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**THE IMPACT OF CENTRALIZATION, CORRUPTION AND INSTITUTIONAL  
QUALITY ON PROCUREMENT PRICES: AN APPLICATION TO PHARMACEUTICAL  
PURCHASING IN ITALY**

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# Collegio Carlo Alberto



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**The Impact of Centralization, Corruption and Institutional Quality on Procurement Prices:  
An Application to Pharmaceutical Purchasing in Italy**

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**Abstract**

This paper deals with the open issue about the choice between a centralized versus a decentralized public procurement strategy. Using a unique dataset on tender prices of selected drugs for hospital usage awarded by a sample of 52 Italian local health service providers (*ASLs*) between 2009 and 2012, we test which procurement system (centralized, decentralized or hybrid) performs better. Controlling for several covariates, we always find that centralized and hybrid procurers pay lower prices as compared to decentralized units. Moreover, our results show that in areas in which corruption is higher or, more generally, institutional quality is lower, the effect of centralization in negotiating lower prices is much stronger, with savings that can reach also 50 percent of the price paid by *ASLs* that procure on their own.

**Keywords:** public procurement, centralization, decentralization, pharmaceutical spending.

**JEL codes:** H57, H83, L33

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## **1. Introduction**

The Organization for Economic Co-operation and Development defines public procurement “*as the purchasing, hiring or obtaining by any other contractual means of goods, construction works and services by the public sector*” (OECD, 2000). Public procurement represents a considerable part of national GDP: a recent study reports that it accounts for 12.8% of GDP (and 29% of total general government expenditure) on average across OECD countries, ranging from 12% in Greece to 45% in the Netherlands (OECD, 2013).

Moreover, since it involves the use of public funds, the procurement activity has become a crucial policy issue in the recent period of financial crisis. In fact, due to current lack of economic resources, there is a consistent pressure on the public agenda of many governments to reform the public procurement sector, in order to have a more efficient and more effective system, so as to save public funds. One way to achieve this goal is to implement the most suitable procurement organizational structure. To that respect, an important strategy is the choice between a centralized and a decentralized system. In the case of centralization, there is a central body who is in charge of handling the purchasing activity (select contractors, negotiate prices and conditions, make purchasing decision) for end-users (i.e. local units), who are just required to send their requests to it. Conversely, in a decentralized system, local units procure on their own. Several countries are experiencing reforms in this area (sometimes involving sudden changes in procurement practices), in an attempt to find the most suitable system.

The economic literature is more and more interested in this topic. Some scholars describe the features of the two systems and try to provide empirical evidence on their impact on several dimensions of public procurement (costs, purchasing prices, corruption practices, collusion practices, and so on). Some of them observe that, even if most governments have a centralized structure for public purchases, there is a trend toward decentralization in an attempt to make local units more responsible. Dimitri et al. (2006a) claim that there is a clear trend towards centralization in Europe, United States and Southern America. It is difficult to assess which framework is prevalent, at least because governments change frequently the system and sometimes the reforms are conflicting. It is also demanding because of the peculiarities of each procurement system. Some authors debate on these features and on the factors at work when one or the other system is adopted. For example, a fully decentralized purchasing process, where procurement is managed at the local level, is usually criticized on the ground that it can be associated with fragmentation, inefficiency and poor transparency. On the other hand, a fully centralized system could suffer from a lack of

flexibility, which is required when goods and services to be procured are complex and involve, other than cost considerations, quality and value aspects, too. As a result of this, assessing which system is preferable is not an easy task: many economic variables act simultaneously on the procurement system and could interact in contrasting ways.

This paper contributes to the above literature by testing which procurement system performs better using data relative to tender prices of selected drugs for hospital usage awarded by a sample of 52 Italian local public procurers between 2009 and 2012. Controlling for several covariates, we always find that centralized and hybrid systems (i.e. consortia of local health service providers) pay lower prices as compared to decentralized purchasing bodies. The average cost saving is greater than 20% for centralized agencies and around 8% for hybrid procurers, but it increases up to 50% in areas characterized by high levels of corruption or, more generally, by low levels of institutional quality.

The remainder of the paper is organized as follows. In Section 2 we provide a critical overview of the literature dealing with the centralization/decentralization choice, and we highlight the relevant issues and trade-offs. Section 3 focuses on the Italian context, and describes the activities of the central agency and of the regional purchasing bodies. Section 4 deals with public procurement in the Italian pharmaceutical sector and describes our dataset on the procurement of drugs for hospital usage. Section 5 presents our empirical strategy and shows our main findings on the performances, in terms of purchasing prices, of the three different procurement systems which are used to buy pharmaceutical products. Section 6 concludes.

## **2. Centralization *versus* decentralization**

While it was traditionally considered as an operational routine, nowadays the purchasing phase has become a crucial activity for both the public and the private sector. Cousins and Spekman (2003) assess that the manufacturing sector spends more than 65% in purchasing goods and services. Therefore, private managers, public managers and policy makers have put more and more attention on this practice. During the 90's, many big companies went through important reorganizations of their activities, including purchasing, and adopted different combinations of centralized and decentralized procurement. Some of them, as Motorola, General Electric, United Technologies and Fiat, decentralized this function, while some others, such as Honda and General Motors, centralized it. These experiences in the private sector have stimulated further research

aimed at finding which process appears to be the most suitable, especially in relation to different contexts, costs and products. Munson (2007) makes a comparative analysis of seven cost categories and proposes the most suitable allocation of different products among three different centralized purchasing schemes: centralized purchasing, decentralized purchasing and centralized pricing with decentralized purchasing. Numerical experimentation suggests that often the best scenario is a combination of the three systems. Some scholars examine the purchasing cooperation between independent firms. For example, according to Tella and Virolainen (2005): “*consortium purchasing is horizontal cooperation between independent organizations that pool their purchases in order to achieve various benefits*”. Using data on Finnish machine manufacturing industry, they find that the main motivations for the establishment of purchasing consortia are to save on costs and to collect information on supply markets. It is straightforward to notice that advantages deriving from belonging to a consortium could be very close to the advantages of using a centralized structure.

The above studies focusing on the private sector are important because they provide useful frameworks and benchmarks to be applied to the public sector, too. However, it is necessary to take into account that the two systems differ at least in terms of performance measures and organization goals, and they differently react to the lack of resources (Reed et al., 2005). For example, the private sector reacts by increasing competition and shake-out, while the public sector reacts by raising inter-organizational cooperation through centralization in order to lower duplications or through purchasing by consortia.<sup>1</sup>

Johnson et al. (2003), using survey data from 267 governmental purchasing groups in cities and counties in the United States, find that 51% of the respondents deal with centralized procurement, 47% with hybrid models, while only 2% manage decentralized purchases. On the other hand, in the private sector, 27% of the respondents have a centralized procurement activity, 51% use a hybrid organization and 22% have a decentralized structure dedicated for buying. The two sectors have only one feature in common: about half of the respondents use a hybrid model, which can be a fruitful way to merge the advantages of centralized and decentralized systems.

Since there are different definitions and different degrees of centralization/decentralization (Karjalainen, 2011), we choose to adopt the one suggested by Dimitri et al. (2006b, page 48):

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<sup>1</sup> Johnson et al. (2003) identify other motivations than the lack of resources behind the creation of consortia in public sector, namely “*opportunities to reduce staff, product and service standardization, improved supplier management capabilities, specialization of staff, customer service, higher profile of consortium members, expanded role of purchasing, and transition of products through volume categories*”. They also describe some negative implications of aggregating purchases, which are classified in the following categories: complexity, uncertainty, coordination costs, free riding governance, declining cost savings, standardization and compliance.

