

## PART XV

## POOLED PROCUREMENT IN BRAZIL: THEORY AND EVIDENCE FROM THE BRAZILIAN SYSTEM OF PRICE REGISTRATION

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**ABSTRACT:** In this paper I describe the Brazilian Pooled Procurement System - Brazilian System of Price Registration (RP) - and analyze, theoretically and empirically, its benefits for public agencies. Basing on standard game theory, we write a theoretical model with the main ingredients of the RP. Using such framework, we investigate public bodies' behavior, characterize the possible equilibria and make predictions on potential outcomes. In particular, we find that the existence of free-riding behavior in pooled procurement may lead to low use of the system by public entities. Additionally, I present evidence on the Brazilian purchases of pharmaceutical and medical supplies by public agencies, and show that the use of RP leads to reduction on price paid by public bodies.

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## 1. INTRODUCTION

The Brazilian Public Pooled Procurement, or simply Price Registration System (RP), is the system through which several Brazilian public entities and bodies procure goods and contract services. Through the System, suppliers provide goods and services at prices and terms recorded in specific minutes or proceedings but the procurement or contracting is made whenever it is more convenient to the public entities and bodies integrating the process.

The Price Registration System (RP) was implemented in Brazil in 2001 through Decree Number 3.931 of 19/09/2001 aiming to cut down the red tape and the high transaction costs in public awarding caused by the Bidding Act (Act Number 8.666/93). Particularly as pointed out by Fiuza (2007), the RP enables (i) higher speed in contracting, (ii) better inventory management and control, (iii) better budget execution and (iv) less bidding processes. Such benefits arise out of higher flexibility of the RP that makes easier for the entities and public bodies to procure goods and services, allowing them to join a Price Registration System at their own convenience. Naturally, such aspects assure better public management.

On the other hand, the Price Registration System (RP) also holds the benefits arising out of the Bidding Act as any RP should be made according to the selection and award criteria provided by such legislation, especially that the RP has the “*lowest price supplier rule*” as selection decision rule, which is a good mechanism for selection of suppliers for standardized products.<sup>2</sup> According to the auction literature – summarized by Krishna (2002), Klemperer (2004) and Milgrom (2004) – the reason why the “*lowest price supplier rule*” is a good mechanism for acquisition of standardized goods and services

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<sup>2</sup>According to Bajari and Tadelis (2001) the decrease in corruption and ad hoc selection are other advantages of selection of suppliers according to the lowest price criterion. Such benefits assure greater transparency to public purchases.

relying on the fact that the most efficient supplier (the lowest price) would be selected for the provision of goods and services, and the buyer would pay the lowest price for them.

In addition to the aspects pointed out above, the Price Registration System offers further flexibility to public management: It allows that different public bodies and entities would purchase goods or contract services jointly. The literature on public and private purchases has already developed theoretical studies on similar mechanisms and arrangements. Particularly such studies point out that such demand aggregation mechanisms offer benefits to member buyers but also there are costs to the associates.

Among the benefits, we can highlight the increase of purchase volume occurring by the demand aggregation of different institutions willing to jointly purchase the same goods/services. Dimini, Dini and Piga (2006), for instance, argue that such effect increases the buyers' bargaining power, enabling them to get discounts for the purchase of large quantities and negotiating better deals and contracts. Differently, Barbosa (2010) looks at the effects of joint purchase on the supplier's production, showing that demand aggregation allows the suppliers to extract the potential gains of scale and scope in the production of goods, and reduce logistic cost. In competitive markets such gains in efficient are transferred to buyers through lower prices. Consistently, Barbosa and Fiuza (2011) document that the price paid by a public body or entity for the provision of certain goods is lower when such body or entity purchases through the pooled procurement (i.e., Price Registration System) than through a standard individual one.

This paper aims to present the Brazilian Price Registration System (RP) by describing its purposes and exposing its structure and organization (stages of process and institutions involved). Furthermore, this paper will analyze the RP in the light of the Game Theory. For that, I will be presenting a theoretical model of the Price Registration System where the public buyers (public bodies and entities) and sellers (suppliers) behavior strategically. This model has an equilibrium which provides prediction on the agents' behavior and

the outcomes. From such results I identify inefficiencies in the system (sub-optimal allocations), and suggest mechanisms to correct for them.

This paper also presents an empirical review of the evolution of use of the Price Registration System by Brazilian public bodies and entities and discusses empirical evidence on the RP benefits to the Brazilian Government and its spheres. To conclude, I briefly describe other pooled procurement systems used by other countries and local governments in Brazil, and compare them with the RP.

This paper is organized as follows: Section 1 presents the Brazilian Price Registration System; Section 2 addresses a theoretical model of the price registration system and discusses the system inefficiencies. Section 3 offers a brief empirical review of the system and discusses its benefits to the Brazilian public bodies and entities. Section 4 presents pooled procurement systems similar to the Brazilian one which have been used in other countries and by local governments in Brazil. Section 5 concludes the paper.

## 2. INSTITUTIONAL BACKGROUND: PUBLIC PROCUREMENT IN BRAZIL

### *2.1 Previous Arrangements: Procurement Laws*

■ **Public Procurement in Brazil.** According to the Brazilian procurement legislation, Bidding Act (Act Number 8.666/93), any sphere of Brazilian government must use competitive tendering as a procedure to make a purchase of a good, perform a work, or acquire a service through third parties. In the Brazilian legislation, competitive bidding is defined as the administrative procedure whereby the public administrator selects, among all applications submitted for the supply of works, goods or services, which one best serves the public interest, and awards to the winner the right to supply to the government.

The spheres of the Brazilian government may use the following forms of procurement for goods, works and services: (i) Open Competitive Bidding (a reverse first-price sealed-bid auction in which any supplier

is allowed to submit a bid), (ii) Pre-Qualified Bidders (a reverse first-price sealed-bid auction in which only suppliers with solid track record of providing good for the government is allowed to bid), (iii) Invited Bidders (a reverse first-price sealed-bid auction in which only invited bidders are allowed to bid), (iv) Open Hybrid Competitive Bidding (a reverse first-price sealed-bid auction followed by a reverse English auction in which any supplier is allowed to submit a bid), and (v) Open Electronic Competitive Bidding (an electronic reverse English auction in which any supplier is allowed to submit a bid).<sup>3, 4</sup>

The value and type of product or service determines the form of procurement to be used. In general, goods, services and works of high values must be acquired through Open Competitive Bidding, while those of lower values can be acquired through Invited Bidders. For intermediate values, one can purchase them through Pre-Qualified Bidders. Open Hybrid and Electronic Competitive Bidding can be used for purchasing of standardized goods and services of any value. However, they cannot be used for construction and engineering services.<sup>5,6,7</sup>

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<sup>3</sup> In the Procurement literature, summarized by Dimitri, Piga and Spagnolo (2006), such auction-based award mechanisms are namely Competitive Tendering.

<sup>4</sup> There are two other formats which are used for other purposes: Contest and Standard Open Ascending Price Auction. Contest, for example, is used to award technical studies, scientific or art works, while Standard Auction is used for selling public assets.

<sup>5</sup> In some cases, competitive bidding is waived or ineligible. Competitive bidding is waived for products, services and works of extremely low value. Ineligibility applies when competition is not possible, because there is only one supplier, or when the goods can be provided with exclusivity a single company (or representative office).

