not only excessive work effort for PBUs but also is subject to the scrutiny of the TCE-SP and the judiciary. Public officers can face punishment if there are irregularities or failure to comply strictly with the law.

With the introduction of considerable opt-out costs for PBUs, this incentive scheme appears to be effective in encouraging the choice of offering exclusive bids to SMEs: adherence to this procedure has increased from approximately 13% to almost 70%, on average, in subsequent periods.

However, between August 2014 and February 2018, bids related to group 65 did not change. The Sao Paulo state government and TCE-SP, in a joint agreement, used a specific interpretation of the new version of the federal SME law to leave group 65 as an exception. The federal law provides that the requirement of restricted bids to SMEs does not apply when "it is not advantageous to the public administration or

represents a loss to public resources." Thus, using this guideline, which allows for a high degree of discretion, the state of Sao Paulo and TCE-SP operated on the interpretation that because group 65 constitutes a set of strategic items to meet such an essential public policy, it should always be subject to open bids. Thus, in this period, there was no bidding restricted to SMEs involving group 65.

However, in November 2017, a different control agency in the state of Sao Paulo, PGE-SP[26], issued a document containing a legal opinion[27] that changed this interpretation. This document reinforces that the principle of isonomy in law enforcement should prevail in public procurement. Then, group 65 should be considered for public procurement purposes in the same way as other groups.

Hence, as of March 2018, the opt-out costs also apply to group 65. Between March 2018 and December 2019, adherence to exclusive bids for SMEs for this group was, on average, 43%. This lower proportion of restricted bids for SMEs for group 65 compared with other groups may be due to the existence of more oligopolies in this group of items, which include, for example, medication. Thus, in many cases, it is not possible to find at least three potential suppliers that are SMEs.

3.2 **Data**

This section describes the data source and details the sample characteristics used in the empirical section.

I use administrative data on bidding-level public procurement tenders of common goods and services in the state of Sao Paulo, Brazil, from January 2016 to December 2019. All transactions took place on the electronic procurement platform called BEC, available for all PBUs across the state. The SEFAZ/SP is responsible for the operational management and centralization of BEC's bidding data.

On BEC, 1,344 PBUs regularly make purchases. These entities include state-level bureaus from the executive, legislative, and judiciary branches in the state of Sao Paulo as well as other affiliated entities, such as municipalities located in the state of

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[26] Attorney General of the State of Sao Paulo (PGE-SP).
[27] PGE-SP's Referential Opinion n. 13/2019.

Sao Paulo and private organizations. PBUs purchased 82,569 different items (goods), totaling 832,984 successful transactions from 2016 to 2019.

Table 10 - Descriptive Statistics: Public Tenders

Variable	Obs	Mean	Std. Dev.	Min	Max
quantity	832984	30720.76	2211000.4	1	1.165e+09
reference price	832984	8450.3	346551.49	0	1.166e+08
negotiated price	832984	5896.56	251894.44	0	1.027e+08
#firms	832984	4.76	3.27	1	79
#bids	832984	11.99	17.93	1	894
distance	832984	182.71	209.77	.01	2694.34
firm age	832984	152.95	144.91	1	969
convite	832984	.55	.5	0	1

Source: BEC-SP.

BEC has a very detailed catalog of standardized goods and services organized in three levels of detail: group, class, and item. For instance, health items are classified as group 65 (medical, dental, and hospital equipment and supplies). The item coded as 110639 refers to the drug 'Furosemide 40 milligrams, coated tablets, units', belonging to class 6531 (Medicines prescribed with or without ANVISA notification/registration) and group 65[28].

Data are organized by purchase offer (PO), the electronic document issued by the PBU that identifies and quantifies the goods and services that will be purchased. A PO is defined by a 22-character code and may contain one or more items listed, but each item has its own purchase process. Thus, the purchase of an item is uniquely identified by the combination of the PO and the purchased item codes (POI).

There is a crucial variable for the empirical section, defined from the item group

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[28] Another example is group 89 (Foodstuff). Item 257419 refers to 'Special coffee; gourmet; roasted in uniform grains; consisting of 100% Arabic grains; free of strange taste; free of fermented black, green, burnt, black-green grains, soft drink or better; striking flavor, medium and clear roasting, chocolate notes, marked sweetness, low bitterness; minimum superior global quality of 7.30 points on the sensory scale; vacuum packaging; with minimum validity on the delivery date of 10 months, with date of manufacture and expiry printed on the packaging', which belongs to class 8965 (Coffees, Teas, Chocolate and Other Soluble Drinks).

codes. It is a binary variable that assumes the value of 1 if it belongs to group 65[29] and 0 otherwise. The items in group 65 constitute the 'switched group,' i.e., the set of items affected by the purchasing policy change. Group 65 accounted for almost 27% of all purchases from 2016 to 2019. All other groups of items comprise the 'control group.'

There are 75 groups of items, excluding group 65. Between 2016 and 2019, the most significant groups were groups 89 (food products), 75 (office supplies), 86 (computer products), and 79 (cleaning materials), representing 37.5% of the total purchases in this period.

For each POI, there is information about item quantities, bid prices (winners and losers), the number of participant firms, the number of bids, whether the public tender was successful or not, the identification of the PBU, and firms' and PBUs' location, among other variables.

3.3 **Empirical Strategy and Results**

This section is organized into two parts. First, I describe the method I use to estimate the impacts of the SME public procurement policy shift on the selected outcomes. I perform a DiD analysis, but unlike a standard DiD, the control group is always treated instead of always untreated (KIM; LEE, 2019). Then, I discuss the identifying assumptions in the context of the DiDiR I employ. In the second part, I discuss the main results.

3.3.1 Main Specification and Identification Strategy

The identification strategy exploits the timing of a change in the policy of restricted SME tenders (March 2018) that affect only a specific group of items (group 65). Thus, it is possible to simultaneously use time and cross-sectional variations to estimate the potential effects of this policy shift.

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[29] Items related to medical, dental, and hospital equipment and supplies.

In a standard DiD with treatment *d* and outcome *y*, there exists a group of units (*q* = 1) with its treatment changing from *d* = 0 to *d* = 1 at some date, and there exists another group (*q* = 0) in which *d* = 0 always. In this paper, however, the framework is slightly different: the group 'q = 0' always has *d* = 1 instead of *d* = 0, and the group 'q = 1', as in DiD, undergoes a switch in the treatment.

This variation of a standard DiD is known as difference-in-differences in reverse (DiDiR), or 'time-reversed DiD' (KIM; LEE, 2019). This same framework can be found in Kotchen and Grant (2011), Chemin and Wasmer (2009), Autor, Donohue III and Schwab (2006), Shapiro and Gentzkow (2008) and Monstad, Propper and Salvanes (2008).

As described in section 3, from August 2015 to February 2018, PBUs faced opt-out costs to avoid tendering for SMEs only, except for group 65 (with mandatory open tenders). From March 2018 to December 2019, PBUs were subject to opt-out costs for all groups of items purchased. Thus, the always treated group here consists of all groups of items but group 65, which comprises the switched group. Table 11 summarizes the above description.

Table 11 - Description of groups in DiDiR

Groups	t=1 (before March 2018)	t=2 (after March 2018)
Group 65 (switched group)	Opt-out costs = 0	Opt-out costs > 0
Others (always treated group)	Opt-out costs > 0	Opt-out costs > 0

Source: Prepared by the author.

DiDiR identifies pre-switch-period effects; i.e., it estimates effects for the past (KIM; LEE, 2019). I estimate this pre-switch-period effect on the switched group, comparing the observed outcomes for group 65 before the policy shift and the outcomes that would have occurred for this group if there had been opt-out costs before March 2018 (t=1).

Using subindex *p* to denote purchase offer, *i* to denote items, *t* to denote months, and *g* to denote groups of analysis, I estimate the following DiDiR model:

$$y_{pigt} = \eta_i + \gamma Pre_t + \beta g65_{pgt} * Pre_t + \mathbf{x}\boldsymbol{\delta} + \epsilon_{pigt} \tag{4}$$

where *y* is an outcome, η_i is item fixed effects, and *Pre* is a dummy variable with the value of 1 if it is a month before March 2018 and 0 otherwise. The variable *g65* is binary with a value of 1 if it belongs to group 65 and 0 otherwise. The covariates are represented by **x**. The error ϵ_{itg} is clustered by item.

The coefficient of interest, β, captures the pre-switch-period effect of the shift in the SME tender policy on the outcomes for the switched group. The central identifying assumption behind the empirical model is that in the period after the shift in the tenders policy, the outcomes for group 65 and the set of all other groups of items would have followed a similar trajectory. Thus, it is necessary to check whether the always treated and switched groups' outcome paths are parallel in the post-switch period.

The validity of this assumption of parallel trends in the post-switch period can be partially assessed by estimating the following nonparametric regression, similar to Naritomi (2019) and Gallego, Prem and Vargas (2020):

$$y_{pgt} = \eta_g + Semester_t + \sum_{k=-3}^{3} \tau^t \left(\beta g65_{pgt} * Semester_t \right) + \mu_{pgt} \tag{5}$$

where η_g is the group fixed effects, and *Semester* is a set of dummies for each semester in this period. The error μ_{itg} is clustered by the group of items. Figure 3 plots the coefficients (without a constant) and the 95 percent confidence intervals from estimating equation (5) with log prices as the dependent variable. The graphs for the other outcomes of interest are included in the appendix B.

Figure 3 - Log Prices: Difference between the always treated group and the switched group
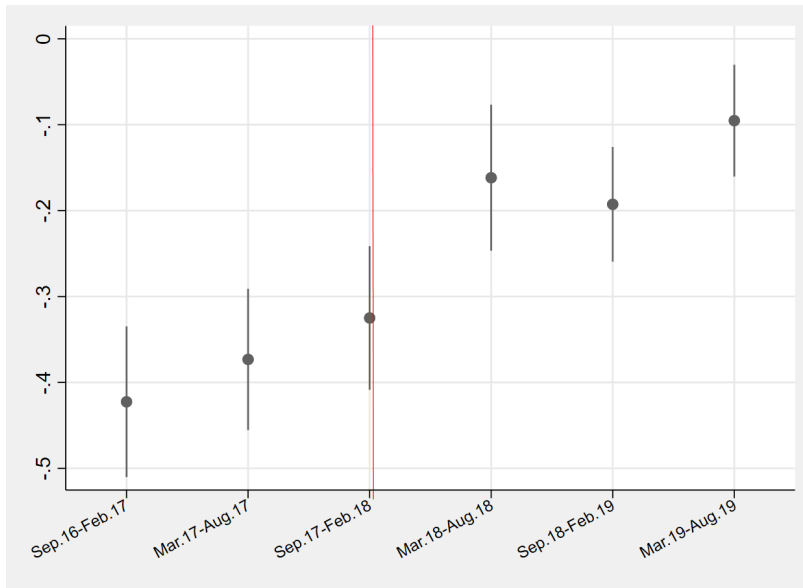
Source: BEC-SP.

Although there are few periods observed after the change in the SME purchasing policy, it is possible to observe that the difference between the two groups is relatively constant after the policy shift. The difference between the groups narrows dramatically after the change in the purchasing policy and then stabilizes in subsequent periods. Figures B.1, B.2, and B.3 (appendix B) report equivalent results regarding the distance from PBUs to winner firms, the number of participant firms, and the number of valid bids, respectively.