*“procurement is fully centralized when all the relevant decisions (what, how and when) to purchase products, whether by competitive tendering procedures or by negotiations, are in the hands of a company headquarters or a central public unit dedicated to buying products to satisfy the needs of the company or public offices. Furthermore, the contract conditions for the products acquired are the same throughout a firm’s local branches or local public administrations.”* On the other hand, *“procurement is decentralized when divisions or local administrations are delegated the power to decide how, what and when to procure”*. *“In between full centralization and full delegation there is a wide range of intermediate procurement models where central and local purchasing share the power on purchasing decisions”*, that are classified as hybrid procurement systems.

As discussed above, some scholars list the advantages and disadvantages of the two opposite systems (Thai, 2009; Tella and Virolainen, 2005; Albano and Sparro, 2010). Briefly, the main arguments in favor of centralization are: savings due to bundling quantities, to minimization of duplications, to the reduction of the number of transactions between suppliers and buyers, the improvement of bargaining power, the enforcement of the negotiation position, the possibility to hire more experienced and skilled managers, to reach higher product and service quality, to reduce supply risks and legal costs for litigations, to have better access to resources and markets. On the contrary, the literature stresses the following disadvantages of recurring to a central agency: higher coordination costs and set-up costs, impossibility to satisfy unique requirements and meet different realities, loss of relationship with local suppliers, possible withdrawn of small suppliers, potential lock-in phenomena, inefficient engagement of central unit in operational planning process, complex coordination process, possibly unsatisfactory schedule for single unit needs, higher costs of maintenance of the central agency. Hereafter, we will discuss in more detail the advantages and disadvantages which are mostly relevant for our analysis.

### ***2.1. Scale economies, process economies and information and learning economies***

The main motivation to organize procurement in a centralized or decentralized way is the possibility to gain considerable cost reductions. One way to achieve this target is to bundle purchasing volumes with one single central buyer in order to obtain quantity discounts. It is straightforward that economies of scale can be easily reached if products are highly standardized. Indeed, on the supply side, standardized products allow firms to lower unit costs and, on demand side, they permit to pool the requests, to raise the volumes, and to use such leverage to negotiate lower prices. Therefore, the success of the centralization strategy is inherently linked to the product

characteristics: the more similar products are, the easier aggregation is. It is the case, for example, for IT equipments, paper, stationery, fuel, coupon for meals, credit cards, electric power. Conversely, when products are peculiar and/or single units have specific needs, it is difficult to use a centralized framework. In all possible intermediate cases, centralization might lead to costs savings but it also faces several disadvantages. Synchronization of centralized purchasing may be an issue because the timing schedule of central purchase cannot correspond to the timing schedule of the single units. Some local units may need to change their requests in order to make them compatible with central agency's requirements. In this case, the staffs of the local units may be forced to spend time and resources in order to be able to use the product acquired by the central agency on their behalf.

Economies of process relate to benefits derived from establishing a common way of working and exchanging best-practice purchasing procedures. In this sense, centralization allows to lower administrative costs such as tender advertisements in official journals and litigation costs. In particular, centralization may reduce litigation costs for, at least, three reasons: first, the number of tenders is lower (i.e. the number of possible critical cases reduces as well); second, by using standardized procedures, the probability of making mistakes (such as wrong or incomplete information processing) is lower as it is lower the room available for discretionary valuation or for petition from the side of bidders; third, in case of controversies, litigations are concentrated just in one Court instead of being scattered across several local Courts. Organization expenses can be reduced by using a centralized purchasing unit because the staff employed in a local unit can be released from the purchase activity and shifted to other local core tasks. This applies also for all items required for purchasing, such as software, stationary, documents and, last but not least, for the time spent for preparing all tender procedures and for the day-to-day management of the contract. Finally, since tender procedures managed by the central unit are quite standard, time spent to prepare a single process should be lower as compared to that spent in a decentralized organization. The same applies for the probability to make material errors. Centralized procedures should be standardized also because they have to be used by all different local agencies (as it is the case of software to gather requests). However, these procedures could be tight or burdensome for the local staff. Similarly to the achievement of economies of scale, economies of process are hard to be achieved in case of not standardized requests. The central unit cannot gain benefits if there is high heterogeneity of products\requests. In such circumstances, it might not even handle to manage the purchase at all.



Economies of information and learning relate to sharing information and knowledge across different sites and locations. Dimitri et al. (2006a) argue that centralization allows to exploit economies of information because a central agency can concentrate specialists in different relevant areas (e.g. legal experts and market analysts). High-skill personnel means savings in terms of time spent in preparing documents and in designing the procedures. Workers in a centralized department can work together, share information and end up with best practices easier as compared to situations in which they are scattered across different units. Moreover, central agencies are better equipped to hire legal experts and high-skill personnel, while it is difficult for local units to have enough budget, since purchasing is not considered as a core business activity, but rather a back-up activity. As in the other two previous cases, economies of information cannot be reached in the presence of peculiar products or very specific unit needs. In these cases, decentralization works better than centralization. In fact, a local unit can better formalize the peculiar requests, while the time and the resources spent in processing information to send to the central unit could be too big (or it could be too difficult for the central agency to process those data).

From our discussion of possible synergies, it appears evident that estimations of savings due to centralization are not easy to find in the literature. Besides, it is often the case that information about prices before bundling the requests is not available (this happens, for instance, when the products purchased are not strictly comparable). Karjalainen (2011), focusing on Finnish government data, estimates the potential price savings by comparing the prices paid by the centralized agency to the market prices for two selected products. She finds savings of around 8% for toner cartridges and of around 37% for specific flights tickets (with very flexible contracts and cancellation terms). She also attempts to compute economies of process using time spent on the tendering both for the decentralized model and the centralized model and estimating the relative costs. Bandiera et al. (2009) provide an important comparison between centralized and decentralized procurement, finding that a central agency can produce considerable cost savings. Using Italian data on a set of 21 standardized items (such as paper, printers, gasoline, laptops, lunch vouchers), they estimate that public bodies that buy through CONSIP, the national procurement agency, save on average 28% of the purchase price. They also assert that a central agency reduces litigation and administrative costs, even if they are not able to precisely quantify them.

## **2.2. Corruption and favoritism**

Many papers deal with favoritism and corruption. According to Lengwiler and Wolfstetter (2006, page 2) “*corruption means that the person who runs the auction, the auctioneer, twists the auction rules in favor of some bidder(s) in exchange for bribes*”. The authors review different kinds of corruption that have been observed in procurement auctions and discuss some tools which could be useful to fight corruption (i.e., the choice of the auction format, or the use of secure electronic bidding systems). Burguet and Che (2004) investigate how corruption affects the allocation of the contracts and its distributional implications. They also investigate the selection rules to prevent its adverse effect considering an endogenous assignment of favors through corruptive competition.

The centralization/decentralization choice clearly affects the extent to which corruption and favoritism are plaguing the procurement process. One could argue that, moving the procurement process away from local administrators, would make it less sensitive to pressures from local firms to obtain rents. The larger the size of the tender, the higher transparency is, and centralization makes a given amount of procurement more visible, leaving less opportunity for corruption. As to favoritism, if on the one hand local units have more information about local suppliers, which can be seen as a positive factor, on the other hand such a proximity could favor the chances for local bidding activity. To that respect, Vagstad (2000) shows how a decentralized organization could be better considering quality because of the importance of local information. However, she also points out that a local unit may favor local firms over foreign ones, which could cause inefficiencies. Dimitri et al. (2006b) provide a numerical example of how favoritism can negatively impact price and quality.