<sup>6</sup> The Brazilian public administrations may use other selection criteria than auction-based mechanism (i.e., the government selects among the potential providers the one with the lowest bidding price) to select suppliers. For instance, they can base their selection decision on (i) best technique, or on (ii) best technique and price. When the buyer uses the best technique criterion, one supplier with best quality (the precision, safety and durability) wins the competition. In this criterion, the lowest price bidder is not overlooked, but the focus is quality. When the buyer uses the best technique

Whenever an administration authority relies on one of those procurement formats to select a supplier, he must specify the maximum unit price (i.e., reserve price) that is willing to pay to acquire the procured goods and services. This reserve price is determined through a market survey conducted by the agency or authority responsible for the purchase.<sup>8</sup>

■ **Procurement Law in Brazil: Benefits and Drawbacks.** The literature on public procurement in Brazil, summarized by Fiuza (2007), highlights the following benefits of such legislation for the public administration: (i) greater transparency in government procurement, and (ii) best selection of the company to supply goods and services. Such benefits come from the competition between suppliers through a competitive bidding process. In particular, as the auction literature, summarized by Krishna (2002) and Klemperer (2004), has pointed

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and price criterion, the company with the best quality that have the lowest bidding price wins the competition. It is important to highlight in the Open Hybrid and Electronic Competitive Bidding, the lowest bidding price is the only criterion for selection of suppliers.

<sup>7</sup> Fiuza (2007) documents that when the selection criterion is auction-based mechanism; contracts are awarded through fixed-price contracts. Despite the benefits of fixed-price contracts and the fact that the supplier selection is based on the lowest price, the theoretical and empirical literature warns that the fixed-price contracts may not have the desired properties for the provision of heterogeneous, customized and non-standard goods. Laffont and Tirole (1993), for instance, show that when high quality inputs/activities have high production costs, then fixed-price contracts may lead to the provision of inputs / activities with lower quality. Rosenberg (1994) and Cabral et

al. (2006) argue that, when suppliers are unable to diversify risk or are risk averse, fixed-price contracts can lead to selection of less risky technologies, which are not socially optimal. Bajari and Tadelis (2001) show that fixed-price contracts have high renegotiation cost when the non-contractible contingencies are not rare.

<sup>8</sup> In the Brazilian legislation, the reserve price is named "estimated price", although no law completely rules out awarding a contract when the lowest bid exceeds that ceiling.

out, auction-based mechanism (competitive bidding), used in most Brazilian procurement transactions, is an efficient mechanism to acquire standardized goods and services. Such mechanism awards the provision of goods and services to the most efficient supplier (the one with the lowest cost), and the buyer pays the lowest price for them.

On the other hand, mandatory competitive bidding (with the exceptions noted above) and rules-based procurement are accountable for a high level of transaction costs in the Brazilian government. For instance, as pointed by Fiuza (2007), excessive red tape in procurement transactions have ended up forcing the public entities to maintain excessively high inventories of goods.

As a means to warrant the benefits of competitive bidding and at the same time to bring down transactions costs, the Brazilian government created the Brazilian System of Price Registration (PR). In the section below we will discuss in details this system works.

## ***2.2 Pooled Procurement: The Price Registration System***

■ **Brief Description.** The Brazilian System of Price Registration (PR) is a pooled procurement system in which several public agencies and entities gather and organize a joint competitive bidding to acquire/purchase goods, and suppliers offer goods and services at uniform prices and terms for all members of the PR. The public entities may contract the winning supplier to provide goods and services and order shipments of various sizes at their own convenience and without a predetermined frequency within a period of 12 months.<sup>9</sup> As in the standard individual procurement system, the administration authority must specify the reserve price, that is, its willingness to pay for the goods/services. The reserve price is also determined through a wide market survey.

The procurement transactions in the Price Registration system must

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<sup>9</sup> The Brazilian System of Price Registration is regulated by Decree 3.931/01 and 4.342/02.

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rely on an Open Competitive Bidding, Open Hybrid or Electronic Competitive Bidding. Lowest price is the only award criterion allowed in PR.

According to the Brazilian law, the Price Registration system should be employed when a set of off-the-shelf goods or services are to be acquired by more than one agency, entity, or government programs along a year; and when, by the nature of the goods, it is not possible to stipulate precisely the demand for them<sup>10</sup>.

■ **Institutions and Assignments.** There are basically two types of institutions in the Brazilian System of Price Registration (PR): buyers (public bodies and entities) and sellers (suppliers).

The buyers in a Price Registration pool are classified as manager-participant, no-manager-participant, and free-rider. A manager-participant is the public entity responsible for the procurement procedures in the PR (e.g., invitation of suppliers for competitive bidding, market research, specification of the demanded goods and quantities, definition of the reserve price, and running the auction), and also for managing all information in the procurement transaction. A no-manager-participant is a public entity that participates in the purchase of goods and helps the manager to organize the procurement procedures. A free-rider, in contrast, does not participate in the procurement process, but he can apply for the acquisition of goods and services at prices and terms convened between the original pool and the awarded supplier.

Suppliers are all companies who apply for the contracts of supply of goods and services to be awarded through a PR - pooled procurement. Any firm that meets the requirements set by the managing agency may apply to be admitted as a new signatory of the

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<sup>10</sup> The existence of prices recorded in a certain price registration system does not require the members to sign contracts with the supplies of the goods and services registered in the system.

PR minutes, the document that certifies the convened price.<sup>11</sup>

### 3. A THEORETICAL MODEL OF THE BRAZILIAN PRICE REGISTRATION SYSTEM

This section will address a review of the Price Registration System in the light of the Economic Theory studying the price registration system in a game theory setting.

Such analysis aims to understand the strategic behavior of the buyers (public bodies and entities) and sellers (suppliers) participating in the price registration game, identifying equilibrium and predicting some outcomes. The use of such framework will enable the identification of possible inefficiencies, that is, the sub-optimal allocations from the public sector finances and social standpoint. Once the system inefficiencies are identified, mechanisms to correct them will be proposed.

For the attainment of such goal, we will be first presenting a basic simple model that describes the price registration system as a game; such basic model has the ingredients required to identify the system upsides and downsides within a formal framework. Then several extensions of the basic model will be presented: such extensions will help us to understand each player's role (buyers and sellers) in the price registration game. The conclusion will address the inefficiencies and the mechanisms to correct them.

#### ***3.1 The Brazilian Price Registration System Game: Basic Model***

Consider a 2-period economy composed by the following agents: buyers and sellers. Buyers demand a unit of a certain good/ service and suppliers are equipped with the technology for the production of such goods. The value of goods for each buyer is:  $v_i = v$  for every  $i$ .<sup>12</sup>

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<sup>11</sup> The winner supplier can opt-out provision for the free-rider.

<sup>12</sup>This hypothesis will be relaxed in the next Section.