In this context, the validity of the parallel trends assumption in the post-change period might be reinforced by an institutional reason. Over time, PBUs accumulate knowledge and develop expertise on how to buy items from the market. After the policy change, when new restrictions are imposed, PBUs adapt to the new conditions, and the pattern of results in tenders might change. However, in subsequent periods, it is reasonable to expect that prices and other performance indicators in tenders tend to vary little, *ceteris paribus*, given that PBUs have already adapted to the new situation.

3.3.2 Results

I perform item-level regressions in a two-period DiDiR for which *t* is collapsed

by *pre* and *post* periods. The estimations refer to the pre-switch-period effect for four distinct outcomes: negotiated prices, the number of participant firms, the number of valid bids, and the distance from PBUs to winner firms.

For each outcome, I run regressions for three different time windows considering different *pre-* and *post-change periods*: (i) a 6-month window where the *pre-change* period is from September 2017 to February 2018 and the *post-change* period is from March 2018 to August 2018; (ii) a 12-month window where the *pre-change* period is from March 2017 to February 2018 and the *post-change* period is from March 2018 to February 2019; and (iii) an 18-month window where the *pre-change* period is from September 2016 to February 2018 and the *post-change* period from March 2018 to August 2019. The results for log prices are presented in Table 12.

Table 12 - Prices (log): Pre-switch-period effect on group 65

	(1) 6-month window	(2) 6-month window	(3) 12-month window	(4) 12-month window	(5) 18-month window	(6) 18-month window
g65xPre	-.0719***	-.0843***	-.0469***	-.0527***	-.0484***	-.0602***
	(.0121)	(.0112)	(.0097)	(.0086)	(.0092)	(.0084)
Sealed bids	-.4407***	-.609***	-.4373***	-.5911***	-.426***	-.5739***
	(.0179)	(.0212)	(.0156)	(.019)	(.0136)	(.0178)
lquantity	-.3191***	-.3716***	-.313***	-.3665***	-.3024***	-.3557***
	(.012)	(.011)	(.0104)	(.0097)	(.009)	(.0088)
_cons	6.1259***	6.4848***	6.1238***	6.8105***	5.9612***	6.4265***
	(.1987)	(.2067)	(.1999)	(.278)	(.1821)	(.1946)
Observations	213422	213422	427544	427544	632729	632729
R-squared	.2817	.3867	.2748	.3698	.2704	.3541
Item Fixed Effects	YES	YES	YES	YES	YES	YES
Controlling for PBU	NO	YES	NO	YES	NO	YES

Standard errors are in parentheses

*** p<.01, ** p<.05, * p<.1

As observed, the negotiated prices are consistently lower in group 65 tenders that occurred before March 2018. Considering all baseline specification variations, the negotiated prices, on average, are between 4.58% and 8.08% lower for group 65 than for other groups before March 2008.

This result emerges as expected. PBUs face better trading conditions in open tenders than in SME-restricted tenders. Accordingly, lower prices for group 65 before the SME tender policy shift may suggest less competition among firms. There is evidence of a decrease in competition in Table 13, which presents estimations for the difference in the number of participant firms.

Table 13 - Number of Participant Firms (log): Pre-switch-period effect on group 65

	(1)	(2)	(3)	(4)	(5)	(6)
	6-month window	6-month window	12-month window	12-month window	18-month window	18-month window
g65xPre	.1985***	.2081***	.1162***	.1221***	.0689***	.0763***
	(.0083)	(.0084)	(.0064)	(.0065)	(.0062)	(.0062)
sealed-bids	.0373***	.0503***	.012	.0188*	.0319***	.0461***
	(.0089)	(.0114)	(.0078)	(.0096)	(.0075)	(.0091)
lquantity	.1458***	.144***	.149***	.1467***	.1455***	.145***
	(.0022)	(.0021)	(.002)	(.0019)	(.0018)	(.0018)
_cons	1.0883***	1.3251***	1.0625***	.9251***	1.0742***	1.0783***
	(.0649)	(.2044)	(.0608)	(.1153)	(.0491)	(.0679)
Observations	260024	260024	522289	522289	769633	769633
R-squared	.1669	.2388	.1714	.2357	.1612	.2216
Item Dummies	YES	YES	YES	YES	YES	YES
PBU Dummies	NO	YES	NO	YES	NO	YES

Standard errors are in parentheses

*** p<.01, ** p<.05, * p<.1

There is a consistent increase in companies participating in group 65 bids when PBUs only used open bids. The number of participant firms was higher for group 65 than for other groups in every time window analysis.

These effects appear higher for the short term: comparing the six months before the policy change with the six months after this change, the number of participants in group 65 is approximately 22% higher than that in the other groups of items in the *pre-switch* period. For instance, in the 18-month time window, this effect is lower (approximately 7%). PBUs accumulate knowledge and develop expertise on how to buy items from the market. It is possible that after facing initial difficulty in attracting companies to bid, PBUs might adapt to the new situation over time and be better able to handle exclusive bids from SMEs.

A higher number of companies does not necessarily mean more competition. Some market items consist of oligopolies with very competitive dynamics, for instance. Thus, the number of valid bids can be complementary information to the number of participant firms to assess the degree of competition in a tender. Table 14 reports the estimations for the difference in the number of valid bids between groups.

Table 14 - Number of Valid Bids (log): Pre-switch-period effect on group 65

	(1)	(2)	(3)	(4)	(5)	(6)
	6-month window	6-month window	12-month window	12-month window	18-month window	18-month window
g65xPre	.2219***	.2349***	.1061***	.1145***	.0562***	.0668***
	(.0118)	(.0121)	(.0094)	(.0095)	(.0094)	(.0095)
sealed-bids	-1.1372***	-1.1298***	-1.1653***	-1.1649***	-1.0871***	-1.0897***
	(.0119)	(.0159)	(.0106)	(.0138)	(.0098)	(.0127)
lquantity	.1638***	.1565***	.1647***	.1582***	.1675***	.1604***
	(.0031)	(.003)	(.0027)	(.0026)	(.0024)	(.0025)
_cons	2.2482***	3.0999***	2.2302***	1.8244***	2.1121***	2.1099***
	(.0596)	(.5513)	(.0555)	(.1679)	(.047)	(.0854)
Observations	260024	260024	522289	522289	769633	769633
R-squared	.3485	.3868	.3474	.3814	.3261	.3608
Item Dummies	YES	YES	YES	YES	YES	YES
PBU Dummies	NO	YES	NO	YES	NO	YES

Standard errors are in parentheses

*** p<.01, ** p<.05, * p<.1

The pattern is the same as that for the number of participant firms. In the short term, the effect is more pronounced (almost 25% greater), while in a longer window of 18 months, for example, the effect drops to approximately 6%.

In addition to a higher level of competition, a higher number of participants associated with a higher number of valid proposals may indicate that the sellers' screening process is better in open tenders. Depending on the item purchased, more efficient companies with more flexible cost structures may participate in open tenders rather than exclusive tenders for SMEs. These combined factors may set up the primary mechanism that explains the lowest prices in group 65 before March 2018.

One explicit objective of the policy of restricting bids to SMEs is to encourage local and regional development. It is expected to observe purchases from local suppliers closer to the PBUs. Table 15 reports the estimations for the difference in the distance from PBUs to winner firms between groups.

Table 15 - Distance from PBUs to winner firms: Pre-switch-period effect on group 65

	(1)	(2)	(3)	(4)	(5)	(6)
	6-month window	6-month window	12-month window	12-month window	18-month window	18-month window
g65xPre	6.5123**	3.3937**	10.6433***	5.6029**	9.8629***	4.8085**
	(2.8813)	(1.8905)	(2.215)	(2.1899)	(2.0851)	(2.0442)
convite	-25.2587***	-12.1397***	-22.2555***	-10.2858***	-20.9674***	-7.6826***
	(2.2172)	(2.3924)	(1.9588)	(1.9587)	(1.7872)	(1.7127)
lquantidade	1.4456***	4.0076***	1.6784***	4.2032***	1.3763***	4.3312***
	(.5426)	(.5036)	(.4589)	(.3983)	(.4274)	(.3428)
_cons	156.8374***	134.1891***	162.7939***	126.0552***	157.0111***	110.9477***
	(6.8616)	(7.044)	(5.971)	(33.5564)	(5.1836)	(15.4403)
Observations	213422	213422	427544	427544	632729	632729
R-squared	.003	.147	.0024	.1321	.0021	.1258
Item Dummies	YES	YES	YES	YES	YES	YES
PBU Dummies	NO	YES	NO	YES	NO	YES

Standard errors are in parentheses

*** p<.01, ** p<.05, * p<.1

As observed, before the policy change, the companies winning tenders for items in group 65 were more distant from the PBUs. On average, when controlled by PBUs among other variables, the winning suppliers were located approximately 4 km away in open public tenders for group 65. This result may indicate that the policy change has successfully induced more local suppliers to win more bids for this group of items.

3.4 **Conclusion**

Governments worldwide have implemented public policies that favor SMEs based on the potential or actual benefits these policies can bring to the economy. One of the most widespread practices to promote local development through public procurement is the restriction of public tenders to SMEs.

Despite the potential positive effects generated by favoring SMEs in public tenders, such a policy may undermine the quality and efficiency of the public procurement process generating waste of public resources. I estimated that negotiated prices were, on average, between 4.58% and 8.08% lower when restricted tenders were not mandatory. Moreover, the number of participants was approximately 22% higher than that in other groups of items. Thus, from a policy perspective, incentivizing

restricted tenders for SMEs may bring relevant costs to PBUs.

3.5 **Further Steps**

Further analyses shall explore heterogeneous effects to identify if these findings are concentrated in items that the municipality has local suppliers and observed for all distance ranges.

The idea is to use auctions results to identify effects on SMEs' performance (employment and revenues), evaluating winner firms in restricted tenders versus runners-up, as in (GUGLER, WEICHSELBAUMER and ZULEHNER, 2020).

4   FREQUENT LOSERS IN PUBLIC TENDERS: ANTICOMPETITIVE BEHAVIOR OR BAD LUCK?

There is an intriguing phenomenon in public procurement. Some participants in bidding contests lose out systematically for long periods and several times. This fact is interesting because there is a fixed cost for companies to participate in public bids; therefore, it would be expected that these companies would win some opportunities or be excluded from the market under competitive conditions.

An alternative hypothesis is that these firms, herein referred to as 'frequent losers,' are not operating autonomously but as part of a cartel that could be sustained by means of side payments to losers. As a consequence, the presence of frequent losers has the potential to serve as a screening for cartel detection in public bids.

Usually, antitrust authorities use two main types of cartel detection mechanisms. The first method gained traction throughout the 1990s in the form of leniency agreements and award-winning disclosure (Wils, 2007). The second mechanism consists of screening methods that became predominant from the mid-2000s due to the greater availability of data and computational capacity. Through observable data such as prices and quantities, screening methods seek to identify behaviors that are consistent with the cartel hypothesis (i.e., coordination among competitors) and inconsistent with the competition hypothesis among participants in a given market. Although these models might be insufficient to prove the bid rigging in courts, they are essential to guide investigation and may constitute evidence for judicial authorization for dawn-raids and wiretapping to get direct evidence of the cartel.

Screening methods available in the literature, such as Green and Porter (1984), Haltiwanger and Harrington (1991) and Abrantes-Metz *et al.* (2006), have two fundamental limitations. First, these models cannot distinguish tacit collusion from cases of explicit collusion (i.e., cartels). This limitation is problematic for their practical application since tacit collusion, unlike cartels, does not constitute an antitrust offense (HARRINGTON JR., 2008).

Second, screening methods usually identify collusive behavior after its occurrence and therefore serve as support only for the repression of cartels but not for their prevention. In public procurement, it would be desirable for screening methods to

identify collusive behavior before the bidding process occurs, through observable variables in public notices and participants' registration, to reduce the social costs of cartels.