The above cited paper by Bandiera et al. (2009), beyond presenting evidence in support of a centralized system, is important because it introduces the distinction between active and passive waste, where the former could be represented by corruption in procurement while the latter relates to inefficiency, i.e. to waste that does not procure a benefit for the buyer (for example the inability to lower costs because of low skilled employees). Comparing purchasing prices obtained by local units to the ones obtained by the central agency, they find robust evidence that the second type of waste counts much more (83% of total waste) than the waste due to corruptive practices. However, as argued by Piga (2011), inefficiency, incompetence and corruption feed on each other and sometimes the distinction between these concepts is artificial.

Even if a decentralized procurement can be more subject to bribes and corruption, it is not fair to assess that centralized organizations are corruption free. However, a centralized system could

help in limiting favoritism for at least two reasons. First, the central body is used to deal with large amounts of money. Usually, the higher is the value of the purchase, the higher is the publicity required for the advertisement: this is the case for EU countries, where the Directive 2004/17 and 2004/18 set thresholds above which it is required to advertise at national level or at European level. Secondly, especially due to standardized purchasing items and procedures, a central agency is more able to use open procedures which may reduce discretion from actors involved in the process.

In the empirical analysis presented in section 5, we will test the effects of both centralization and corruption on purchasing prices. In particular, we will include as explanatory variables some measures of corruption and, more in general, of institutional quality which are prevailing in the area in which the public procurer operates. In fact, several authors have argued that differences in institutional quality (i.e. social capital, rule of law, regulatory quality, etc.) across different regions of a country affect a wide range of economic outcomes, including the performance of the public sector (Nifo and Vecchione, 2013).

### **3. The Italian context**

#### ***3.1 The national purchasing body: CONSIP***

Italy has its central agency, named CONSIP, which is a private company completely held by the Ministry of Economy and Finance and whose operations are financed by a government budget through a three-year framework agreement, which is partly incentivized. CONSIP was founded in 1997, initially to manage the information technology change in the former Ministry of Treasury. Subsequently, two years later, CONSIP was designed as the structure designed to buy goods and services for the Public Administration in order to rationalize the public expenditure through standardized purchase orders. In 2001 and 2002<sup>2</sup> the role of CONSIP was reinforced, as it became mandatory for all central administrations to use the framework contracts subscribed by CONSIP, while it remained as an option for other public administrations. Nevertheless, since 2002, if a local administration decides to follow its own procedure for purchasing a specific good, even in the case of the existence of a framework for that good already signed by CONSIP, it is compulsory to use the prices negotiated by CONSIP as a starting point for its procurements. In 2003, laws<sup>3</sup> weakened CONSIP's role by limiting its purchasing area and the compulsory requirement for the central administration. However, just one year later, its functions were again extended. In fact, starting

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<sup>2</sup> Laws n. 388, December 23<sup>rd</sup>, 2000, and n. 448, December 28<sup>th</sup>, 2001.

<sup>3</sup> Decree n. 143, June 24<sup>th</sup>, 2003, Law n. 326, November 24<sup>th</sup>, 2003, and Law n. 350, December 24<sup>th</sup>, 2003.

from 2003, new rules<sup>4</sup> modified the compulsory requirements for public administrations as well as the range of CONSIP's functions: essentially, CONSIP's agreements are mandatory for State administrations, while all the other public entities are required to use CONSIP prices and quality requirements as a benchmark for their own tenders.

The last main government intervention on centralized procurement is the “spending review” decree (D.L. 95/2012, then turned into law n. 135 of August 7<sup>th</sup>, 2012), an urgent measure which intended to rationalize public expenditure. To achieve this goal, the Italian Government places its trust in centralized procurement and in information and communication technologies (ICTs) as peculiar tools to diminish the costs for the procurement process. In fact, CONSIP's own research evaluates that, by aggregating demand from different public administrations, it is possible to save 15-20% of purchasing costs without reducing quality standards. The decree implements the use of internet platforms and forces central administrations and municipalities to use them for purchases valued less than the European threshold. It enlarges the number of entities that are obliged to use CONSIP contract frameworks and imposes their use for products such as fuel, electricity, telecommunication services. Moreover, the spending review decree introduces strong penalties for public administrators who sign public contracts in violation of the obligation of recurring to the centralized procurer. This violation implies a disciplinary offence and an administrative responsibility for the signer, and entails the nullity for that contract.<sup>5</sup>

### ***3.2 The Regional Purchasing Bodies***

Italian Regions have the possibility to set up their own centralized purchasing bodies, which act on behalf of regional or local authorities. In 2001, the Ministry of Economy was given the task of improving the aggregation of local purchasing bodies as Provinces, Municipalities, *ASLs* (i.e. *Aziende Sanitarie Locali*, that is local health authorities), and Universities, and different laws were introduced or modified to implement the use of regional purchasing bodies.<sup>6</sup> In particular, Law 266/2005 introduced the possibility for local units such as municipalities, provinces, consortia and “*comunità montane*”, to group together and act as central purchasing bodies that sign framework agreements for their group members. Law 296/2006 introduced the so called “*sistema a rete*”, a

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<sup>4</sup> Law July 30<sup>th</sup>, 2004, Law n. 266, December 23<sup>rd</sup>, 2005, Law n. 244, December 24<sup>th</sup>, 2007, Decree n. 112, June 25<sup>th</sup>, 2008, Law n. 191, December 23<sup>rd</sup>, 2009.

<sup>5</sup> The spending review decree introduces also some specific rules for health procurers which will be described in section 4.

<sup>6</sup> In Italy, a province is an administrative division of intermediate level between a municipality and a region, similar to a county. A province is composed of many municipalities, and usually several provinces form a region.

network which can be used by regional central bodies and CONSIP in order to capitalize the different experiences, harmonize functions and tools, give evidence on best practices and incentivize a national e-procurement system. This ambitious project encountered some problems in its implementation, as observed by AVCP's Census.<sup>7</sup> The Authority monitored the activity of the Central Purchasing Bodies (*CPBs*) for the period 2007-2008, finding that in 2008 they were handling procedures for 9.7 billion euro (87% of which were in the health sector and concentrated in Northern Italy). In any case, the Census noticed many differences among the central bodies regarding the coverage in terms of users, the economic values and the functions involved. While reinforcing the role of CONSIP, the spending review decree has also redefined the role of the regional purchasing units. In fact, *CPBs* have to consider CONSIP's frameworks for price and quality benchmarks but they are free to contract without being subject to the limitation imposed by the decree to all the other administrations. Furthermore, the limitations do not cover all the contracts signed by a single administration if the contract belongs to a regional framework. Finally, to facilitate demand aggregation, municipalities with less than 5000 inhabitants can opt between the introduction of a central purchasing unit and the use of the e-platform available from CONSIP or from their regional purchasing unit.

As will be explained in the next section, our dataset refers to pharmaceutical items which are purchased directly by the local health authority (the *ASL*), by a consortium of *ASLs*, or by the regional purchasing body. Therefore, our maximum level of centralization is not the national agency, CONSIP, which is instead the object of analysis of the study by Bandiera et al. (2009).