■ **Buyers:** There are two types of Buyers: Type 1 and Type 2. Buyers are indexed by  $i$ , that is, buyer-  $i$ . Type 1 buyers know in  $t=1$  that they need one unit of the relevant goods at  $t=3$ . There are  $l$  Type 1 buyers and the set of Type 1 buyers is represented by the set  $L = \{1, 2, \dots, l\}$ . Type 2 buyers will only know in  $t=2$  whether or not they will demand the goods at  $t=3$ . Particularly with probability  $\mu \in (0, 1)$  they will demand one unit of the relevant goods. There are  $m$  Type 2 buyers and the set of Type 2 buyers is represented by the set  $M = \{l+1, l+2, \dots, l+m\}$ . Thus the total of Buyers (Type 1 and Type 2) is  $l+m$ .

The purchasing mechanism used by buyers is the price registration system. The buyer which organizes the RP (manager-participant) incurs in a process cost  $K$  (or cost of preparation/organization) for organization of the price registration system. It is assumed to be independent of the number of buyers which joins the RP.

Any buyer that purchases goods through the price registration system pays a unit price  $p$ . Thus, buyer manager-participant's payoff is the following:

$$v - p - K$$

On the other hand, buyer no-manager-participant's payoff, who derives utility  $v$  and pay  $p$  for the good (who does not pay the organization cost  $K$ ) is the following:

$$v - p$$

■ **Suppliers:** Assume that there is a continuum of suppliers indexed by  $\beta \in [\underline{\beta}, \bar{\beta}]$ . The unit cost to the supplier  $\beta$  is  $c(\beta, Q)$  where  $Q$  is

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the total quantity sold by the supplier. That unit cost includes cost of production, logistics and delivery of goods to the buyers participating in the RP procedure.

Besides identifying the supplier, parameter  $\beta$  is also a parameter related to the efficiency in the supplier's production; particularly the lower the value of  $\beta$ , the lower the unit cost. Therefore, supplier  $\underline{\beta}$  is the most efficient (lowest cost). Thus we can assume that  $\frac{\partial c}{\partial \beta}(\beta, Q) \leq 0$ . For simplicity, we assume that  $\beta$  of each supplier is common knowledge.

It will be assumed that suppliers have economies of scale at least in part of the production process, that is, any supplier can reduce the unit cost by increasing the production. Formally, there is  $\bar{Q}$  such that

$$c(\beta, \bar{Q}) = \min_Q c(\beta, Q),$$

where

$$\forall Q \in [0, \bar{Q}] \rightarrow \frac{\partial c}{\partial Q}(\beta, Q) \leq 0, \quad (4)$$

and

$$\forall Q \in [\bar{Q}, \infty] \rightarrow \frac{\partial c}{\partial Q}(\beta, Q) > 0. \quad (5)$$

Equation (4) states that for any  $Q$  lower than  $\bar{Q}$ , the unit cost decreases as  $Q$  increases. On the other hand, Equation (5) states that for any  $Q$  higher than  $\bar{Q}$ , the unit cost increases as  $Q$  decreases. Particularly, unit cost reaches its minimum value when  $Q = \bar{Q}$ . Such hypothesis is represented by Equation (3).

■ **Auxiliary Hypothesis:** It will be assumed that the following condition is satisfied:

$$v - c(\underline{\beta}, l + \mu m) - \frac{K}{(l + \mu m)} > 0 \quad (6)$$

To understand such condition it is worth recalling that the total number of Type 1 buyers demanding one unit of goods is ( $l$ ) and the expected number of Type 2 buyers demanding one unit of goods in Period 2 is  $\mu m$ . Thus the total expected number of buyers is  $l + \mu m$ . Note that this number coincides with the total demand of goods, since each buyer demands one unit of the good.

Condition (6) states that the unit value of the goods ( $v$ ) minus the cost of one unit of the good  $c(\underline{\beta}, l + \mu m)$  when  $l + \mu m$  buyers buy from the most efficient suppliers, minus the average process cost  $\left(\frac{K}{(l + \mu m)}\right)$  (the process cost  $K$  divided by the expected number of buyers  $l + \mu m$ ) is positive. Such condition states that it is socially efficient for all buyers to purchase one unit of the goods in a pooled procurement if they equally share the organization cost of the price registration system.

■ **Sequence of Events in the Price Registration Game:** The Game is divided into 3 stages: (i) Design Stage, when the buyers become members of a price registration and determine the quantities (units) demanded by a price registration; (ii) "Free-Rider" Stage when Nature reveals if the Type 2 buyers demand or not the good at  $t=3$ . Those who demand, join an existing price registration system Last (iii) Bidding Stage where suppliers compete for provision of good to the RP. Below are the events in each stage.

*Design Stage:* At the Design Stage the following successive events occur: (i) buyers decide whether or not they participate in the process.  $n$  is the number of buyers in a RP, which is endogenous determined and can be 0 ou  $l$ ; (ii) Type 1 buyers decide to contribute to the organization of the price registration process by sharing the process cost  $K$ . The buyer who pays the largest share of the cost  $K$  will be

the manager-participant. And last (iv) manager-participant organizes a competitive bidding, informing the suppliers the quantities demanded by the pool of buyers.

*Free-Rider Stage:* The following successive events occur at Free-Rider Stage: (i) Type 2 buyer finds out whether or not he needs the goods; (ii) if affirmative, Type 2 buyer decides to open a new price registration or free-rides in an existing one; (iii) the manager-participant authorizes the free-rider to participate or not, and (iv) the winning supplier decides to supply the free-rider within the price registration or not.

*Bidding Stage:* At the Bidding Stage the following successive events occur: (i) Suppliers offer their bid for  $n$  units; (ii) supplier offering the lowest bid will win the competitive bidding, (iii) contracts of provision of goods to the pool of buyers are awarded.

■ **Game Equilibrium Result:** As the price registration game presented in this Section is a dynamic game with perfect information, the relevant concept of equilibrium for such context is the Perfect Equilibrium in Sub-Games. As described by Fudenberg and Tirole (1991), this type of equilibrium assumes that the players will have common knowledge on the preferences of all individuals of the economy, on the firms' technologies, on all the game stages and on all actions each individual can take in each possible contingency. Such hypothesis is called "common knowledge" in the economic literature.<sup>13</sup>

The principle of backward induction will be used to identify such equilibrium. So, players anticipate future actions by other players, taking into account that in every contingency and in each instant of time the players always choose the actions that maximize their own payoff.

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<sup>13</sup> For a full description of hypotheses and concepts of equilibrium in games see Fudenberg and Tirole (1991).

Through this principle the Nash equilibrium can be identified in each sub-game (or stage) starting with the smallest sub-game which is the Bidding Stage.

*Bidding Stage:* The following successive decisions are optimal at the Bidding Stage:

- Accordingly, suppliers know that by winning the competition they will sell  $\mu m + n$  units. Competition between suppliers causes the unit bid to be equal to the unit cost. Therefore the equilibrium bid is  $p(\beta) = c(\beta, \mu m + n)$ .
- As a result the Supplier with  $\beta = \underline{\beta}$  wins the bidding as it is the most efficient supplier offering a bid equal to  $p = c(\underline{\beta}, \mu m + n)$ .