This paper proposes an alternative screening method that directly addresses these two limitations and does not require additional data beyond those already available to competition authorities and control bodies.

Primarily, the proposed method consists of the use of frequent losers as 'flags' for the ex-ante screening of cartels in public tenders. To this end, this research proposes a method for identifying frequent losers to differentiate these companies from others that, although they may lose frequently, do not exhibit sufficiently abnormal behavior. The article also presents frequent losers' descriptive characteristics, reinforcing their properties as markers of collusion.

Finally, this paper examines the relationship between the presence of frequent losers in public bids and the price level and other indicators of competition intensity, such as the number of participants and the number of bids. The results indicate that tenders in which frequent losers participate have 10% higher prices, a 32% higher number of participants, and a 29% increase in the number of bids.

These results are consistent with cartel behavior (higher prices) and a strategy to avoid detection by increasing higher competitive intensity signs. Note that this is precisely the expected effect of frequent losers: more participants and no competitive pressure on the winning bid.

This paper has five sections, including this introduction. Section 2 provides an overview of cartel screening methods to clarify the contributions of this research. Section 3 presents the method for identifying frequent losers and its descriptive characteristics. An analysis of the relationship between frequent losers and the results of public tenders is presented in section 4. Finally, in section 5, I present the implications of the results and final considerations.

4.1 Models for Detecting Cartels in Public Tenders

Cartels are a common practice and are quite costly to society. It is estimated

that less than 15% of US cartels are identified by the Department of Justice (BRYANT; ECKARD, 1991). Considering that US anti-cartel policy is recognized as the most active, it is reasonable to assume that this proportion is even lower in countries with less antitrust enforcement tradition.

Cartels are associated with higher prices to final consumers (CONNOR, 2007), resulting in lower production than the socially optimum level and costs of maintaining the cartel and covering up its activities. For those reasons, the identification and subsequent punishment of cartels are a priority for virtually all competition authorities. Since it is a known illicit practice, it is not easy to detect cartels. There are two essential and complementary instruments to identify this anticompetitive behavior.

The first instrument is the disclosure by one of the cartel's participants through leniency agreements or award-winning disclosure or of third-party claimants who had access to direct evidence of the agreement among the cartel's participants (WILS, 2007). Even if the competition authority develops a leniency program, its position is predominantly passive because third parties perform the identification of the cartel and the initial collection of evidence (WILS, 2016).

The second identification tool is predominantly active and consists of methods for analyzing companies' behavior in different markets with the aim of identifying suspicious behavior that is consistent with the existence of a cartel and inconsistent with the hypothesis of competition between companies. These methods are known as *screening methods* (HARRINGTON JR., 2008).

Observing suspicious behavior is not enough to prove a cartel's existence, but it is a crucial tool to guide competition authorities' investigations in their search for direct evidence. Evidence can be obtained through search and seizure operations or by intercepting communications, which are only authorized by the judiciary when there is robust evidence of suspicious conduct. Screening methods could help to identify this evidence.

Those two detection instruments - leniency agreements and screening methods - are complementary, not substitutes (HÜSCHELRATH; VEITH, 2014; SCHINKEL, 2013). Companies' incentives to opt for the leniency agreement by providing the competition authority with evidence of a cartel are associated with the probability of cartel detection. Proper screening methods can significantly increase the likelihood of

identifying cartels.

In addition, the most stable cartels (i.e., those with a lower probability of detection) are possibly the most harmful to society and the least vulnerable to award-winning disclosure. For these reasons, authorities increasingly tend to use screening methods in their investigations (IMHOF; KARAGÖK; RUTZ, 2018; SCHINKEL, 2013). This trend is reinforced by increased data availability and processing capacity through machine learning and artificial intelligence, which give competition authorities a greater capacity to identify suspicious behaviors (SANCHEZ-GRAELLS, 2019).

The literature on cartel detection models is reasonably prolific. In general, statistical models use observed price and quantity data to infer firms' patterns of behavior and reaction curves to identify whether such patterns are consistent with the cartel assumptions and inconsistent with the competition hypotheses.

Some of these models test whether the behavior of companies participating in a cartel differs from the action of nonparticipants, such as Porter and Zona (1993) and Porter and Zona (1999). In both cases, the model shows that the suspicion of cartel conduct, with defined participants and a defined period of operation, presents a correspondence with their market behavior, which has the value of proof if combined with a *plus factor* (HOVENKAMP, 2005). However, it is not a full screening method; its role is not to identify suspicious conduct but to test the relevance of evidence that may have been brought by a complaint. Full screening methods use markers to signal which markets and firms are engaging in suspicious behavior[30]. These markers can be of three types.

The first deals with the relationship between firms' prices and demand movements, considering that a cartel structure reacts to demand fluctuations differently than firms that operate in competition. Some of the most notable papers on screening methods are from this first group, such as Green and Porter (1984) and Haltiwanger and Harrington (1991). The second group is about the relationship between market shares and price variance and is based on theoretical models and the empirical regularity of greater price stability in cartelized markets, which is broadly well documented in the literature (ABRANTES-METZ *et al.*, 2006; IMHOF, 2019). Finally, the third group focuses on the relationship between firms' prices, estimating reaction

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[30] A comprehensive review of *screening* models is presented by Harrington (2008).

functions, and how they would be associated with competitive or collusive behavior (BAJARI; YE, 2003).

In the case of screening methods for public procurement, the variables used for cartel detection are specific to those observed in public tenders, such as the bidding pattern and the existence or absence of rotation among the winners, as is the standard of cartel operation; it has become conventional to call this *bid-rigging* (IMHOF, 2019).

This pattern is essential in cases where the cartel participants do not have mechanisms for transferring the revenues derived from the cartel, so the rotation of winners becomes a necessary mechanism to avoid defections. However, this identification is not appropriate for cases where transfer mechanisms are feasible, either via corporate control or informally among cartel participants.

One of the difficulties that should be addressed by screening methods is their ability to rule out alternative hypotheses. For example, in the case of public bids, the bidding pattern may respond to cost differentials between companies, resulting in bids and ranking of winners that might appear to be the result of coordination between competitors.

An interesting proposal to circumvent this problem is offered by Kawai *et al.* (2019), who use the margin of victory, analogous to a discontinuous regression method, to compare firms with supposedly similar cost structures to rule out this alternative hypothesis. They show that the inferences of the model or the robustness of the results are a recurring concern of the new screening methods.

There are two characteristics of the models mentioned that deserve to be highlighted because they emphasize the contributions of this paper. First, none of the cited models distinguishes tacit collusion from explicit collusion cases, i.e., cartel (HARRINGTON JR., 2008). However, this distinction is fundamental to the application of antitrust policy because, although the cartel is considered the most serious of antitrust offenses, tacit collusion is not even an offense and, therefore, not punishable.

The second characteristic is that the models mentioned above are a means of detecting a cartel after its occurrence. The variables used are prices, quantities, and the winners' rotation pattern observed in a given period. Therefore, these methods are here called *ex-post screening models*. In conventional markets (i.e., those that are not public procurement), this qualification is unnecessary because the repression of cartels

is typically carried out a posteriori, and preventive intervention is performed through the control of structures such as mergers and acquisitions (HOVENKAMP, 2005).

In the case of public procurement, however, the cartel is often held before the bidding process, i.e., before the participants disclose their bids. Identifying the cartel a posteriori fulfills the punitive nature by intending to inhibit future illicit conduct, but it does not prevent the loss of a fraudulent tender by the cartel's practice. These costs are exceptionally high in public bids, which require time for planning and high transaction costs to cancel contracts in execution and to conduct a new tender process.

Therefore, it would be desirable to develop *ex-ante cartel screening methods* that could identify suspicious behavior before the bid's execution. The use of frequent losers as a marker for collusion may consist of ex-ante screening, thereby distinguishing it from the other models in this regard. This is the main contribution of this research.

This marker can also be used in conjunction with other markers and variables in the ex-post analysis to strengthen the analysis, as recommended by (HARRINGTON JR., 2008). The 'frequent losers' marker might distinguish tacit collusion from explicit collusion, bringing more efficiency to the investigation techniques[31].

Finally, it is relevant to note that cartelized companies respond strategically to the enforcement of antitrust authorities in what Schinkel (2013) called a *cat & mouse game*: cartelized companies will simultaneously seek to raise prices and to avoid detection by the competition authority. This situation may result in high prices coinciding with other market evidence that indicates increased competition, such as the number of participants and price dispersion.

In addition, cartel participants will seek to alter their behavior according to the detection model used to avoid being caught. For this reason, Schinkel (2013) argues that the development of screening methods is a continuous process that is necessary every time cartelized companies change their behavior to avoid detection. Companies increase costs in this process, which may render the cartel unfeasible when avoiding detection is more costly than its benefits.

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[31] See section 4 for more details.

4.2 Frequent Losers: Definition and Characteristics

The collusion marker proposed by this paper requires an empirical definition of frequent losers. This section presents this definition, beginning by presenting the data used and followed by the method of identifying frequent losers.

Finally, this section presents a descriptive analysis of the main characteristics of this group of firms in the sample. These descriptive characteristics are already sufficient to distinguish the behavior of this group of bidders from what would be expected of bidders operating under competitive conditions.

4.2.1 Data Source and Description

I use administrative data on bidding-level public procurement tenders of common goods and services in the State of Sao Paulo, Brazil, from January 2009 to December 2019. All transactions took place under the electronic procurement platform named Bolsa Eletronica de Compras (BEC), which is available for all PBUs (Public Buyer Units) across the state. SEFAZ/SP (Department of Finance of Sao Paulo State) is responsible for the operational management and centralization of BEC's bidding data.

In total, 1,344 PBUs make regular purchases at BEC, including state-level executive, legislative, and judiciary bureaus in the State of Sao Paulo as well as other affiliated entities, such as some municipalities located in the State of Sao Paulo and a group of other private organizations. PBUs purchased 169,607 different types of items (goods and services), totaling 3,866,407 transactions from 19,007 distinct firms in this period.

BEC has a very detailed catalog of standardized goods and services organized at three levels of detail: group, class, and item[32]. Data are organized by purchase offers

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[32] Office items, for instance, are classified as group 75 (Office, educational and psychological articles and utensils). Thus, the code 127817 refers to the item 'Sulfite Stationery Paper; weight 75g / m2; A4 format; measuring (210x297) mm; minimum opacity of 87%; humidity between 3.5% (+/- 1.0), according to norma Tappi; Rotary Cut, ph alkaline in ivory color; Bopp Coated Packaging; product with fsc or cerflor environmental certification, with seal and license code printed on the packaging', belonging to class 7520 (Materials and supplies for didactic, pedagogical, psychological use, stationery, brushes and accessories for manual painting) and group 75.

(PO), the electronic document issued by the PBU that identifies and quantifies a set of goods and services that will be purchased. A PO is defined by a 22-character code and may contain one or more items listed, but each item has its own purchase process. Thus, the purchase of an item is uniquely identified by the item code purchase offer (POI), consisting of the combination of the PO and the purchased item codes.

Table 16 - Descriptive Statistics: Public Tenders

Variable	Obs	Mean	Std. Dev.	Min	Max
quantity	2021523	227024.46	2.273e+08	1	3.000e+11
reference price	2021523	14656.14	1509895.8	0	1.435e+09
negotiated price	2021523	5255.22	297523.82	0	1.233e+08
#firms	1859668	5.05	3.42	1	79
#bids	1859668	10.63	14.69	1	894
distance	1671773	177.7	213.06	0	2760.4
firm age	1671773	134.96	128.29	1	969
convite	2021523	.53	.5	0	1

Source: BEC-SP.