#### **4. The Italian public procurement of pharmaceuticals**

The health sector represents a consistent part of GDP: the OECD average is 9.3%, ranging from 5.9% in Estonia to 17.7% in the United States, and the public component is higher than the private one almost everywhere. On average, OECD governments cover 72.2% of the total health expenditure, even if there are significant differences across countries<sup>8</sup>. From a public expenditure perspective, the health sector is a challenge, given the current economic crisis and the consequent pressure on national public debts.

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<sup>7</sup> AVCP is the Italian Authority for the Supervision of Public Contracts.

<sup>8</sup> Chile, Mexico and the United States cover less than half of total expenditure, while in the Netherlands, in Denmark, in Norway, in the Czech Republic and in the Luxembourg the public sector's share is higher than 84%.

The public procurement for the health sector varies across countries and has been largely studied in the academic literature. For example, Sorenson and Kanavos (2011) discuss the procurement of selected medical devices in England, France, Germany, Spain and Italy, highlighting that there has been a movement towards more centralized procurement with the introduction of purchasing groups or consortiums. In a similar vein, Nollet and Beaulieu (2003) analyze the benefits of establishing purchasing groups by interviewing 73 individuals working in the health sector (as purchasers, suppliers, hospital CEOs, etc.) and coming from different countries (United States, Canada, France and Belgium).

Some data for the Italian context are provided by Calabrese et al. (2010), Vellez (2011), and by France et al. (2005). The Italian public health sector is clearly an interesting case, because both centralized and decentralized systems coexist. As highlighted by Calabrese et al. (2010, p. 3): “*Italy – as many others European countries – has been experimenting with a new idea of public purchasing that allows public administration to purchase goods using alternative methods and practices in every stage of the purchasing process such as on-line purchasing, purchasing group, purchasing consortia and centralized purchase systems*”.

Briefly, the National Health System (NHS) is managed by both central and regional governments. While the central government is responsible for the general organization of the NHS and for the essential levels of care to be granted to all citizens, the Italian regions have the exclusive responsibility for the organization and administration of regional budget allocation and control. At the lowest level, the local health authorities (*ASLs*, i.e. *Aziende Sanitarie Locali*) are in charge of coordinating and providing primary medical services (primary care, ambulatory specialist medicine, residential care) and secondary care (for acute and rehabilitation patients) for each regional area, through a network of hospitals and health care centers. While some single *ASLs* carry out public procurement on their own (i.e. following a decentralized system), some regions have introduced a centralized system, where procurement has been delegated to a central body (*Centrale di Acquisto Regionale* or *Centrale di Committenza Regionale*). In general, if a central unit is constituted, the *ASLs* located in the regional area have to procure through it.<sup>9</sup> Finally, *ASLs* could also group together and designate one who is in charge of buying for the whole group. The latter procurement strategy could be considered as a hybrid model. In principle, hybrid systems could match the advantages of the other two systems: by exploiting the benefits of demand aggregation, *ASLs* that

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<sup>9</sup> *ASLs* can procure otherwise (on their own or grouping with other *ASLs*) if the good they need is not in the list of the goods acquired by the regional agency.

group purchases can bring cost savings (as in a centralized system), while at the same time they can have a better knowledge of the needs of procurers and of the reference market (as in a decentralized system). In fact, in our sample, a hybrid model is just a “larger” *ASL*, endowed with all specific expertise of employees in the health structure. Moreover, while a centralized system implies extra management costs (for example, the structural costs of the new body appointed to pull the decentralized needs), the hybrid system requires only networking costs. On the other hand, in areas plagued by corruption or endowed with low levels of institutional quality, a centralized system may be better equipped to pursue efficiency goals, since a central structure can be more sheltered from the conditions of operating in a weak institutional environment.

#### 4.1. Data

As detailed above, the Italian health procurement system presents three types of procurement organizations: a centralized system (*Centrali di Committenza Regionale*), a decentralized model (single *ASL*), and a hybrid (group of *ASLs*) system. We investigate which type of procurement organization performs better using a unique dataset on drugs for hospital usage purchased by single *ASLs*, groups of *ASLs* and central (i.e. regional) units between 2009 and 2012. These data were collected from AVCP in April 2012 in order to compute the “reference prices”<sup>10</sup> for goods acquired by public health purchasers. This special commitment was assigned to AVCP by the “spending review” Decree. The object of this decree, that has partially reformed the health sector procurement, was to rationalize the public health expenditure through the introduction of benchmark prices. Namely, if the price paid by a public health contractor for item A exceeds 20% of the reference price computed by AVCP, then the public procurer has to renegotiate with A’s seller that price in order to bring it back to the required threshold (i.e., reference price for item A plus 20%)<sup>11</sup> or, even better, below it.

AVCP, in collaboration with *AGENAS*<sup>12</sup>, has firstly collected data on prices paid by public administrations for five health products which have been selected for their impact on the national health expenditure: drugs for hospital usage, medical devices, food service, cleaning service and

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<sup>10</sup> For more details on the reference prices see AVCP’s “Annual Relation 2012” at: [http://www.avcp.it/portal/rest/jcr/repository/collaboration/Digital%20Assets/pdf/Relazione\\_2012.pdf](http://www.avcp.it/portal/rest/jcr/repository/collaboration/Digital%20Assets/pdf/Relazione_2012.pdf) (AVCP, 2013).

<sup>11</sup> To be more precise, the Spending Review Decree has just introduced the reference prices, while the Spending Review Decree 2 (Decree 95/2012) modified the former by making them “mandatory”.

<sup>12</sup> *AGENAS* is the National Agency for Regional Health Services, and provides technical and operational support for government health policies shared between the central government and the regions.

laundry service.<sup>13</sup> Regardless of the motivation behind the introduction of the reference prices and their effective application<sup>14</sup>, this data collection represents an opportunity to study how prices vary across the different regions of the country. Most importantly, for the topic of this paper, it is a unique occasion to investigate if and how prices differ among the three procurement organizational structures of interest.

Thanks to AVCP, we have been given the possibility to analyze drugs' prices. Previously, Vellez (2011) analyzed data on Italian healthcare service providers in order to assess which procurement procedures (negotiations or auctions) are leading to lower prices. She used data on a broad set of healthcare products including pharmaceutical drugs but also medical and treatment devices which are extremely heterogeneous (for example, in terms of quality, there are differences in duration, installation and assistance requirements, depreciation rate); these data were collected by the Observatory of Prices and Technology over a rather long period of time (1994-2003) and were relative to 937 procurement contracts for medical technology products signed by 37 local health units (*ASLs* and *AOs*)<sup>15</sup>. The main result coming from the estimations was that auctions were not yielding lower prices as compared to negotiations.

Differently from Vellez (2011), our dataset is limited to drugs' prices. However, the data appear to be particularly interesting for at least three reasons. First, drugs' expenditure is a considerable part of the entire health spending. In particular, in 2010, the Italian pharmaceutical expenditure counted for the 1.24% of GDP, and the public sector financed about 75% of the total drugs' purchase. Second, AVCP data are relative to a short period of time (2009-2012); this is an important aspect, since prices could strongly vary across time, especially for drugs which are covered by patents<sup>16</sup>. Third, AVCP gathered data regarding the procurement of the active principles in pharmaceutical products, rather than the final specific drug; this allows to compare highly standardized items. This means that we can observe and examine procurers' performance relating to almost identical items. We believe that these last two points constitute the major strengths of our analysis.