*Free-Rider Stage:* The following successive decisions are optimal at the Free-Rider Stage:

- Supplier accepts supplying the Free-Rider if  $p - c(\beta, n + 1) \geq p - c(\beta, n)$ . Particularly, if  $n + \mu m \leq \bar{Q}$ , then supplier accepts all free-riders.
- The manager-participant authorizes the free-rider if the latter's presence will allow to reduce the unit cost, that is, if supplier has economies of scale,  $c(\beta, n + 1) \leq c(\beta, n)$ . Such strategy is optimal for the manager-participant. Otherwise, accepting the free-rider when  $c(\beta, n + 1) > c(\beta, n)$ , allowing the seller to supply the free-rider will increase the supplier's marginal production cost. A higher marginal cost increases the price paid by the manager-participant, which reduces its *payoff*.
- All  $\mu m$  free-rider if  $n + \mu m \leq \bar{Q}$ .

*Design Stage:* The following successive decisions are optimal at the Design Stage:

- All Buyers participate in the Design:  $n = l$ ;
- Only one of the buyers pays the cost of process of organization of the price registration

Note that in equilibrium only one of the buyers organizes and pays the cost of organization of the price registration. This happens because the price registration is a kind of public good – the price registration or act of purchase is non-rival goods; because the cost to develop/organize a price registration is independent from the number of participating bodies and entities, then only one entity organizes and pays the cost of price. The buyer paying the cost of organization of the price registration is the manager-participant.

As it will be highlighted further on, such nature of public good of the price registration organization may generate certain inefficiencies.

Consider the case where all free-riders are accepted:  $l + \mu m \leq \bar{Q}$ . Then two equilibria are possible:

- 1) There is Price Registration:  $v - c(\beta, \mu m + l) - K \geq 0$ ;
- 2) There is no Price Registration:  $v - c(\beta, \mu m + l) - K < 0$

Note that there may exist two different equilibria: an Equilibrium where there is price registration and another where there is no price registration. In particular, note that there may no exist a price registration when a buyer who pays the cost of preparation of the price registration is not willing to bear such expense alone. This is inefficient equilibrium as for the condition (6) it is socially optimal that all buyers jointly purchase the units of the demanded goods. As mentioned before, such result is due to the fact that the preparation of the price registration is a kind of public good.

A possible solution for the problem would be the sharing of costs of the Price Registration Process between the managing body, the participants and free-riders. Alternatively, it may be permitted by law that the manager-participant would charge an affiliation or membership fee to any buyer interested in participating in the price registration for which it is responsible.

### **3.2 Price Registration Game: Extensions**

This Sub-section will present 2 extensions to the basic model. In the

first extension we will review the case in which the buyers have different utilities; here one of the possible manners in which the body managing the price registration is determined.

In the second extension, we will be examining the case in which the buyers have different demands; here one of the possible manners in which the body managing the price registration is determined will also be studied.

■ **Extension I: Buyers with different utilities.**

*Assumption 1:* Assume that each buyer has a different utility  $v_i$  for the good; with no loss of generality assume:

$$v_1 > v_2 > \dots > v_{l+n}$$

For simplicity sake, consider the case where all free-riders are accepted:  $l + \mu m \leq \bar{Q}$ . So, the equilibrium is characterized as follows:

*Equilibrium:* The result of the price registration game under such hypotheses is the following:

- Bidding Stage: Each supplier's bid is equal to  $p(\beta) = c(\beta, \mu m + n)$  and the winning supplier is the supplier  $\beta = \underline{\beta}$  whose bid is equal to  $p = c(\underline{\beta}, \mu m + n)$ .
- Free-Rider Stage: All free-riders are accepted by the supplier and the manager-participant.
- Design Stage: In equilibrium all Type 1 buyers participate in the design  $n = l$ . Therefore, the following equilibria are possible.

- o There is no Price Registration if

$$v_1 - c(\underline{\beta}, \mu m + l) - K < 0$$

- o There is Price Registration if

$$v_1 - c(\underline{\beta}, \mu m + l) - K \geq 0 > v_2 - c(\underline{\beta}, \mu m + l) - K$$

In such case, the managing body is the buyer deriving most utility for the goods

- o There is Price Registration if

$$v_i - c(\underline{\beta}, \underline{\mu}m + l) - K \geq 0 > v_{i+1} - c(\underline{\beta}, \underline{\mu}m + l) - K$$

- o In such case any of the  $i$  buyers with the highest utility for the goods can be considered a manager-participant.

■ **Extension II: Buyers with different demands**

*Assumptions II:* Assume that the buyers' preferences are quasi-linear having the following form:

$$U(\theta_i, q_i, T_i) = \theta_i V(q_i) - T_i$$

Where  $\theta_i V'(q_i)$  is the goods' marginal utility for the buyer-  $i$  and  $T_i$  is the transfer paid by buyer to supplier for the  $q_i$  acquired units.

With no loss of generality, assume that:

$$\theta_1 > \theta_2 > \dots > \theta_{l+n}$$

$$V'(q_i) > 0 \quad e \quad V''(q_i) \leq 0$$

For simplicity sake, consider again the case in which all free-riders are accepted:  $\bar{Q}$  is sufficiently large.

*Determining each Buyer's Demand*

Prices are linear in the Price Registration System; thus  $T_i = pq_i$  where  $p$  is the unit price paid by each buyer in the price registration. Therefore, the payoff of buyer-  $i$  has the following form:

$$U(\theta_i, q_i, p) = \theta_i V(q_i) - pq_i$$

Buyer determines the demanded that maximizes his payoff. The demand of buyer-  $i$  is  $q_i^*$ , where  $q_i^*$  is the solution for the following problem:

$$q_i^* = \arg \max_{q_i} U(\theta_i, q_i, p) = \theta_i V(q_i) - pq_i$$

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The first order condition (FOC) of the problem is the following:<sup>14</sup>

$$V(q_i^*) = \frac{p}{\theta_i} \quad (13)$$

The first order condition (FOC) of the problem above determines the demand of buyer-  $i$  for a given price which may be charged by the winning supplier in the price registration. Such demand is represented by the following expression:

$$q_i^* = q_i(\theta_i, p)$$

Note that for each price there is a different quantity demanded by each buyer. It is worth mentioning that the demand equation in (13) has some properties:

- 1) Buyers with higher  $\theta_i$  have higher demand:

$$\frac{\partial q_i(\theta_i, p)}{\partial \theta_i} = \frac{-p}{V''(q_i)\theta_i^2} > 0$$

- 2) The demand is decreasing in the price:

$$\frac{\partial q_i(\theta_i, p)}{\partial p} = \frac{1}{V''(q_i)\theta_i^2} < 0$$

Define  $U^*(\theta_i, p)$  as the value function of the problem of maximization of buyer -  $i$ . Such function corresponds to the utility each buyer derives by consuming the optimal quantity of goods when the price is equal to  $p$ . Such function formally is defined by:

$$U^*(\theta_i, p) = \max_{q_i} U(\theta_i, q_i, p) \equiv \theta_i V(q_i^*) - pq_i^*$$

The proposition below shows that for one same unit price the buyers

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<sup>14</sup> The second order condition is satisfied.

with higher  $\theta$  's have greater utility.