For each POI, it is possible to observe parameters such as item quantities and reference prices and tender outcomes such as bid prices (winners and losers), the number of participating firms, the number of bids, whether the public tender was successfully, and the identification of the PBU and the auctioneer, among other variables.

Additionally, there is much information about the companies that participate in tenders. For each firm, it is possible to observe its uniquely defined firm national code (CNPJ), firm age, geocoded address, three-digit level of the National Classification of Economic Activities (CNAE)[33], number of victories and losses in public tenders, number of bids and all bid values offered in every tender process, among others.

4.2.2   Definition of Frequent Losers: 'Always Losers' Outliers

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[33] See more details on CNAE: https://concla.ibge.gov.br/busca-online-cnae.html. Access in: 08 Nov. 2020.

To properly define 'frequent losers,' it is necessary to identify suppliers who participated in the bid at least once and never won - the 'always losers' firms. Figure 4 shows the number of suppliers' losses that failed in all their participation in public bids from 2009 to 2019. The data show a highly unequal distribution of defeats and victories among the companies.

The vast majority of firms lost only a few times, indicating that they participated in a small number of contests. However, it is possible to observe a group of companies that participated in many public tenders and lost systematically. As mentioned, the existence of firms that frequently lose tenders raises the question of why they continue to compete despite a growing number of defeats over time.

Figure 4 – Number of losses: 'Always Losers'
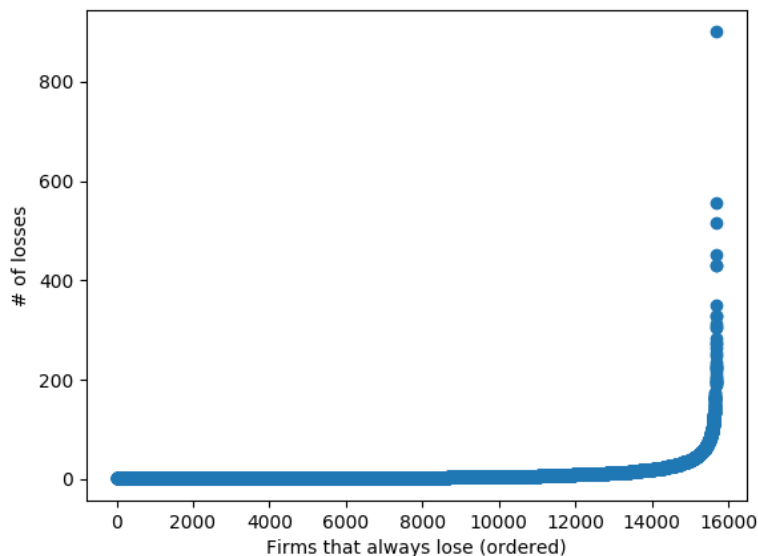
Source: BEC-SP.

An outlier detection method, the interquartile range method (IQR)[34], was chosen to identify the frequent loser sellers. This method separates the data into two groups according to a calculated threshold: (i) a standard group (companies that lost only a few times and stopped competing for whatever reason) and (ii) an outlier group (firms that participated in many tenders and won none).

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[34] See Chandola, Banerjee and Kumar (2009) for more information.

The IQR algorithm classifies the outliers as firms whose losses are 1.5 times above the distance between the first and third quartiles plus the median of firms' losses. For this paper, these outlier sellers are called frequent losers. There are 2,471 companies identified as frequent losers using this classification, indicated to the right of the red vertical line in Figure 5. At least one frequent loser participated in 73,591 tenders (approximately 3.61% of all bids).

Figure 5 - IQR Method: Identifying Frequent Losers
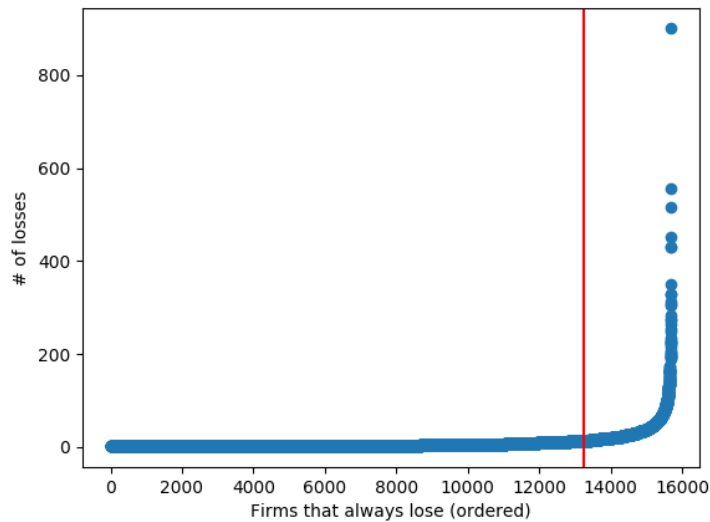
Source: BEC-SP.

It is possible to observe much better uniformity within this group. In addition, Figures 6(a) and 3(b) suggest that frequent losers tend to lose consistently over time. This fact reinforces the perennial character of the behavior of frequent losers.

Figure 6 - Frequent Losers: (a) Number of Months Competed. (b) Total Number of Losses
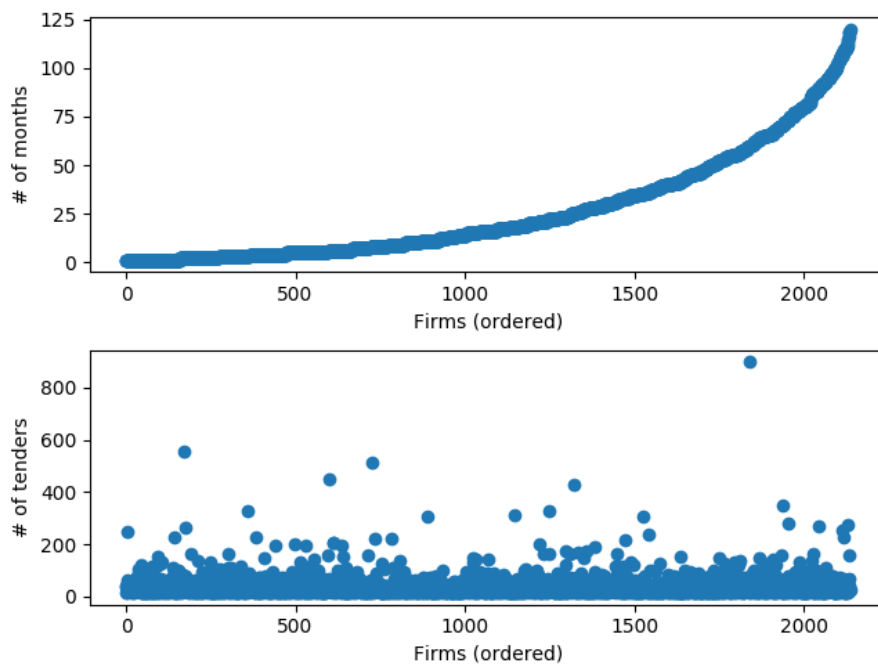
Source: BEC-SP.

4.2.3 BEC Sample: Characteristics of Frequent Losers

The main objective of this section is to characterize frequent losers in the BEC sample. First, I provide a description of the modes of tenders in which the frequent losers participate. Frequent losers are almost equally involved in sealed-bid (convites) and multi-round descending auctions (pregoes), but they rarely participate in direct negotiation (dispensa de licitacao), as shown in Figure 7.

Figure 7 - Frequent Losers: Modes of Tenders
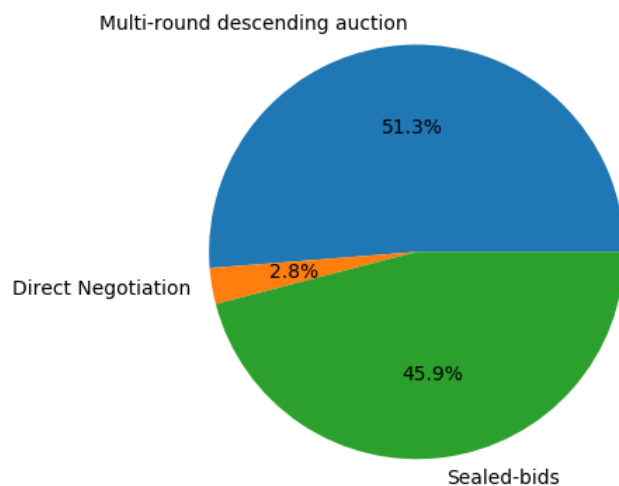
Source: BEC-SP.

Pregoes and convites are different procedures whose successive losses might have different interpretations. There is a relatively higher transaction cost to participate in pregoes since in this mode, it is necessary to actively participate on the day of the tender by submitting bids and, if required, presenting appeals and questions to the personnel in charge. In the case of convites, participants only need to submit one-shot proposals, which reduces the costs.

In terms of participation in different modes of tenders, it is interesting to observe that companies can also be separated into three distinct groups: (i) firms that only participate in convites; (ii) firms that only participate in pregoes; and (iii) firms that

participate in both modes. Figure 8 shows that approximately 14% of frequent losers only participate in convites, and 49.4% participate only in pregoes. Approximately 37% of frequent losers are present in both convites and pregoes.

Figure 8 – Types of Frequent Losers
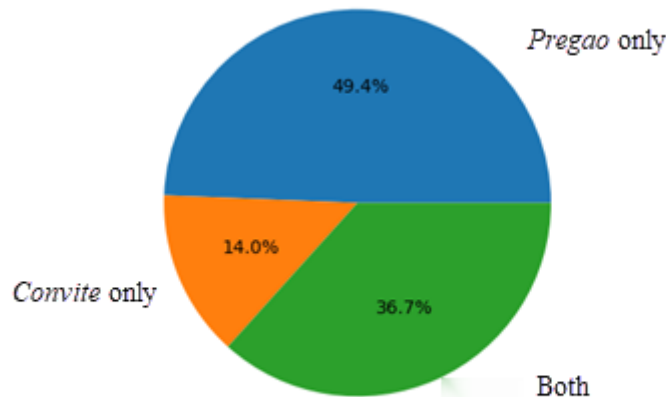
Source: BEC-SP.

Analogously, the diversity of item groups to which frequent losers are linked may lead to another classification type. A frequent loser can compete in tenders of many distinct groups of items or participate in bids of specific ones. Thus, the diversity (or lack of diversity) of purchase items of a frequent loser who chooses to participate might provide relevant additional information.

To deepen this analysis, the diversity of items in which companies participate, Shannon's entropy coefficient[35], is calculated for each group of items and each frequent loser firm, defined according to the following equation:

$$H = -\sum p(x) \log p(x) \tag{6}$$

H is the final entropy value, and p (x) is the probability that each element would be found randomly in the universe of elements. If H is closer to 0, it means that

[35] See Dehmer and Mowshowitz (2011) for more information.

companies bid for only one group of items or something close to that. The higher H is, the greater the diversity of item groups. An entropy of 5 means that the company bids for approximately 32 different groups of items.

There are at least two valid interpretations regarding the results obtained. First, firms can act in good faith in public tenders for different groups of items to diversify their activities. Second, it is also possible that companies are only used to simulate competition and manipulate the tender. Figure 9 shows the graph of the entropy of the item groups for all frequent losers.