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<sup>13</sup> Later on, two categories have been added to the list: cloakroom service and stationary.

<sup>14</sup> AVCP faced the resistance of some pharmaceutical companies who have undertaken legal actions in order to block the publication of these prices.

<sup>15</sup> Their sample includes two types of hospitals: those directly managed by the local health unit (*ASLs*), and other major hospitals that have been hived off from the local health unit and transformed into independent enterprises called "Aziende Ospedaliere" (*AOs*).

<sup>16</sup> We have controlled our data for this issue. For all items, there is no significant correlation between price and time.



In 2012, AVCP interviewed 52 procurement agencies. The latter have been selected mainly taking into consideration the coverage index (i.e. the ratio between the number of drugs advertised in tenders by a specific agency and the total amount of drugs tendered in the region in which it is located). Data on drugs refer to 43 selected active principles (classified according to the Anatomical Therapeutic Chemical or ATC system). They are characterized by a specific dosage and a specific shape. This implies that for each ATC principle there could be several items (i.e. ATC x DOSAGE x SHAPE). In our data, 43 ATCs turn into 141 items. In the interviews, the 52 agencies have been asked to report the last paid price and purchased quantity of these 141 items. We restrict the dataset by dropping items with less than 10 observations and, keeping in mind the aim of our analysis, by dropping items that are bought using a procurement model which cannot be classified in one of our three categories (i.e., centralized, decentralized, or hybrid)<sup>17</sup>. Our final dataset contains 52 procurers, 116 items and 2343 observations.

## 5. Empirical strategy and results

The above data represent a unique opportunity to study the performance, in terms of paid price, of different procurement systems. Indeed, we know if the procurer has purchased for itself (decentralized system), for other selected units (hybrid system), or for all the units located in the regional territory (centralized system). Table 1 shows that the decentralized system has been preferred by 34 procurers (who bought on aggregate 920 items), while the other *ASLs* have chosen to aggregate purchases so as to form 10 centralized bodies (who bought 670 items) and 8 hybrid units (who bought 753 items). Table 2 presents the descriptive statistics of the variables included in the analysis.

In order to understand if there is any significant difference in paid prices among the three structures we estimate the following BASELINE econometric models (which include also drugs, years as well as geographical areas dummies):

$$\text{Ln PRICE}_{ijrt} = \alpha + \beta_1 \text{CENTR}_{ijt} + \beta_2 \text{HYBRID}_{ijt} \quad (1)$$

$$\text{Ln PRICE}_{ijrt} = \alpha + \beta_1 \text{CENTR}_{ijt} + \beta_2 \text{HYBRID}_{ijt} + \beta_3 \text{INSTQUAL}_r \quad (2)$$

$$\text{Ln PRICE}_{ijrt} = \alpha + \beta_1 \text{CENTR}_{ijt} + \beta_2 \text{HYBRID}_{ijt} + \beta_4 \text{CORRUPT}_r \quad (3)$$

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<sup>17</sup> This happens just for two items.

where the index  $i$  indicates the procurer,  $j$  the item procured,  $r$  the area (province or region), and  $t$  the year. *CENTR* is a dummy that identifies centralized procurers, *HYBRID* is a dummy for hybrid procurer, while the reference category is the decentralized agency. *INSTQUAL* is an index which summarizes the institutional quality in the province (or in the region, in the case of centralization) in which the procurer is located. This index, which has been introduced by Nifo and Vecchione (2013), summarizes five different dimensions of quality such as: voice and accountability (citizens' participation to public elections, number of associations and social cooperatives), government effectiveness (endowment of social and economic structures and quality of public polices in areas such as health, waste management, environment protection), regulatory quality (the ability of local administrators to promote and protect business activity), rule of law (crime levels, shadow economy, magistrate productivity, trial times), corruption (crimes against the public administration).<sup>18</sup>

Table 3 presents the results of the estimates of the BASELINE models. Regional dummies show that procurers set in the central and southern parts of Italy perform worse than procurers operating in the north-west, and year dummies indicate a declining trend in paid prices across time.

In column (1) only the *CENTR* and *HYBRID* dummies are included as regressors, while in columns (2) and (4) we add *INSTQUAL* and *CORRUPT*. Our variables of interest are always significant across all specifications. The coefficients indicate that centralized and hybrid systems perform better (in terms of awarded prices) compared to decentralized system. On average, the centralized (hybrid) procurer pays about 22%-25% (7%-8%) less than the decentralized agency. The presence of a high institutional quality (column 2) or of a low corruption level (column 4) in the area in which the agency operates is associated with lower drugs prices, too. Column 3 (5) evaluates the joint impact of centralization and institutional quality (corruption) on purchasing prices by adding two interacting terms *INSTQUALxCENTR* and *INSTQUALxHYBRID* (*CORRUPTxCENTR* and *CORRUPTxHYBRID*, respectively).<sup>19</sup> The positive and significant coefficients on the interacted variables clearly indicate that the benefits of both *CENTR* and *HYBRID* are reduced in correspondence of high institutional quality levels (low corruption

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<sup>18</sup> See Nifo and Vecchione (2013) for a detailed description of the elementary indexes use to build up the *INSTQUAL* variable, which ranges between zero and one.

<sup>19</sup> We run also regressions in which, instead of the composite index *INSTQUAL*, separate measures for voice and accountability, regulatory quality, rule of law and government effectiveness were introduced. Results confirm that each component of institutional quality has the effect of reducing pharmaceutical prices. Moreover, the interacted terms with the two centralization dummies confirm that both strategies are less effective in correspondence of high levels of institutional quality.

levels).<sup>20</sup> To elaborate more on this, we report the impact using a centralized or a hybrid system for different levels of institutional quality and corruption in figures 1 and 2. Figure 1 shows that, at very low levels of institutional quality, centralized and hybrid systems have a similar impact, since they both imply savings of around 40% with respect to a decentralized system. As far as the institutional quality increases, the savings reduce, at a faster rate for a hybrid system. For a local health unit located in a province endowed with very high institutional quality, the benefits of regional centralization are about 10%, while recurring to a hybrid system would imply an increase in drugs' purchasing price. In a similar vein, Figure 2 shows that for very high corruption levels, the two systems have a similar positive impact (a 50% price rebate), while for very low corruption levels, only centralization is effective in reducing purchasing prices.<sup>21</sup>

Such figures seem quite reasonable, with price reductions similar to the ones found by Bandiera et al. (2009) for goods and services procured through the Italian central agency, CONSIP. In a recent paper, Kastanioti et al. (2013) found that the establishment in 2008 of the Health Procurement Committee in Greece had the effect of unifying tenders, and prices reduced overall by 10%. Moreover, framework agreement tenders for selected medical devices (prostheses, pacemakers, dialysis systems, lenses) and e-auctions for 32 active substances resulted in an abatement of purchasing prices of the order of 30%-75% and 57%, respectively.

In order to check for the robustness of our results, we have enriched our specifications by adding further control variables. Model (1) reads now as follows (and the same applies for models (2) and (3)):

$$\begin{aligned} \text{Ln PRICE}_{ijt} = & \alpha + \beta_1 \text{CENTR}_{ijt} + \beta_2 \text{HYBRID}_{ijt} + \beta_5 \ln Q_{rt} + \beta_6 \text{DSO}_{it} + \beta_7 \text{POLIT}_{rt} \\ & + \beta_8 \ln \text{GDP}_{rt} + \beta_9 \text{RP}_{rt} \end{aligned} \quad (1')$$

In particular, paid price could be correlated with quantity. The AVCP survey contains also information about this dimension but, unfortunately, only few procurers have reported quantity

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<sup>20</sup> In order to be comparable to the other measures of institutional quality, the corruption index is constructed in such a way that a value of zero corresponds to maximum corruption, while one identifies minimum corruption.