**Proposition:** The following ordering is valid:

$$U^*(\theta_1, p) > U^*(\theta_2, p) > \dots > U^*(\theta_{l+m}, p).$$

Proof: *Direct Application of the Envelope Theorem.* ■

Once the individual demand is calculated and its properties derived, we can aggregate such demands. At the design stage the total demand is equal to:

$$Q^D = \sum_{i=1}^l q_i(\theta_i, p)$$

The aggregate demand including the expected free-riders ones is the following:

$$Q^A = \sum_{i=1}^l q_i(\theta_i, p) + \sum_{i=l+1}^{l+m} \mu q_i(\theta_i, p)$$

*Equilibrium:* Assume that  $Q^A < \bar{Q}$ . Thus, the result of the price registration game is the following:

- Bidding Stage: Each supplier's bid is equal to the unit cost, that is  $p(\beta) = c(\beta, Q^A)$ . In particular, the winning bid is equal to  $p = c(\beta, Q^A)$ .
- Free-Rider Stage: All free-riders are accepted by the Suppliers and manager-participant.
- Design Stage: In equilibrium, all Type 1 buyers participate in the design  $n = l$ . Therefore, the following equilibria are possible.

- There is no Price Registration if

$$\theta_1 V(q_1^*) - c(\beta, Q) q_1^* - K < 0 .$$

- There is Price Registration if

$$\theta_1 V(q_1^*) - c(\beta, Q) q_1^* - K \geq 0 > \theta_2 V(q_2^*) - c(\beta, Q) q_2^* - K$$

In such case the manager-participant is the buyer deriving the highest

utility for the goods (higher  $\theta$ ). So, there is Price Registration if

$$\theta_i V(q_i^*) - c(\underline{\beta}, Q)q_i^* - K \geq 0 > \theta_{i+1} V(q_{i+1}^*) - c(\underline{\beta}, Q)q_{i+1}^* - K.$$

In such case, any of the buyers  $i$  with higher utility for the goods (higher  $\theta$ ) may be the manager-participant since that he is identified as the player who organizes the price registration and incurs the process cost.

### **3.3 Price Registration Game: Inefficiencies and Solutions**

A major inefficiency detected by the study of the price registration system is the non-existence of registration when it is socially desirable. This happens because in any equilibrium there is only one buyer who bears all the costs of preparation of the price registration. That is because the development of the price registration is a kind of public good.

One possible solution for the problem would be the sharing of costs of the Price Registration Process between the managing body, participants and free-riders. Alternatively, it could be legally permitted that the manager-participant would charge a membership fee to any buyer interested in participating in the price registration for which he is responsible.

## **4. EMPIRICAL EVIDENCE ON THE PRICE REGISTRATION BENEFITS AND INEFFICIENCIES**

Some theoretical works such as those by Fiuza (2007), (2010) and Barbosa (2010) point out virtues and certain inefficiencies of the Brazilian Price Registration System. However, empirical studies on the matter are scarce; Barbosa and Fiuza (2011) conducted the first study investigating the benefits and costs of the system. This Section will offer an empirical analysis of the evolution of use of the Price Registration by Brazilian public bodies and entities and will be discussing the empirical evidences on the system benefits to the Brazilian Government and its spheres; and the results found by

Barbosa and Fiuza (2011) will also be summarized.

The empirical review of the Price Registration benefits and costs will use the data of Brazil governmental purchases carried out between 2002 and 2009. Such data are available in the ComprasNet Data Warehouse and contain information on all purchases by the Federal Government made either through a price registration system or through a standard bidding. This database also includes all purchases made by State and City Governments through a price registration organized by the Federal Government or to which the latter adhered.

For such empirical study, the review was limited to procurement of health related products. In such sector, all products are described, standardized and coded according to the Materials and Services Code Catalog. Such standardization enables a more rigorous comparison between prices of products purchased through different regimes.<sup>15</sup> Furthermore, only the biddings in the Competitive Bidding are considered as only one of these modes can be carried out in the Price Registration.

The database contains information on the procurement of 8.511 different items-products. Products vary a great deal from drugs and medicines to medical-hospital furnishings and equipment. The products analyzed are within the Classes 6505 (drugs and medicines), 6510 (surgical materials for dressings), 6515 (medical and surgical instruments and supplies), 6530 (hospital furnishings, equipment, utensils), 6532 (hospital and surgical clothing / apparel and correlated items) and 6545 (medical sets and assemblies) of the classification of the Federal Government Materials and Services Code Catalog. In addition to the information on the price paid for each

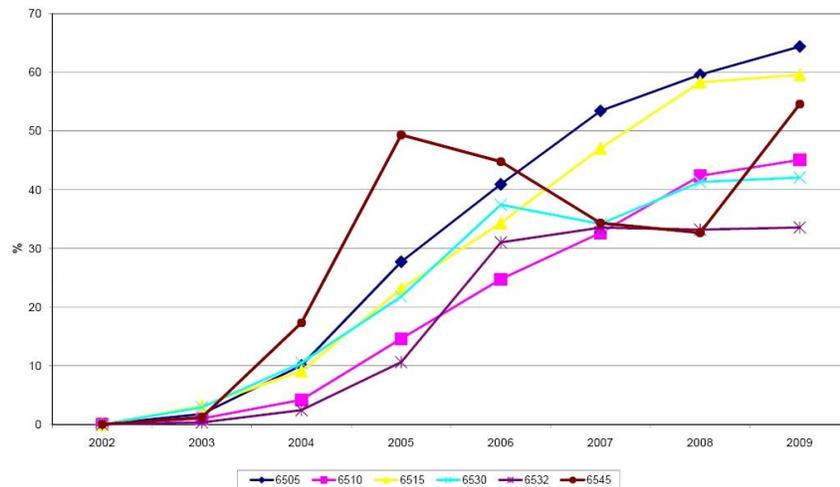
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<sup>15</sup>The standardization of description, coding and supply units of purchased items-products was carried out for the creation of the Health Prices Database of the Ministry of Health. The purpose was the integration of data in order to standardize and unify the language by favoring the comparisons of product prices.

product, its description and classification, the database provides information on the year of purchase, reserve price for each product in the competitive bidding (estimated price), the quantity under bidding, the quantity purchased, suppliers, buyers and number of bidders – suppliers for each product. Where a price registration is addressed there is also information on the manager-participant, and the quantities purchased thereby.

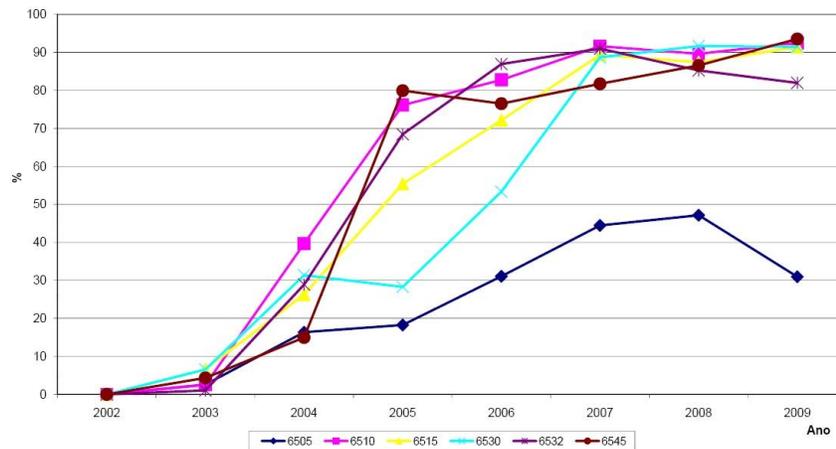
Figures 1 to 3 analyze the evolution of use of the Price Registration System by public bodies and entities of the Brazilian Federal Government. Such evolution is broken down by type of product according to the Federal Government Materials and Services Code Catalog. All Figures show that the Brazilian Government has favored the use of the Price Registration (RP) over the standard individual procurement in procuring for medical-hospital products. Such migration from purchases under standard individual procurement to Price Registration is consistent with the theoretical works claiming that the Price Registration enhanced the public procurement system in Brazil.