Figure 9 - Frequent Losers: Entropy Coefficient
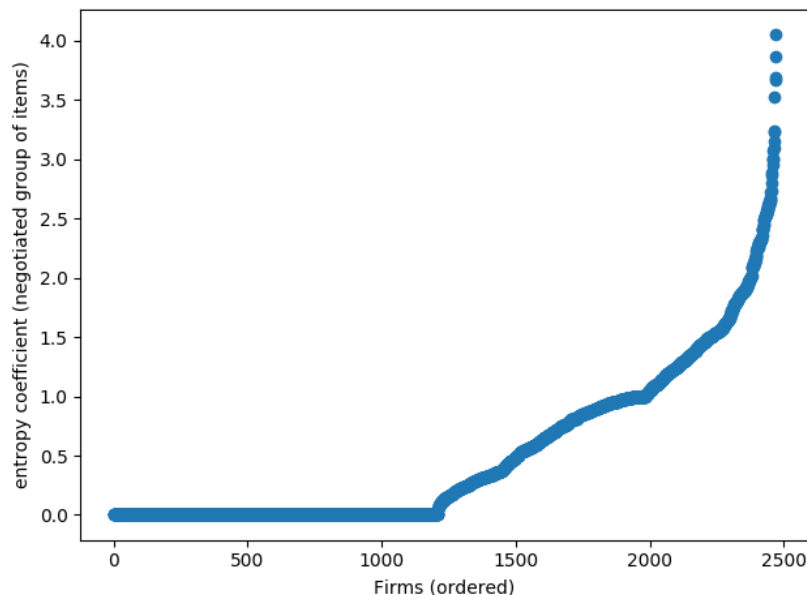
Source: BEC-SP.

It is possible to observe that half of the companies participate in tenders related to only one item, and approximately half participate in contests related to two or more item groups. The analysis is limited to companies that participate in tenders of less than 16 distinct item groups. The frequency at which every item appears reveals a high concentration of tenders in a few groups of items. Figure 10 presents the graph of the frequency of the item groups.

Figure 10 - Frequent Losers: Item Group Variety
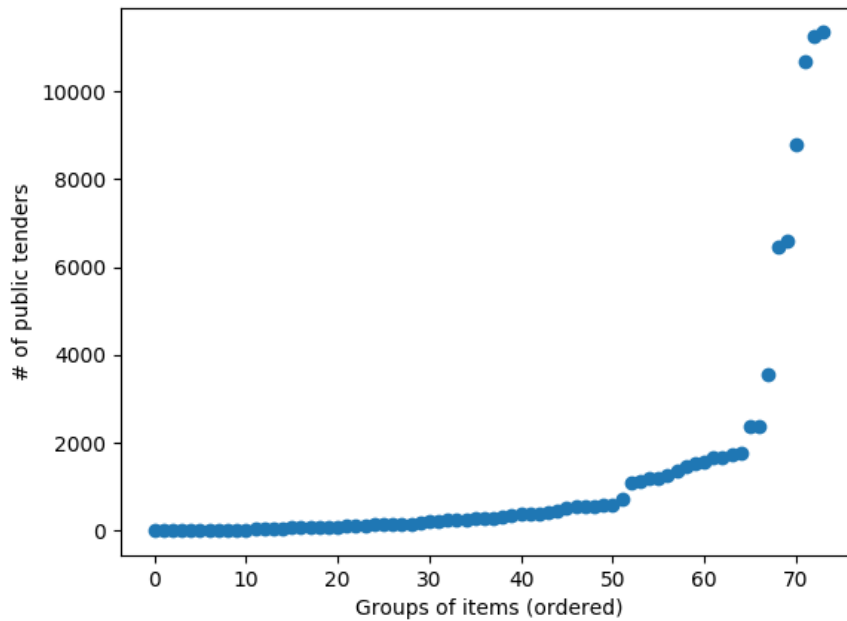
Source: BEC-SP.

The high concentration of item groups explains the low entropy of companies into a few categories. High entropy indicates the participation of some companies in various tenders always without success.

Another dimension of the analysis is related to identifying PBUs involved in tenders with the participation of frequent losers. PBUs involved in 'frequent losers tenders' are also concentrated, as shown in Figure 11.

Figure 11 - Frequent Losers and PBUs
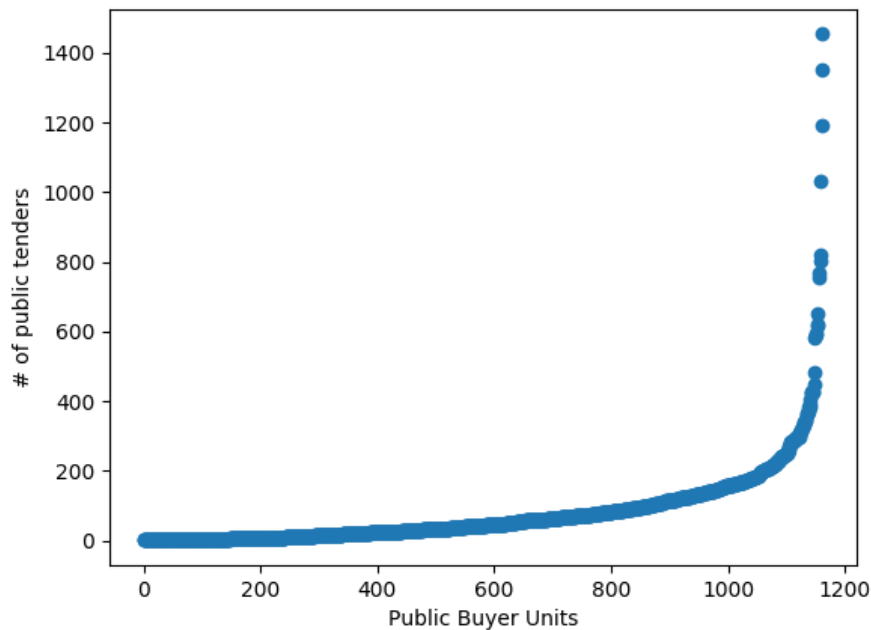
Source: BEC-SP.

4.3 **Frequent Losers and Outcomes in Tenders**

The outcomes observed in public tenders with participation by frequent losers can identify evidence of explicit collusion, potentially serving as a screening mechanism for the existence of these practices. As developed in Section 2, an essential principle of effective screening models is their ability to distinguish collusive behaviors from those that could arise from different competitive models.

This section investigates the properties of this collusion marker and observes the relationship between the presence of frequent losers and the performance of bidding contests in several dimensions, such as prices, the number of participants, and the number of bids. Based on these results, I evaluate the effectiveness of this marker in identifying collusive behavior.

Possible differences in bidding results are estimated by comparing public tenders with at least one frequent loser and tenders without the presence of a frequent

loser[36]. This estimation of differences in outcomes y between purchases i, with and without the participation of a frequent loser, of an item g and in year t has the following baseline specification:

$$y_{igt} = \beta \, losers_{igt} + \alpha_g + \lambda_t + x\delta + \epsilon_{igt,} \tag{7}$$

where α_g and λ_t are fixed effects of purchased items and year dummies, respectively. The variable $losers_{igt}$ has a value equal to 1 if the tender has at least one frequent loser and 0 otherwise. Additionally, x are the control variables, such as dummies for purchasing units and tender mode.

The data used come from public purchases made at BEC from January 2009 to December 2019. However, for the purposes of this section, the subsample used in the estimates consists only of items with at least one purchasing process with the presence of frequent losers. The estimates for the negotiated prices are presented in Table 17.

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[36] As in most *screening* models proposed by the literature, empirical results may be subject to self-selection problems because there was no randomization process in the allocation of frequent losers in the contests.

Table 17 - Negotiated Prices: With vs. Without Frequent Losers

	(1)	(2)	(3)	(4)
	General	General	Pregao	Convite
losers	.1255***	.1011***	.1344***	.0315***
	(.014)	(.0122)	(.0184)	(.0046)
convite	-.0449***	-.0442***		
	(.0057)	(.0056)		
pregao	.4865***	.5653***		
	(.0177)	(.0208)		
lquantity	-.2666***	-.2988***	-.4781***	-.2118***
	(.0098)	(.0098)	(.0175)	(.0109)
_cons	3.6905***	4.0337***	5.5803***	3.7513***
	(.0352)	(.0703)	(.1422)	(.0825)
Observations	1671773	1671773	474219	924725
R-squared	.2085	.2596	.4219	.2066
Item Dummies	YES	YES	YES	YES
Year Dummies	YES	YES	YES	YES
PBU Dummies	NO	YES	YES	YES

Standard errors are in parentheses

*** p<.01, ** p<.05, * p<.1

It can be observed that the negotiated prices are consistently higher in tenders with the presence of frequent losers. Considering variations in the baseline specification containing all the bidding modes, the negotiated prices, on average, are between 10.64% and 13.37% higher in bids with losers.

The results also suggest that prices in pregoes tend to be more affected than prices in convites by the participation of frequent losers. Considering only pregoes, it is possible to observe that prices tend to be 14.39% higher in bids that include losers than when losers are not present; for convites, prices are only 3.20% higher on the same comparative basis.

Possible explanations for this difference might be related to (i) the degree of discretion of the public official in charge of the tender and (ii) the possibility for suppliers to affect the dynamics and outcome of the process.

In convites, the process consists of merely opening (virtual) envelopes containing participating suppliers' proposals. After making the bids public, the

auctioneer's role is restricted to declaring the firm that offered the lowest price the winner. Thus, the interaction between the participating firms and public officers is minimal during the purchase procedure.

In the case of the pregao, the public officer in charge has a more active role in the process, and there is more room for firms to influence the process. In addition to revealing the initial bids in the first phase, the auctioneer is responsible for coordinating and monitoring firms' bids during the auction phase.

During this auction phase, firms and PBUs interact through the real-time bidding process and real-time chat. A great variety of information is exchanged through this communication channel, such as confirming product specifications, complaints about competitors' performance, and even dissatisfaction with how the contest is conducted.

At the end of the auction phase, there is another moment of interaction between suppliers and PBUs. There is an ex-post negotiation phase in which public and private parties can direct bargaining for the lowest price. Thus, in pregao, there is more room for manipulation. This situation may lead to higher prices in this type of tender.

Higher prices in tenders with frequent losers may suggest that there is less competitiveness or aggressiveness for suppliers. This fact cannot be verified in the estimates of Tables 19 and 20. In these tables, I compare tenders with and without frequent losers in terms of the number of firms and bids, respectively.

Table 18 - Number of Firms: With vs. Without Frequent Losers

	(1)	(2)	(3)	(4)
	General	General	Pregao	Convite
losers	.329***	.3256***	.3104***	.2926***
	(.0052)	(.0048)	(.008)	(.0041)
convite	-.7742***	-.7755***		
	(.0069)	(.007)		
pregao	-.1181***	-.1228***		
	(.0081)	(.0099)		
lquantity	.1504***	.151***	.0925***	.1817***
	(.0021)	(.0022)	(.0028)	(.0028)
_cons	.9159***	1.2013***	1.0851***	.8704***
	(.0093)	(.028)	(.0451)	(.0624)
Observations	1670719	1670719	473819	924336
R-squared	.3675	.3882	.2176	.2699
Items Dummies	YES	YES	YES	YES
Year Dummies	YES	YES	YES	YES
PBU Dummies	NO	YES	YES	YES

Standard errors are in parentheses

*** p<.01, ** p<.05, * p<.1

More firms participate, and more bids are offered in tenders with frequent losers than in bids without their presence. Between 33.99% and 38.96% more firms participate in tenders with losers, with an average of 25.51% to 34.35% more bids offered.