<sup>21</sup> The corruption measure computed by Nifo and Vecchione (2013) is a weighted average of three indices: the number of crimes committed against the public administration, the number of city councils dismissed over "mafia infiltration", and the Golden and Picci (2004) index, which compares the value of public infrastructure with the costs borne by the government to build it. By running regressions in which we included only the Golden-Picci index or the index based on the number of crimes, as alternative measures of corruption (see Abrate et al. 2014, for more details), we obtained very similar results.

data. Some respondents<sup>22</sup> refer that they have faced some difficulties in reporting this information because sometimes they did not know it or because they just knew the required quantity reported on the tender documents, which often did not match with the purchased quantity. Moreover, most of them asserted that they could not observe any relationship between quantity and prices. Some of them suggested that prices could be more correlated with the time of payment rather than with quantity. For instance, if the procurer usually pays in due time, then the seller is more prone to offer a lower price. For these reasons, instead of reported quantity, we use the number of residents of reference area as a proxy of potential users of the hospital services ( $Q$ ). Since it is hard to disentangle the potential users of single health structures, we use population in the province in the case of single *ASLs*<sup>23</sup> and regional population in case of both group of *ASLs*<sup>24</sup> and centralized structures<sup>25</sup>. Following what respondents have noticed, we control for payment delays. For drug payment delay we refer to *DSO* index (days sales outstanding) computed by Assofarmaco – Confindustria. Then, we use  $DSO_{drug}$  that is the number of delay days (yearly average) for drugs payments. Considering that the price offered by drugs sellers in auction in  $t$  could be more correlated with payment delay in time  $t-1$  rather than in  $t$ , we compute a second variable, that is  $DSO_{drugL1}$ , i.e. the lagged  $DSO_{drug}$ . Unfortunately, Assofarmaco computes only payment delays at the regional level. Since Dirindin et al. (2012) find significant interregional differences in terms of payment delay, we use also a *DSO* measure for medical devices that is computed at single procurer unit level ( $DSO_{med}$ ). Unfortunately, we have *DSO* for medical devices only for 2013.

*RP* is a dummy for a region where a repayment plan applies. A repayment plan is a special program for regions which exhibit a large deficit for health expenditure.<sup>26</sup> Since the health budget is mainly managed at regional level, we check if different government coalitions have different attitude toward health expenditure. In particular, we include the following political regional variables: *POLIT*, which is equal to 1 if there is a right-wing government coalition, and  $\Delta$ *POLIT*, which is a dummy equal to 1 if a majority change (from right to left or *vice-versa*) took place in the previous twelve months. Finally,  $\ln$  *GDP* is the provincial log natural per capita value added, and

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<sup>22</sup> After the submission of the questionnaire, the interviewed procurers were called back to confirm the outlier data. Actually, most of them were interviewed again.

<sup>23</sup> This could be a good proxy considering that AVCP has selected the most important procurers for each region in terms of coverage index. This implies that the single *ASL* considered should be the most important at least at province level.

<sup>24</sup> In the case of a group of *ASLs*, we are probably overestimating the potential users (since they are more than the number of residents in the province where that procurer unit is located, but lower than the residents in the region), but unfortunately we have no information on the number of *ASLs* which form each group.

<sup>25</sup> This is not true for Tuscany, where there are three central agencies covering three large areas. In this case we use the sum of the number of inhabitants of the provinces covered by each agency.

<sup>26</sup> The Italian regions most involved in the program are: Lazio, Abruzzo, Campania, Molise, Calabria.

takes into account the differences in income among Italian provinces. Indeed, richer areas may have more financial resources available and higher level of expertise, which could turn into better procurement activity and more convenient purchasing prices.

Table 3 reports our main results. All specifications contain drugs, years and areas dummies. The estimates show that the previous results, as far as the impact of HYBRID, CENTR, INSTQUAL and CORRUPT are concerned, are robust to the inclusion of new controls. In particular, centralization implies a reduction of purchasing prices of 20%, while for the hybrid procurer there is a discount of 9%. The estimates of columns (3) and (5) confirm that the benefits of centralization reduce as far as corruption increases and the institutional quality reduces. Figure 3 and Figure 4 exhibit a similar pattern to Figures 1 and 2, with the only exception that the centralized system seems to perform better than the hybrid one also for very low levels of institutional quality/very high levels of corruption. Ln GDP is negative and significant suggesting that procurers set in richer provinces perform better than the others. The dummy for repayment plans is negative and significant, as expected. Conversely, the coefficient relative to our proxy for quantity (i.e. residents in the area of interest for the procurer) is not significantly different from zero. Even if it could seem a puzzling result, it is in line with the observations reported by some workers we interviewed.<sup>27</sup> Contrary to the results of Vellez (2011), who found that payment delay was directly discouraging participation and indirectly increasing prices, and to what some respondents were expecting, the signs of the coefficient of days of outstanding payments index is negative (the longer is the delay, the lower is the paid price).<sup>28</sup> Finally,  $\Delta$ POLIT exhibits a positive and significant coefficient, suggesting that procurers settled in areas in which there has been a majority change in the previous year are paying drugs at higher prices.<sup>29</sup>

## 5. Conclusion

Choosing between a centralized and a decentralized procurement policy is not an easy task. Many factors have to be taken into account, and it is difficult to ascertain *a priori* which is the best procurement system. This paper contributes to the literature by using as performance indicator the

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<sup>27</sup> In a similar vein, Vellez (2011) found for her sample of medical technologies that size was not associated to lower purchasing prices.

<sup>28</sup> Results of regressions in which  $DSO_{drugL1}$  or  $DSO_{drug}$  are alternatively tested are similar and available from authors upon request.

<sup>29</sup> However, Table 1 highlights that a majority change occurred only for 4% of observations, so we cannot put too much emphasis to this somewhat puzzling result. POLIT does not seem to have a discernible impact in all specifications. Results are available upon request.

prices of selected drugs for hospital usage awarded by a sample of 52 Italian public procurers (*ASLs*) between 2009 and 2012. We group the *ASLs* into three categories: decentralized, centralized and hybrid procurers. This latter category refers to a model where some decentralized units group together and designate one *ASL* who procures for the whole group.

Our regressions show that, controlling for several covariates, centralized and hybrid systems always perform better with respect to decentralized systems. In particular, in our favorite specification, the hybrid agency pays about 8% less and the centralized agency pays about 20% less than decentralized procurer. The average cost savings inflate up to 40%-50% for areas which are highly plagued by corruption or, more generally, which are characterized by low levels of institutional quality.

Overall, our results show that regional centralization and, to a lesser extent, the establishment of purchasing consortia among *ASLs*, could be effective ways to reduce the prices at which pharmaceutical products, which are rather standardized items, are bought. Figures 2 and 4 show that this is particularly true for regions in which there are high corruption levels. On the contrary, according to our estimates, if corruption is very low, the benefits from recurring to a centralized system reduce from 50%-60% to 12%-15%, while the advantages of using a hybrid system disappear. From a policy standpoint, therefore, our findings are supportive of the view that centralization, other than allowing the exploitation of scale economies, could be also a good strategy to shelter *ASLs* from corruption practices.