Figure 1: Number of items purchased through the Price Registration as compared to the Total Number of Purchased Items – Federal Government Procurement



Source: *Compras Net*. The above classes refer to the following items: 6505 (drugs and medicines), 6510 (surgical materials for dressings), 6515 (medical and surgical instruments and supplies), 6530 (hospital furnishings, equipment and utensils), 6532 (hospital / surgical clothing / apparel and correlated items) and 6545 (medical sets and assemblies) of the classification of the Federal Government Materials and Services Code Catalog.

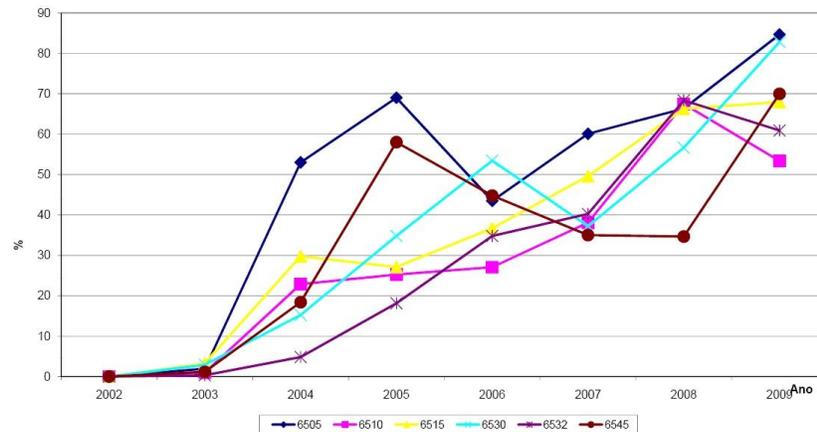
Figure 2: Total Confirmed Value of Purchases through the Price Registration System as compared to the Value of all Purchases - Federal Government Procurement



Source: *Compras Net*. The above classes refer to the following items: 6505 (drugs and medicines), 6510 (surgical materials for dressings), 6515 (medical and surgical instruments and supplies), 6530 (hospital furnishings, equipment and utensils), 6532 (hospital / surgical clothing / apparel and correlated items) and 6545 (medical sets and assemblies) of the classification of the Federal Government Materials and Services Code Catalog.

Figure 3: Number of Government Units purchasing through the Price Registration System as compared to the Number of Government Units - Federal Government Procurement

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Source: *Compras Net*. The above classes refer to the following items: 6505 (drugs and medicines), 6510 (surgical materials for dressings), 6515 (medical and surgical instruments and supplies), 6530 (hospital furnishings, equipment and utensils), 6532 (hospital / surgical clothing / apparel and correlated items) and 6545 (medical sets and assemblies) of the classification of the Federal Government Materials and Services Code Catalog.

Table 1 excerpted from Barbosa and Fiuza (2011) compares the purchases made by the public sector through the Price Registration System with those made through standard individual procurement. Specifically, such Table presents the tests of difference between the unconditioned averages of certain variables of the price registration system and the standard bidding. Tests show that the unconditioned averages of the price paid, the reserve price and the total confirmed value (the value approved for purchases through bidding of a lot of a certain product) are statistically equal in both procurement methods: price registration or standard bidding. On the other hand, the tests also show that the open auction is more used in the price registration than in the standard individual procurement.<sup>16</sup> Besides, there is

<sup>16</sup>Such difference would be still greater if the other modes not authorized in the Price Registration (Price Quotation, Invitation, Waiver and Ineligibility) would have been included.

evidence that quantities requested and confirmed are in average larger in the price registration system than in the purchases through standard bidding. Note also that the number of companies competing for supply of goods and services and the distance between supplier and buyer are bigger in the purchases made through the price registration system than in the standard bidding.

Table 1: Price Registration System and Standard Bidding – Difference between Averages

The table below was extracted from Barbosa and Fiuza (2011). The difference between unconditioned averages of certain variables of the price registration system *versus* standard bidding is tested below. The calculation of the statistics below excludes from the original database all those purchases in which the ratio Price Paid – Reserve Price is greater than 1.

	Pooled Procurement	Individual Procurement*	t-statistics	P-value**
Price Paid (unit)	34.18	33.85	0.03	0.98
Reserve Price (unit)	787365	45.95	0.27	0.79
Ratio Price Paid-Reserve Price	0.60	0.70	-26.75	0.00
Unrestricted Hybrid and Electronic Competitive Bidding (dummy)	0.98	0.97	3.28	0.00
Initial Demand (units)	98121	37708	2.21	0.03
Quantity Purchased (units)	96537	37708	2.21	0.03
Total Value of the Purchase	37819	49898	-1.17	0.24
Competitors (suppliers)	4.93	4.64	5.59	0.00
Units/ Agencies in the Procurement Transaction	27	1.00	16	0.00
Distance Buyer-Supplier	887.30	688.66	18.91	0.00

\*Individual Procurement in the following formats: Unrestricted Hybrid and Electronic Competitive Bidding, and Unrestricted Competitive Bidding

\*\* P-value for two tailed test.

It is worth mentioning that such tests are only statistical analyses of

unconditioned averages and as such, they show only some elements of the database. Observed and unobserved characteristics of different public purchase in different procurement methods (price registration system or standard individual procurement) may explain the difference between the price paid by the Government and the ratio between paid price and reserve price. An econometric analysis of data is required to control by observable and non-observable effects.

Barbosa and Fiuza (2011) perform an econometric analysis of the Brazilian Price Registration System in which they control for observable and non-observable effects and correct for potential problems of endogeneity which would cause a biased estimation of the parameters of interest. Barbosa and Fiuza show that the price paid by public agencies or entities for the provision of a certain good is lower when they purchase through pooled procurement (Price Registration) than through a Standard Bidding.

On the other hand the price paid by a public agency or entity for the provision of a certain good increases when the buyer associates, through pooled procurement, to another buyer with higher risk of default. Such effect is consistent with Fiuza (2007), (2010) where Fiuza suggests that the demand aggregation through the Price Registration System may increase the price of goods and services for buyers with good reputation with suppliers. That occurs because only one price is recorded for all participant bodies in the RP. Thus when a reputable buyer associates with a disreputable buyer the former will pay a price that is contaminated by the risks of delays and defaults by the bad buyer.

Additionally, Barbosa and Fiuza (2011) show that the reserve price is higher in the pooled than in individual procurement; a possible explanation is the existing problem of free-riding effect in the determination of the reserve price in the Price Registration System. Consistently with the theoretical model of the Section – Theoretical Model herein this occurs because the reserve price is a kind of public good where the social benefit to correctly determine it (investing time and resources in market surveys) is greater than the private benefit.

Such conditions lead to an equilibrium with low (or poor quality) provision of public goods which may be interpreted as a high reserve price in the Price Registration System *versus* in the standard individual procurement.