Table 19 - Number of Bids: With vs. Without Frequent Losers

	(1)	(2)	(3)	(4)
	General	General	Pregao	Convite
losers	.2953***	.2937***	.2272***	.2926***
	(.0062)	(.006)	(.0108)	(.0041)
convite	.0314***	.0249***		
	(.0093)	(.0093)		
pregao	.931***	.9225***		
	(.01)	(.0126)		
lquantity	.169***	.1674***	.1059***	.1817***
	(.0026)	(.0027)	(.004)	(.0028)
_cons	.7849***	1.5003***	2.17***	.8704***
	(.0114)	(.0478)	(.077)	(.0624)
Observations	1670719	1670719	473819	924336
R-squared	.2945	.3117	.1351	.2698
Items Dummies	YES	YES	YES	YES
Year Dummies	YES	YES	YES	YES
PBU Dummies	NO	YES	YES	YES

Standard errors are in parentheses

*** p<.01, ** p<.05, * p<.1

These results are compatible with the literature on cartels and other illicit purchases. As Schinkel (2013) notes, cartel participants' behavior also responds strategically to competition policy enforcement. A higher number of participating firms and bidders could be associated with attempting to build a mechanism to conceal possible illicit competitive practices.

It is important to note that, assuming there is no correlation between the companies' cost structure and the presence of frequent losers, the simultaneous occurrence of higher prices and a higher number of bids and participants in public tenders is inconsistent with expectations for a model of competition or tacit collusion.

This scenario might mean that the screening proposal based on frequent losers presents two essential properties. First, it shows that it is capable of distinguishing collusive behaviors from those that would be expected in competition. Second and more importantly, because the observed behavior reveals the intention to hide the collusion, it is a marker that identifies explicit and non-tacit collusion, a recurrent

problem in screening models (HARRINGTON JR., 2008).

To establish the reliability of this screening model, however, it is necessary to highlight possible alternative explanations for the presence of frequent losers in public procurement. A first alternative hypothesis is the existence of a learning curve for companies to become victorious at BEC. Supplying goods and services to the state would require suppliers to develop specific processes and legal adjustments that would demand consistent efforts over some time.

If there were such a learning curve, then companies that eventually won the first bid would spend a considerable time losing until they became victorious. This situation may be the case for some suppliers; however, the data suggest that this is not the general case. Figure 12 shows the number of contests up to a company's first victory, limited to 100 contests for better viewing. Almost 30% of companies win one of the first three events in which they participate.

Figure 12 - Number of Participations in Tenders until the First Victory
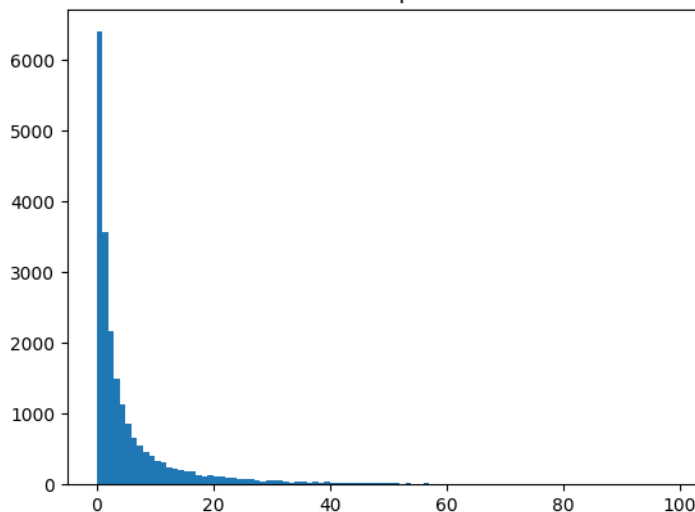
Source: BEC-SP.

In addition, as explained in Section 3, it is known that a small number of companies win public tenders. Thus, a learning curve hypothesis seems unlikely, except for a few companies that achieve very frequent wins in bids.

There is an additional alternative explanation that could be considered in this context. Frequent losers might be a phenomenon found mostly in the short term: there

would be a significant number of participations without victories in a short period, followed by the abandonment of the public contracting market. As shown in Figure 3, presented in Section 3, companies have participated in tenders for up to ten years and were repeatedly defeated. It is not reasonable to suppose that there is a financial incentive to participate in tenders in good faith and to lose repeatedly.

It is also important to note that even if the companies participated for a short time, they still participated in a sufficient number of tenders to be classified as frequent losers by the outlier detection method.

4.4 **Conclusion**

Companies that systematically lose public tenders in which they participate are not expected in a competitive environment. An analysis of the relationship between performance variables and the participation of these companies in public bids in Sao Paulo State between 2009 and 2019 indicates that the negotiated price was 10% higher; however, the number of participants was 32% higher, and the number of bids was 29% higher.

This apparent paradox, in which one variable indicates less competitive pressure (i.e., negotiated prices) while others indicate more competition (i.e., number of participants and number of bids), is consistent with the behavior of a cartel that seeks to avoid detection. This scenario is the function that would intuitively be expected of a frequent loser, that is, to simulate a higher level of competition, drive away competitors, and avoid detection by control agencies. Precisely because of this characteristic, frequent losers can be used as markers in a cartel screening method.

This proposal presents some virtues common to other screening methods and addresses two limitations common to most available models. It is a simple application method that requires only data already available to competition authorities and control agencies.

The identification of frequent losers may occur before the public tender on the occasion of the first stage of the bid, in which the participants are defined. Unlike all available screening methods based on prices and quantities observed after the cartel's

materialization, frequent losers may signal suspicious behavior before bidding occurs, reducing the costs associated with a defrauded event.

This property stems from a characteristic of cartels in public tenders: the agreement among bidders occurs before the tender takes place, and it is possible to observe elements that may signal fraud before the conclusion of the bid. The presence of frequent losers also emphasizes the separation between explicit collusion and tacit collusion since the behavior identified is consistent with the deliberate act of concealing competition.

There are, however, some limitations in the use of these screening methods; some of these limitations are remedial, and another is common to all. The proposed method identifies suspicious conduct only in bidding cartels cases, where some mechanism for transferring the benefits of the cartel among its members is possible. This is still a relevant subset of cases, but it does not apply to all cartels. However, this limitation is remedial because the method can be associated with any other screening method and can act in a complementary manner, as suggested by Harrington Jr. (2008).

A common problem with all screening methods is that once they become known to cartel participants, they will modify their behavior to avoid detection (SCHINKEL, 2013). However, this is not a reason to rule out screening methods; on the contrary, it is necessary to develop them continuously, and the cumulative process of screening methods is associated with increasing costs for cartel participants to avoid detection. Eventually, this cumulative process may result in the deterrence of such an antitrust offense.

4.5 **Further Steps**

Improvement of the empirical strategy through the development of a structural model for public auctions. The idea is to identify the causal effects of the presence of frequent losers on the auction results.

FINAL REMARKS

Most of the resources used to prepare and execute public policy, such as common goods and services, are purchased from private firms. The way the planning procedures for the acquisition of these goods is carried out may substantially affect the procurement conditions or outcomes and, ultimately, it might influence the results of public policies.

This dissertation investigates factors and institutional arrangements that could undermine public tenders' performance and generate waste of public resources. An appropriate time for identifying all needs and ends, analyzing market conditions, and setting relevant tenders parameters (items specification, quantities, and reserve prices, for instance) may increase the likelihood of achieving public policies goals efficiently and effectively.

On the other hand, under unfavorable planning conditions, purchases might be inadequate to meet public needs and more expensive, undermining public policies' outcomes. Thus, analyzing aspects that facilitate or hinder the public procurement process contributes to understanding the effectiveness of public policies and their effects on economic development.

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APPENDIX A: Paper 1

A.1   Public Notice Disclaimers

A.1.1 Administrative Purchases

EDITAL DE PREGÃO ELETRÔNICO CGA n.º 156/2019

SPDOC SES n.º 1322708/2019

OFERTA DE COMPRA Nº 090102000012019OC00321

ENDEREÇO ELETRÔNICO: www.bec.sp.gov.br

DATA DO INÍCIO DO PRAZO PARA ENVIO DA PROPOSTA ELETRÔNICA: 05/07/2019

DATA E HORA DA ABERTURA DA SESSÃO PÚBLICA: 24/07/2019 as 10h00min

A SECRETARIA DE ESTADO DA SAÚDE DE SÃO PAULO – COORDENADORIA GERAL DE ADMINISTRAÇÃO, por intermédio do(a) Senhor(a) ADHEMAR DIZIOLI FERNANDES, RG nº 10.129.374-4 e CPF nº 130.456.788-58, usando a competência delegada pelos artigos 3º e 7º, inciso I, do Decreto Estadual nº 47.297, de 06 de novembro de 2002, torna público que se acha aberta, nesta unidade, situada a Avenida Doutor Enéas de Carvalho Aguiar, 188, Cerqueira César, São Paulo/SP, licitação na modalidade PREGÃO, a ser realizada por intermédio do sistema eletrônico de contratações denominado "Bolsa Eletrônica de Compras do Governo do Estado de São Paulo – Sistema BEC/SP", com utilização de recursos de tecnologia da informação, denominada PREGÃO ELETRÔNICO, do tipo MENOR PREÇO, objetivando a AQUISIÇÃO DE ITENS DE ENFERMAGEM EM ATENDIMENTO ÀS DEMANDAS ADMINISTRATIVAS, que será regida pela Lei Federal nº 10.520/2002, pelo Decreto Estadual nº 49.722/2005 e pelo