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**Table 1. The Three Purchasing Systems**

	Number of procurers	Number of Items Acquired
Decentralized	34	920
Centralized	10	670
Hybrid	8	753
Total	52	2343

**Table 2. Descriptive Statistics**

Variable	Description	Mean	St.dev.	Min	Max	Nobs
<b>Baseline Model</b>						
PRICE	Price paid per item (euro)	131.263	284.029	0.003	1534.250	2343
Ln PRICE	Log of price paid per item	2.492	2.724	-5.878	7.336	2343
DECENTR	Decentralized procurer	0.398	0.490	0	1	2343
CENTR	Centralized procurer	0.284	0.451	0	1	2343
HYBRID	Hybrid procurer	0.318	0.466	0	1	2343
INSTQUAL	Institutional Quality Index of province/region <sup>a</sup>	0.634	0.214	0	1	2343
CORRUPT	Corruption Index of province/region <sup>a</sup>	0.766	0.161	0	1	2343
NORTH-W	Dummy for North-West regions	0.278	0.448	0	1	2343
NORTH-E	Dummy for North-East regions	0.123	0.329	0	1	2343
CENTER	Dummy for Central regions	0.216	0.412	0	1	2343
SOUTH	Dummy for Southern regions and Islands	0.382	0.486	0	1	2343
YEAR2009	Dummy for 2009	0.032	0.175	0	1	2343
YEAR2010	Dummy for 2010	0.256	0.437	0	1	2343
YEAR2011	Dummy for 2011	0.510	0.500	0	1	2343
YEAR2012	Dummy for 2012	0.202	0.402	0	1	2343
<b>Extended Model</b>						
Ln DSO <sub>med</sub>	Log of Payment delay of procurer (n. of days): mean value 2013	5.264	0.577	4.402	7.262	2343
POLIT	Right-wing regional coalition	0.394	0.489	0	1	2343
ΔPOLIT	Change of majority in the previous 12 months	0.043	0.203	0	1	2343
RP	Dummy for regions involved in repayment plans	0.099	0.299	0	1	2343
GDP	Per capita GDP of province/region (euro)	23845	6476.917	13122	43688	2343
Ln GDP	Log of per capita GDP	10.043	0.272	9.482	10.685	2343
Ln Q	Log of inhabitants in the province/region	14.488	1.085	11.749	16.088	2343

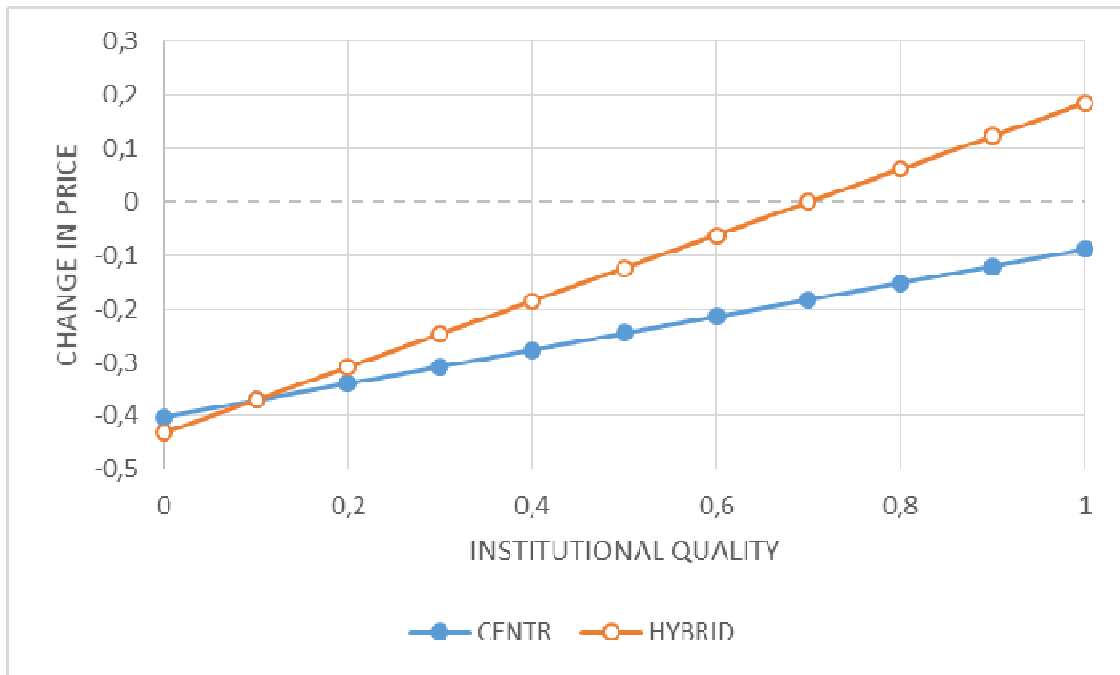
<sup>a</sup>Source: Nifo and Vecchione (2013)

**Table 3. Estimates of Baseline Model**

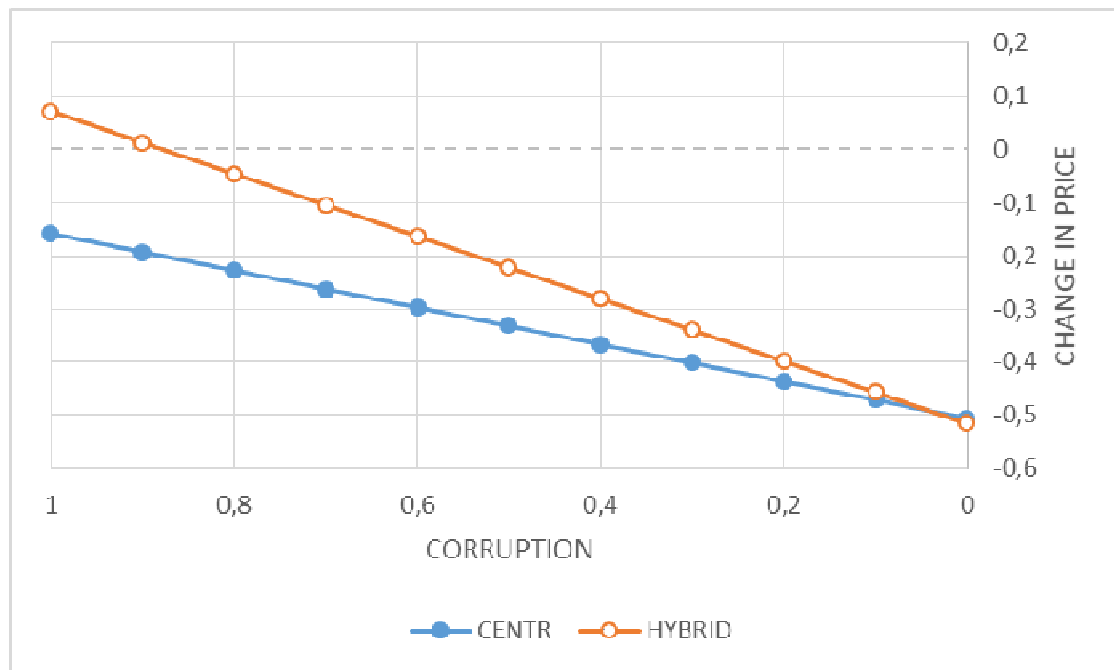
VARIABLES	Ln PRICE (1)	Ln PRICE (2)	Ln PRICE (3)	Ln PRICE (4)	Ln PRICE (5)
CENTR	-0.230*** (0.030)	-0.217*** (0.030)	-0.402*** (0.079)	-0.250*** (0.031)	-0.506*** (0.121)
HYBRID	-0.072*** (0.024)	-0.081*** (0.024)	-0.432*** (0.095)	-0.079*** (0.024)	-0.516*** (0.141)
NORTH-E	0.030 (0.031)	0.003 (0.032)	0.003 (0.033)	0.044 (0.031)	0.046 (0.030)
CENTER	0.206*** (0.037)	0.228*** (0.038)	0.204*** (0.040)	0.235*** (0.039)	0.208*** (0.040)
SOUTH	0.178*** (0.023)	0.068 (0.041)	0.066 (0.048)	0.100*** (0.033)	0.089** (0.035)
YEAR2010	-0.094 (0.059)	-0.137** (0.060)	-0.105* (0.061)	-0.113* (0.059)	-0.072 (0.060)
YEAR2011	-0.213*** (0.058)	-0.246*** (0.058)	-0.235*** (0.058)	-0.218*** (0.057)	-0.192*** (0.057)
YEAR2012	-0.334*** (0.063)	-0.358*** (0.063)	-0.355*** (0.063)	-0.328*** (0.063)	-0.306*** (0.063)
INSTQUAL		-0.312*** (0.095)	-0.566*** (0.131)		
INSTQUALxCENTR			0.313*** (0.119)		
INSTQUALxHYBRID			0.617*** (0.153)		
CORRUPT				-0.325*** (0.102)	-0.632*** (0.153)
CORRUPTxCENTR					0.348** (0.153)
CORRUPTxHYBRID					0.588*** (0.183)
Observations	2,343	2,343	2,343	2,343	2,343
R-squared	0.973	0.973	0.973	0.973	0.973