## 5. EXPERIENCES IN JOINT PURCHASES AND CONSORTIA

Public administration in several countries in the world has been seeking new institutional arrangements similar to the hybrid models adopted by the 274 international companies of the A.T. Kearney study. Specifically in the last few years, the literature on procurement (Karjalainen, Kemppainen and Raaij (2009)) has documented that a specific institutional arrangement has become quite popular in several organizations and governments in the world. Such system is called Joint Purchases also known in the international literature as Pooled Procurement or Bulk Purchasing. Through such arrangements several companies, entities and agencies acquire goods and contract services in a joint or aggregated manner through one single selection process. Such initiative is motivated by the potential benefits coming from economies of scale and by the best and more advantageous purchasing conditions which are potentially obtained when large volumes are purchased.

Legally such arrangements may be entered into through normative mandates or proxies or through institutional agreements or consortia. The latter two are quite flexible as they allow that the interested agencies and entities organize and establish, between them, the agreements for bulk purchasing.

European Governments have elected a specific arrangement of joint purchases, the so-called Framework Agreements (FAs). Framework Agreements are agreements between one or more public procurement units and one or more suppliers of goods or services and set forth the contracting terms (price, quantity and quality) for a certain effective time. Other countries in the world have elected the formation of purchasing consortia. This is the case of the United States, England, Caribbean countries and some Latin American countries like Peru.

In Brazil, local governments have chosen the creation of inter-municipal consortia. An inter-municipal consortium is a legal instrument enabling several municipalities to collaborate or cooperate through an associated management of public services aiming to join efforts and resources to carry out a better public administration. Such consortia have several purposes and operate in several areas and many of them are formed for the joint procurement of goods and services. Particularly most of them is operating in the health industry and procure medicines and medical-hospital instruments for the member cities.

### ***5.1 European Framework Agreements***

Framework Agreement is an agreement between one or more public procurement units and one or more suppliers of goods or services introduced in the European Community in 2004. The Agreement sets forth the contracting terms (price, quantity and quality) for the effective time of the framework agreement under which suppliers will sign contracts and provide goods/services. Summing up, through the Framework Agreements an agreement is established between governmental buyers and suppliers to determine the Agreement specific procurement terms and conditions.

As described by Albano and Sparro (2008) and Bandiera, Pratt and Valletti (2009), the Brazilian Price Registration System is quite similar to the Framework Agreements in Europe.<sup>17</sup>

Framework Agreements were created through European Commission, EP and CEU Directives 2004/17 and 18 (2004) which suggest the use of Framework Agreements as a mechanism of coordination of the selection processes of suppliers or providers of services or public goods.<sup>18</sup>

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<sup>17</sup>Fiuza (2007 e 2010) offers a comparison between the Europe Framework Agreements and the Brazilian Price Registration System.

<sup>18</sup>In England, the mechanism responsible for implementation of Framework Agreements is the UK Public Procurement Regulations.

Framework Agreements provide several benefits. Firstly, they offer a higher flexibility of purchases as the agreement members are not required to purchase the products and services and they in turn do not obligate the associated entities to acquire goods / services exclusively through such purchase mechanism. Secondly, they offer greater practicality to the agreement members for the following reasons: (i) there is no need of a new announcement or new selection to enter into new procurement contracts between the Framework Agreement members and suppliers, (ii) provided that the legal procedures will have been observed in the Framework Agreement new contracts do not have to go once more through all formal procedures, (iii) the effect of Framework Agreements can be indeterminate being effective for up to 4 years, and (iv) new contracts can be signed based on one previously existing Framework Agreement (generally up to 12 months).

#### ***5.1.1 Framework Agreements Benefits: Empirical Evidence***

Bandiera, Pratt and Valletti (2009) review the implementation of Framework Agreements in Italy through commitments signed between Consip (Italy procurement center) and local governments. By using detailed information on purchases made individually or through the Consip Framework Agreement by Italy public agencies, entities and local administrations, the authors show that the creation of the Consip-Framework Agreement enabled a reduction of 22 % in the prices paid by the Italian Government.

Bandiera, Pratt and Valletti (2009) also show that the most inefficient Italian bodies and entities in holding biddings are the most likely to make centralized purchases through Consip; the reason for that, according to the authors, is that Consip allows them to purchase goods and services at lower prices. Bandiera, Pratt and Valletti claim that such inefficiency arises out of the poor quality of labor in charge of procurement and the excess of bureaucratic processes for

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procurement by public bodies. Such inefficiencies raise the bidding costs and the Government expenditures.

Karjalainen (2010) analyzes public purchases made through the Framework Agreements in Finland. From such information the author estimates two potential gains for the public sector from pooled procurement: lower unit price (larger purchased volumes allow the negotiation of better contracts with suppliers) and lower administrative costs in preparing the biddings (centralization of purchase avoids duplication of efforts in the preparation of biddings). Karjalainen shows that the price paid for certain items (office supplies and air tickets) in pooled procurement in Finland is lower than the market price of such products, also demonstrating that the average administrative cost of bidding through pooled procurement is approximately 4 times lower than the average administrative cost of decentralized or individual purchases.

## ***5.2 Other International Experiences of Procurement Consortia***

The procurement consortia or bulk-buying pools' international experience is quite diversified: accordingly, we will be describing each country experience separately.

### ***5.2.1 United States***

In the last decade, several US States have created mechanisms similar to the FAs for bulk purchasing of pharmaceuticals. Such process started in 1999 with the enactment of state acts and executive orders authorizing public entities and governments to organize bulk purchasing of pharmaceuticals thus causing the advent of several Bulk Buying Pools.

Currently there are several multi-state bulk buying pools for purchases and acquisition of drugs, medicines and hospital services. Major pools are:

- NMPI (National Medicaid Pooling Initiative) created in 2003 formed by Alaska, Kentucky, Michigan, Minnesota, Montana, Nevada, New Hampshire, New York, North Carolina, Rhode Island,

South Carolina and Washington, D.C.;

- TOP (Top Dollar Program) created in 2005 formed by Delaware, Idaho, Nebraska, Pennsylvania and Wisconsin;
- SSDC (Sovereign States Drug Consortium) created in 2005 by the members Iowa, Maine, Oregon, Utah, Vermont, West Virginia and Wyoming;
- NPCD (Northwest Prescription Drug Consortium) created in 2007 by Oregon and Washington.
- MMCAP (Minnesota Multistate Contracting Alliance for Pharmacy) created in the late nineties associating agencies and clinics of 45 states.

### **5.2.2 England**

In England several Local Government Acts (1972, 1988 and 2002) transferred (and currently regulate) the provision of certain public services to local governments. At the same time, such acts enable the local authorities to join efforts through local consortia to share administrative and operational experiences and acquire goods and services jointly.

Naturally, after the enactment of such acts several inter-municipal consortia appeared in England such as the Cambridgeshire Procurement Group (CPG) created in 2003 by 5 Cambridgeshire districts. The CPG was created to avoid duplication of efforts in the provision of local services as several goods and services acquired by the 5 districts are common to all of them; thus significant economies of scale could be attained.