A.1.2 Litigated Purchases

EDITAL DE PREGÃO ELETRÔNICO n.º0157/2019

PROCESSO n.º1887851/2019

OFERTA DE COMPRA Nº 090133000012019OC00172

ENDEREÇO ELETRÔNICO: www.bec.sp.gov.br

DATA DO INÍCIO DO PRAZO PARA ENVIO DA PROPOSTA ELETRÔNICA: 10/09/2019

DATA E HORA DA ABERTURA DA SESSÃO PÚBLICA: 20/09/2019 – as 09H10MIN

O Departamento Regional de Saúde de São João da Boa Vista-DRS XIV, por intermédio do Senhor Diretor, Dr. Benedito Carlos Rocha Westin, RG nº 4.849.352 e CPF nº 901.204.188-00 , usando a competência delegada pelos artigos 3º e 7º, inciso I, do Decreto Estadual nº 47.297, de 06 de novembro de 2002, torna público que se acha aberta, nesta unidade, situada a Praça Dr. Boa Vista, 221 – Centro em São João da Boa Vista, licitação na modalidade PREGÃO, a ser realizada por intermédio do sistema eletrônico de contratações denominado "Bolsa Eletrônica de Compras do Governo do Estado de São Paulo – Sistema BEC/SP", com utilização de recursos de tecnologia da informação, denominada PREGÃO ELETRÔNICO, do tipo menor preço, objetivando a AQUISIÇÃO DE MEDICAMENTOS PARA PACIENTES QUE INGRESSARAM COM AÇÕES JUDICIAIS, que será regida pela Lei Federal nº 10.520/2002, pelo Decreto Estadual nº 49.722/2005 e pelo regulamento anexo à Resolução CC-27, de 25 de maio de 2006, aplicando-se, subsidiariamente, no que couberem, as disposições da Lei Federal
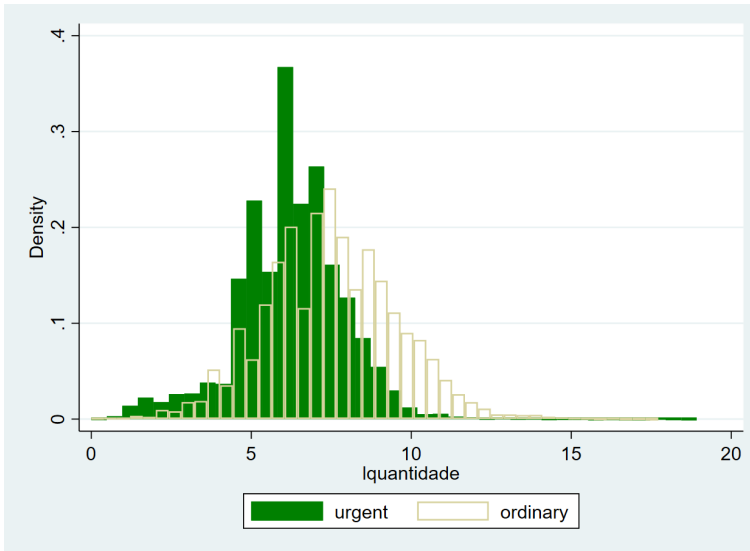
A.2 Ordinary and Urgent (Litigated and Administrative) Purchases
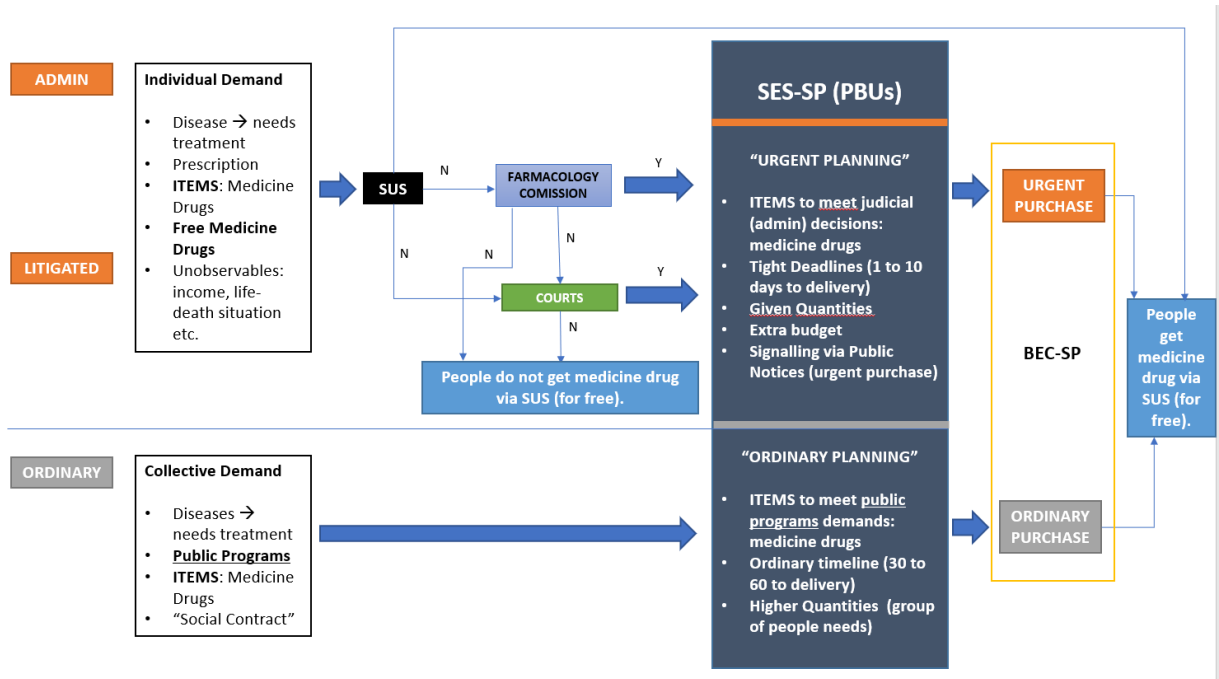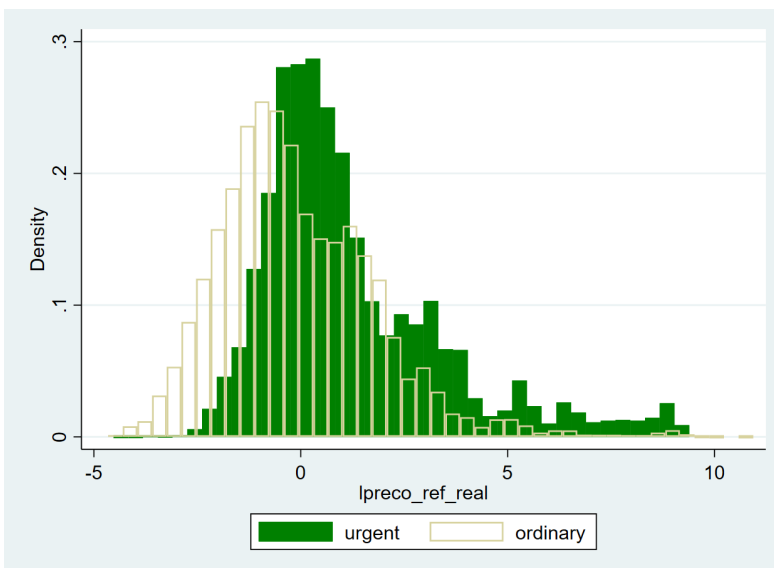

Source: Prepared by the author.

A.3   Additional Graphs

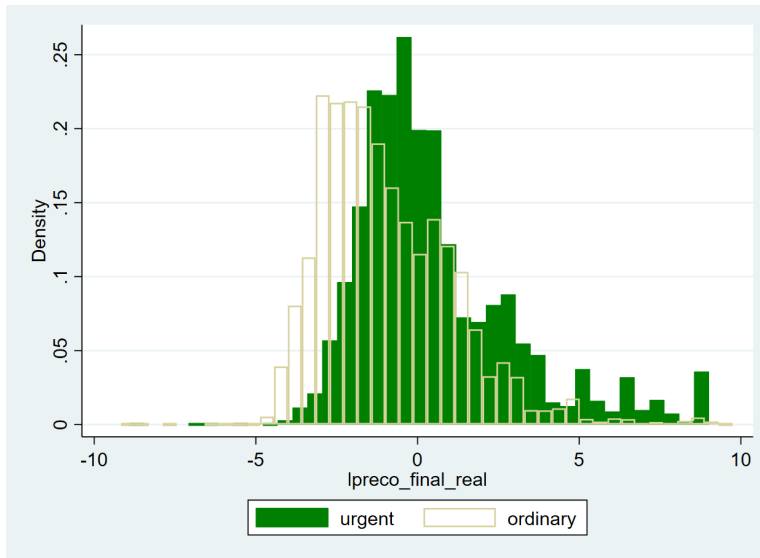**A.3.1** – Log Quantity: litigated vs ordinary purchases

Source: BEC-SP.

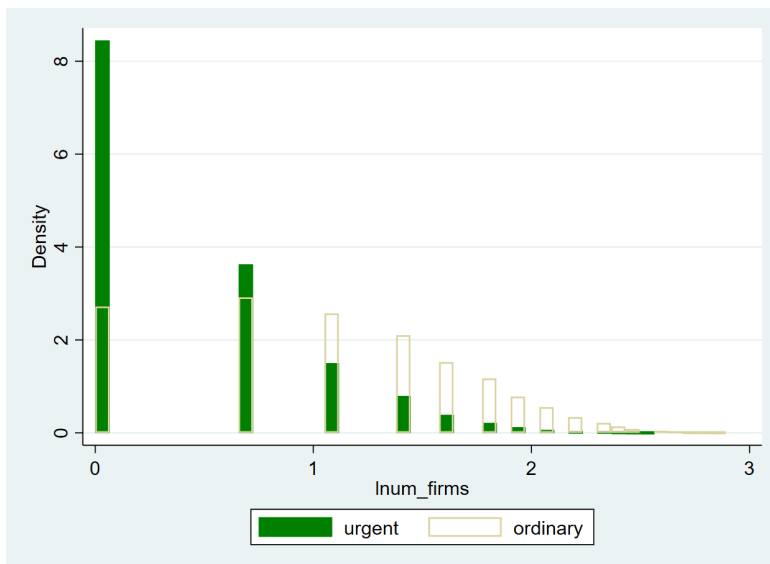**A.3.2** – Log Reference Prices: litigated vs ordinary purchases

Source: BEC-SP.

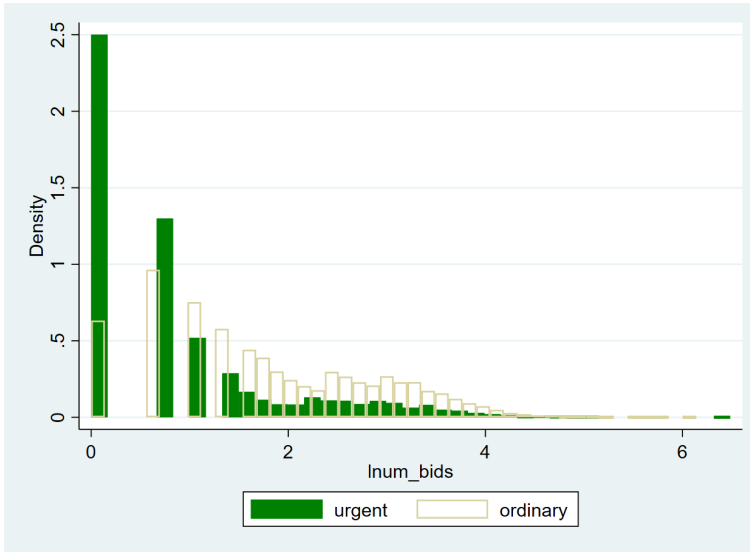**A.3.3** – Log Prices: litigated vs ordinary purchases
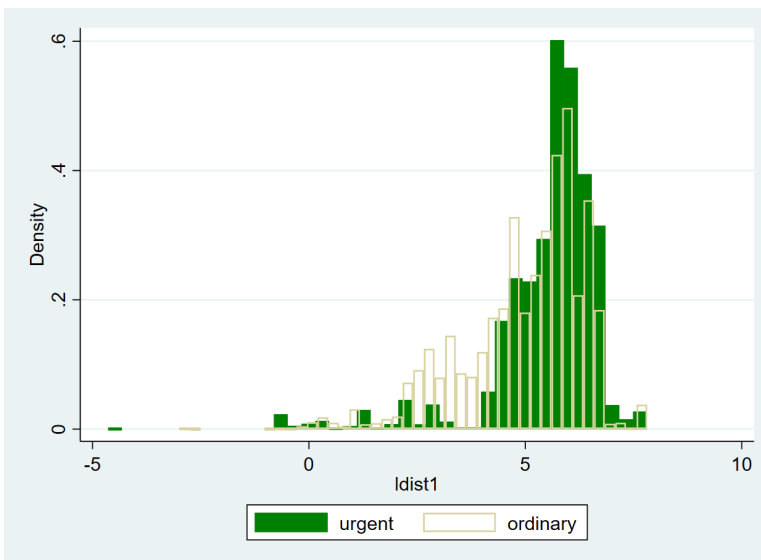

Source: BEC-SP.