Dependent variable: Ln PRICE  
 Robust standard errors in parentheses  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Figure 1. Effect of Centralization and Institutional Quality on Pharmaceutical Prices**



**Figure 2. Effect of Centralization and Corruption on Pharmaceutical Prices**

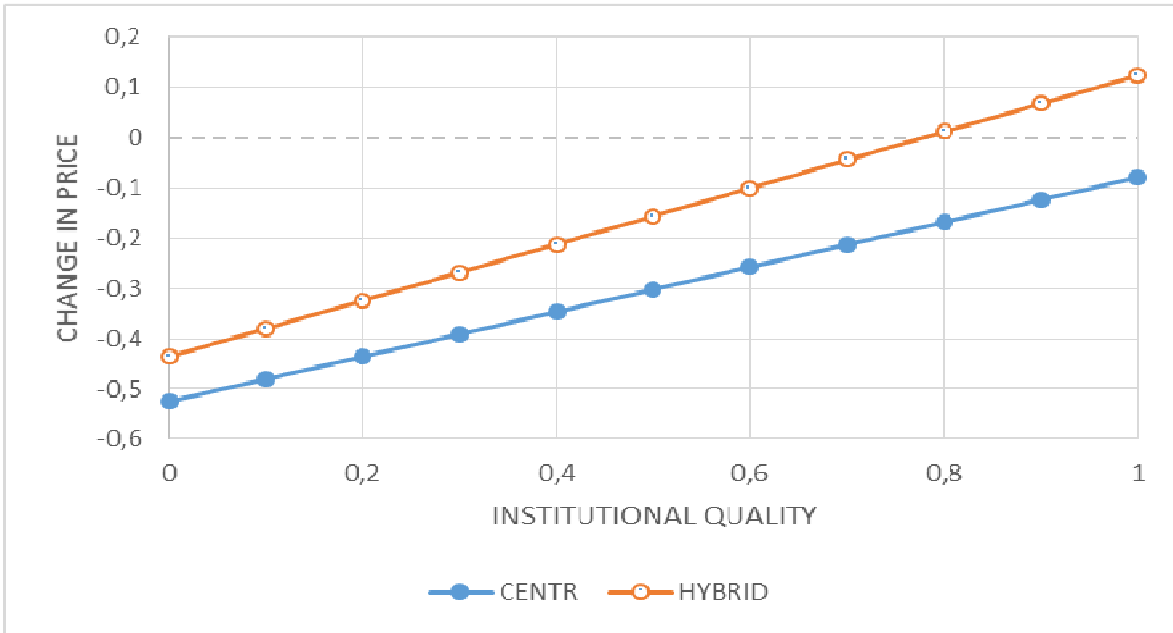


**Table 4. Estimates of Extended Model**

VARIABLES	Ln PRICE (1)	Ln PRICE (2)	Ln PRICE (3)	Ln PRICE (4)	Ln PRICE (5)
CENTR	-0.201*** (0.045)	-0.251*** (0.045)	-0.525** (0.107)	-0.268*** (0.045)	-0.580*** (0.139)
HYBRID	-0.087*** (0.029)	-0.131*** (0.027)	-0.436*** (0.102)	-0.132*** (0.027)	-0.435*** (0.151)
NORTH-E	0.031 (0.031)	0.054 (0.036)	0.025 (0.037)	0.071** (0.032)	0.061* (0.031)
CENTER	0.202*** (0.039)	0.262*** (0.041)	0.219*** (0.044)	0.269*** (0.041)	0.228*** (0.045)
SOUTH	0.179*** (0.041)	0.131*** (0.041)	0.123*** (0.051)	0.114*** (0.044)	0.102** (0.046)
YEAR2010	-0.093 (0.061)	-0.108* (0.061)	-0.096 (0.062)	-0.106* (0.060)	-0.072 (0.062)
YEAR2011	-0.197*** (0.059)	-0.216*** (0.058)	-0.214*** (0.058)	-0.210*** (0.057)	-0.187*** (0.058)
YEAR2012	-0.284*** (0.068)	-0.303*** (0.064)	-0.320*** (0.063)	-0.293*** (0.063)	-0.274*** (0.064)
Ln DSO <sub>med</sub>	-0.059* (0.033)	-0.052* (0.032)	-0.053* (0.032)	-0.047 (0.032)	-0.063* (0.033)
Ln GDP	-0.118* (0.063)	-0.158** (0.075)	-0.044 (0.079)	-0.171*** (0.060)	-0.145** (0.062)
RP	-0.134*** (0.043)	-0.133*** (0.043)	-0.130*** (0.041)	-0.109*** (0.043)	-0.110*** (0.042)
ΔPOLIT	0.305*** (0.060)	0.142** (0.063)	0.183** (0.074)	0.140*** (0.054)	0.218*** (0.066)
Ln Q	0.007 (0.015)	0.002 (0.016)	0.001 (0.015)	0.005 (0.016)	0.004 (0.015)
INSTQUAL		-0.200** (0.070)	-0.486** (0.161)		
INSTQUALxCENTR			0.446*** (0.147)		
INSTQUALxHYBRID			0.560*** (0.166)		
CORRUPT				-0.274*** (0.107)	-0.523*** (0.153)
CORRUPTxCENTR					0.452** (0.177)
CORRUPTxHYBRID					0.417** (0.200)
Observations	2,343	2,343	2,343	2,343	2,343
R-squared	0.973	0.973	0.973	0.973	0.973

Dependent variable: Ln PRICE  
 Robust standard errors in parentheses  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Figure 3. Effect of Centralization and Institutional Quality – Extended Model**



**Figure 4. Effect of Centralization and Corruption – Extended Model**