### **5.2.3 Caribbean**

In the Caribbean the ECDS was created in 1986, a consortium or pooled procurement formed by 9 Caribbean countries to buy prescription drugs.<sup>19</sup> The consortium members are tiny countries

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<sup>19</sup>The ECDS member countries are Anguilla, Antigua and Barbuda, British Virgin Islands, Dominica, Grenada, Montserrat, St Kitts and Nevis, St Lucia, St Vincent and Grenadines.

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strongly depending on imports of medicines, as they have no pharmaceutical industry. In addition, the limited size of their demands does not allow the members to negotiate prices individually with major pharmaceutical suppliers.

According to Huff-Rousselle and Burnett (1996), the delegation to procure prescription drugs to the ECDS member countries reduced the costs of a basket formed by 69 medicines/drugs by approximately 50 % what was considered a success by the member countries.

#### **5.2.4 Peru**

In Peru, Mucha (2010) documents that since 2007 the Ministry of Health has encouraged pooled procurement of pharmaceuticals in the different Government agencies and entities such as EsSalud, the Military and National Police; this has secured an expressive reduction in the price of acquisition of such products.

#### **5.2.5 France**

There is little empirical evidence on the experience of pooled procurement in France; however, there is solid information that such arrangements exist in that country. Printed media, for instance, describes the experience of the pooled procurement of the France Department of Oise.

In 2009, the Department of Oise created a Procurement Center for acquisition of goods and services under the interest of the communities comprising the region. In its inception, the Oise Procurement Center has prioritized purchases of foodstuffs, microcomputers and printers; recently the center has invested in agreements for purchases of uniforms, protective clothing for employees, accessories and office supplies.

The Oise Procurement Center comprises the following members:

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Department of Oise, Creilloise Agglomeration Communities and other 8 members such as the Beauvais-Tille Airport, but the Pool is open to new members of the region. There is no membership fee but the members pay a fee proportional to the value of products purchased through the Pool.

The Procurement Center is institutionally under the General Council of the Department of Oise and uses this departmental council's physical structure and professional experience in management and public procurement.

In practice, the Center operates as follows: based on a survey on products with highest shortage in the region, the Center purchases a large bulk of such goods which will be subsequently delivered by the Center. Next, the Center contacts its members informing them the price of the products available at the Center; although the Center takes the risk of buying without having yet a demand for the goods, the Administration mentioned that this is a low risk as all purchases are based on surveys on local needs.

#### ***5.2.6 Consortia of Other Countries***

Other studies summarized by Ombaka (2009) analyze the Group Procurement (GP), composed by several countries such as Kenya, Uganda, England, Togo, India, Thailand and New Zealand. Ombaka shows that the implementation of the GP caused reduction of costs and efficiency gains to the member countries.

#### ***5.2.7 Experience from International Bodies***

International entities and agencies have been adopted another procurement model enabling joint purchases through the delegation of procurement to third parties. Such third party engages in the negotiation with suppliers and attempts to secure better prices and payment conditions for the different buyers which are members of the consortium. Such practice is used for purchases of prescription drugs and vaccines and became common after the creation of the Clinton Foundation HIV/AIDS Initiative (CHAI) in 2003 when this agency

started negotiating purchases of antiretrovirals for several countries.

Using database information from the Global Fund Purchase and World Health Organization (Global Price Reporting Mechanism) related to 7.253 procurement transactions of 12 antiretroviral (ARV) and 24 different doses of these drugs, Waning *et al.* (2009) show that buyers generally pay lower prices for those when they purchase them through pooled procurement.

In contrast, Waning *et al.* (2009) find weak positive relationship between low price paid and high amount purchased (that is, elasticity of demand is not statistically significant). Based on such results the authors conclude that potential price reductions arising out of a pooled procurement system can be quite limited and when compared to the costs of implementation of such system the net benefits can be negative.

### **5.3 The Brazilian Experience**

In Brazil another legal instrument enabling joint purchases by governments or governmental spheres is the inter-municipal consortium; such legal instrument is frequently used by Brazilian local governments.

Brazilian literature on the formation of health procurement pools for provision of services is quite extensive. Borges (2009), for instance, describes all institutional aspects of inter-municipal consortia in Brazil and Lima (2000) documents the origins and profile of inter-municipal consortia in the health area. Teixeira, MacDowell and Bugarin (2003) analyze the formation and sustainability of inter-municipal health consortia by means of a dynamic game where two mayors decide on joining and remaining in the consortium. Gontijo, Donnini, Ribeiro and Cunha (1994), Peixoto (2000) show that inter-municipal health consortia increase the efficiency and quality of health services offered to the populations of the member municipalities.

However, none of the above studies reviews the benefits and costs of consortia for procurement of goods and services. The only documented study was carried out by Ferraes and Cardoni Junior (2007), in which the authors document the benefits of the CPS – *Consórcio Paraná Saúde* (Paraná State Health Consortium), an inter-municipal health consortium formed by Paraná State city administrations for acquisition of prescription drugs.<sup>20</sup>

By comparing the prices of 55 items in the CPS purchase list and in the Ministry of Health Price Base (BP/MS) in 2000, Ferraes and Cardoni Junior (2007) show that: (i) 46 items presented lower prices in the CPS purchases than the prices of the same item in the BP/MS in average (ii) 1 item had the same price (iii) while 8 items presented higher prices in the CPS than in the BP/MS, and (iv) purchases through the consortium had the cost of R\$ 32,397.70 Reais (29.7% ) less than what it would cost with the prices indicated in the BP/MS. Such results confirm the hypotheses that, by aggregating demand, inter-municipal consortia enable buyers to pay lower prices and spend less public resources for acquisition of goods and services.

## 6. CONCLUSION

This paper presented the Brazilian Price Registration System (Public Pooled Procurement) and reviewed the Brazilian price registration model in the light of the Economic Theory. For that, it presented a theoretical model of the Price Registration System where the players' (buyers and sellers) strategic behavior, the equilibrium and predictions that can be made through this model were analyzed. From such results the system inefficiencies were identified, that is, the sub-optimal allocations from the public sector finances and social standpoint.

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<sup>20</sup>The *Consórcio Paraná Saúde* (CPS) is formed by 85 cities and was created for acquisition of basic medicines. The consortium scope covers the participant municipalities and their populations.

A major inefficiency detected when studying the price registration system is the non-existence of registration even when it is socially desirable. This occurs because in any equilibrium there is one single buyer who bears all costs of preparation of the price registration, and also due to the public good nature of the price registration system.

A possible solution for the problem would be the sharing of costs in the process of Price Registration between the manager-participant, no-manager-participant and free riders. Alternatively, it might be permitted by law that the managing body would charge an affiliation or membership fee to any buyer interested in participating in the price registration for which it is responsible.

This paper also presented a brief empirical analysis of the evolution of use of the Price Registration by Brazilian public agencies and entities and discussed the empirical evidences on the system benefits to the Brazilian Government and spheres thereof.

One issue worth of a more detailed and thorough study in a future research project is to compare the price registration procurement auction system with the auctions of different units widely used and highlighted by procurement auction literature: auctions from multiple units and a reverse auction where several units of the same item are to be purchased. Such comparison would enable us to state whether or not the auction system currently used should be replaced by conventional auctions of multiple units. In that aspect it would be interesting and important to carry out an experimental study, for instance, to assess such properties. Such study would enable us, for example, to affirm whether the price registration auction prevails or is prevailed by the usual multiple-unit auction.