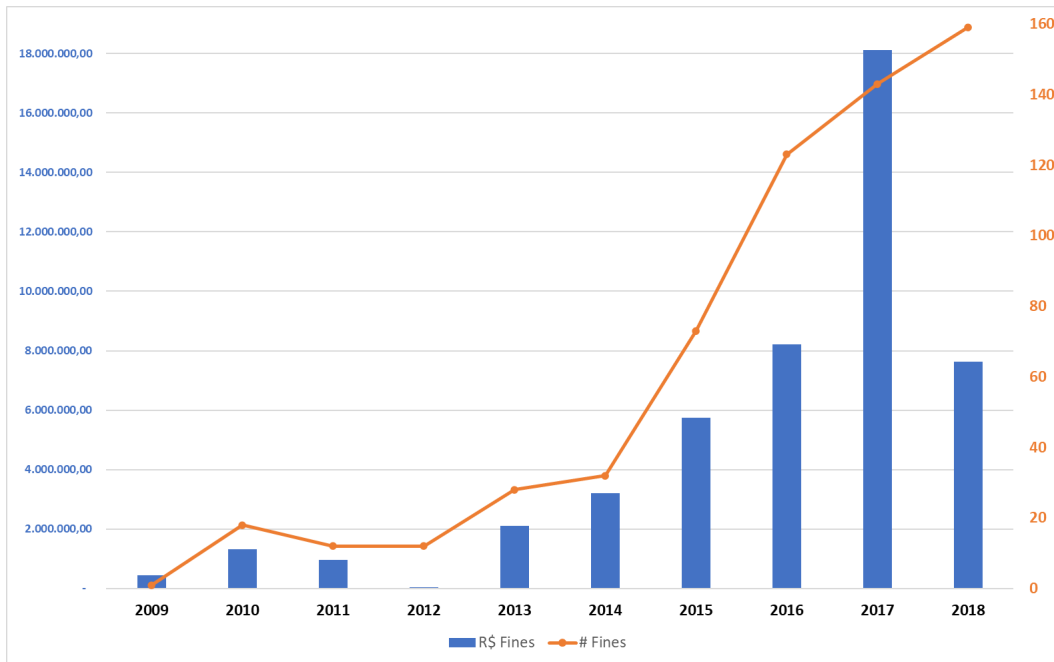**A.3.4** – Log number of participant firms: litigated vs ordinary purchases

Source: BEC-SP.

A.3.5 – Log number of bids: litigated vs ordinary purchases

Source: BEC-SP.

A.3.6 – Log distance from PBU to supplier: litigated vs ordinary purchases

Source: BEC-SP.

A.3.7 – Fines against PBUs for non-compliance with court orders

Source: S-CODES.

APPENDIX B: Paper 2

B.1 – Public Notice Disclaimers: SMEs restricted tenders

SECRETARIA DE ESTADO DA SAÚDE
COORDENADORIA DE SERVIÇOS DE SAÚDE
CONJUNTO HOSPITALAR DO MANDAQUI
Rua Voluntários da Pátria, 4.301 – Mandaqui – Tel.: 2281-5000

MINUTA DE EDITAL DE PREGÃO ELETRÔNICO OBJETIVANDO A AQUISIÇÃO DE BENS COM ENTREGA IMEDIATA – PARTICIPAÇÃO RESTRITA A ME/EPP/COOPERATIVAS

EDITAL DE PREGÃO ELETRÔNICO CHM n.° 116/2018
PROCESSO CHM n.° 001.0143.000195/2018
OFERTA DE COMPRA N° 090172000012018OC00191.
ENDEREÇO ELETRÔNICO: www.bec.sp.gov.br
DATA DO INÍCIO DO PRAZO PARA ENVIO DA PROPOSTA ELETRÔNICA: 15/03/2018
DATA E HORA DA ABERTURA DA SESSÃO PÚBLICA: 28/03/2018 – as 09:00 min

O(A) **CONJUNTO HOSPITALAR DO MANDAQUI**, por intermédio do(a) Senhor(a) **DRA. MAGALI VICENTE PROENÇA**, RG n° **7.812.119-X** e CPF n° **040.589.888-60**, usando a competência delegada pelos artigos 3° e 7°, inciso I, do Decreto Estadual n° 47.297, de 06 de novembro de 2002, torna público que se acha aberta, nesta unidade, situada a **RUA VOLUNTARIOS DA PATRIA 4301 - MANDAQUI-SÃO PAULO- SP**, licitação na modalidade **PREGÃO**, a ser realizada por intermédio do sistema eletrônico de contratações denominado "Bolsa Eletrônica de Compras do Governo do Estado de São Paulo – Sistema BEC/SP", com utilização de recursos de tecnologia da informação, denominada **PREGÃO ELETRÔNICO**,

SECRETARIA DE ESTADO DA SAÚDE
COORDENADORIA DE REGIÕES DE SAÚDE
DEPARTAMENTO REGIONAL DE SAÚDE DE BAURU – DRS VI
NÚCLEO DE FINANÇAS, SUPRIMENTOS E GESTÃO DE CONTRATOS
Rua Quintino Bocaiuva, 5-45, Centro, Bauru - SP – CEP: 17015-100
Telefone (14) 3235-0177 - Correio Eletrônico: drs6-nfsgc@saude.sp.gov.br

EDITAL DE PREGÃO ELETRÔNICO OBJETIVANDO A AQUISIÇÃO DE BENS COM ENTREGA IMEDIATA – PARTICIPAÇÃO RESTRITA A ME/EPP/COOPERATIVAS

EDITAL DE PREGÃO ELETRÔNICO n° 052/2018
PROCESSO n° 001.0206.000487/2018
OFERTA DE COMPRA n° 090115000012018OC00069
ENDEREÇO ELETRÔNICO: www.bec.sp.gov.br
DATA DO INÍCIO DO PRAZO PARA ENVIO DA PROPOSTA ELETRÔNICA: 13/04/2018
DATA E HORA DA ABERTURA DA SESSÃO PÚBLICA: 27/04/2018 às 09:00 horas

O **Departamento Regional de Saúde de Bauru – DRS VI**, por intermédio da Senhora **Doroti da Conceição Vieira Alves Ferreira**, RG n° **11.908.923-3** e do CPF n° **033.164.958-60**, **Diretoria Técnica de Saúde III**, usando a competência delegada pelos artigos 3° e 7°, inciso I, do Decreto Estadual n° 47.297, de 06 de novembro de 2002, c.c. artigo 8°, do Decreto Estadual n° 49.722, de 24 de junho de 2005, torna público que se acha aberta, nesta unidade, situada a **Rua Quintino Bocaiuva, n° 5-45, Centro – CEP: 17015-100 - Bauru/SP**, licitação na modalidade **PREGÃO**, a ser realizada por intermédio do sistema eletrônico de contratações denominado "Bolsa Eletrônica de Compras do Governo do Estado de São Paulo – Sistema BEC/SP", com utilização de recursos de tecnologia da informação, denominada **PREGÃO ELETRÔNICO**, do tipo **MENOR PREÇO**,
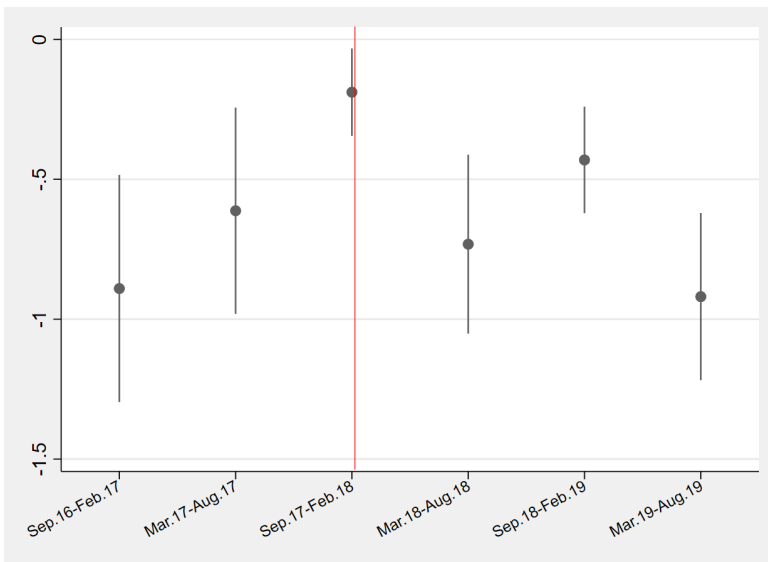
B.2 – Additional Graphs

B.2.1 - Distance from PBU to winner firms: Difference between the always treated group and the switched group
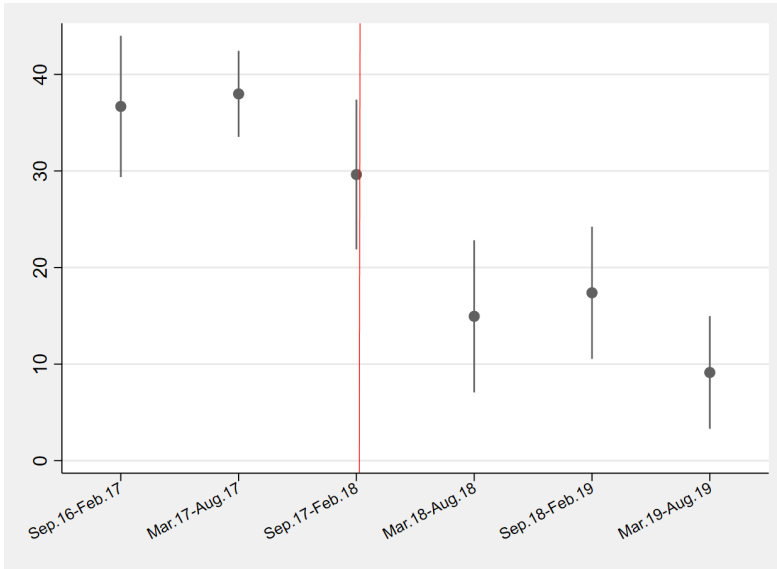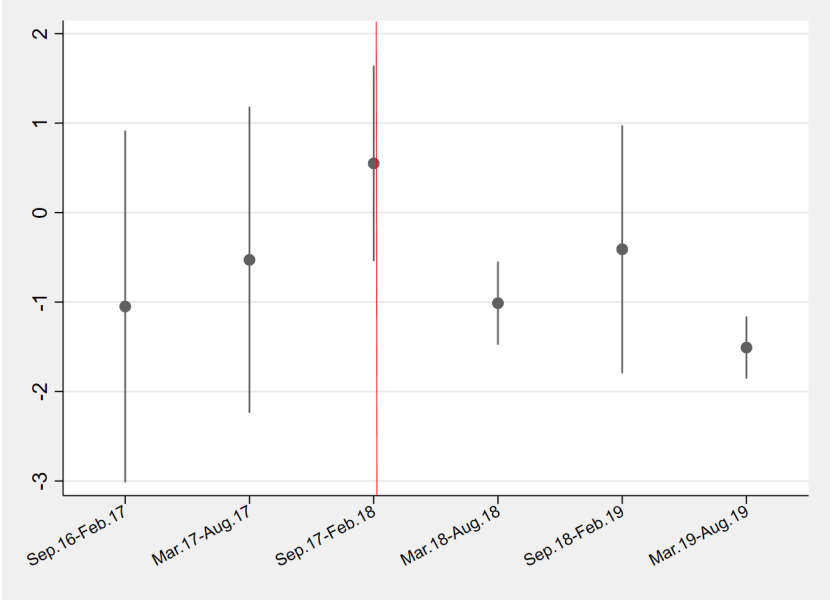

Source: BEC-SP.

B.2.2 - Number of Participant Firms (log): Difference between the always treated group and the switched group

Source: BEC-SP.

B.2.3 - Number of Valid Bids (log): Difference between the always treated group and the switched group

Source: BEC-SP.