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GOVERNMENT SPENDING: EVIDENCE  
FROM A POLICY EXPERIMENT**

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## ABSTRACT

### Active and Passive Waste in Government Spending: Evidence from a Policy Experiment\*

We propose a distinction between active waste and passive waste as determinants of the cost of public services. Active waste entails utility for the public decision maker (as in the case of bribery) whereas passive waste does not (as in the case of inefficiency due to red tape). To assess the empirical relevance of both forms of waste, we analyze purchases of standardized goods by Italian public bodies and exploit a policy experiment associated with a national procurement agency. A revealed preference argument implies that if public bodies with higher costs are more likely to buy from the procurement agency rather than from traditional suppliers, cost differences are more likely to be due to passive waste. We find that: (i) Some public bodies pay systematically more than others for observationally equivalent goods and such price differences are sizeable; (ii) Differences are correlated with governance structure: the central administration pays at least 22% more than semi-autonomous agencies (local government is at an intermediate level); (iii) The variation in prices across public bodies is principally due to variation in passive rather than active waste; (iv) Passive waste accounts for 83% of total estimated waste.

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# 1 Introduction

How efficient is government in providing public services? The answer to this question should inform our decision of whether to provide the service and in what form. In particular, it should impinge on the choice between direct public provision and outsourcing to private contractors (Hart et al., 1997).

A key related question is what determines how efficiently a certain public service is provided. This paper proposes a distinction between *active waste* and *passive waste* in determining the cost of public services. While this dichotomy has been present, in various forms and with different names, in discussions of the role of government at least since Buchanan and Tullock (1962, Chapter 18), our contribution is to develop a formal framework and provide quantitative evidence.

Active waste is such that its presence entails direct or indirect benefit for the public decision-maker. In other words, reducing waste would reduce the utility of the decision-maker. The classical example is corruption in procurement, whereby the public official inflates the price paid for a certain good in exchange for a bribe. Active waste is perceived to be a key issue in public management. For some, it is even *the* key issue. It makes, for instance, the top four list on the World Bank's Challenge to Reduce World Poverty: "Combat corruption, or there is not much that can be done that is effective."

Passive waste, in contrast, is such that its presence does not benefit the public decision-maker. In other words, reducing waste would (weakly) increase the utility of the decision maker. Passive waste can derive from a variety of sources. One is that public officials simply do not possess the skills to minimize costs. Another is that public officials have no incentive to minimize costs, although they are able to do so. A final cause of passive waste, following Kelman (1990, 2005), is that excessive regulatory burden may make procurement cumbersome and increase the average price that the public body pays. A stark example is provided by the procurement system in use by the US Military. Under this system, tender documents are excruciatingly detailed, like the 26-page description of chocolate cookies or brownies.<sup>1</sup> More importantly, the requirement that all characteristics be specified *ex ante* makes it difficult to use existing commercial production lines, greatly increasing fixed costs.

In a first-best world, both active and passive waste would be kept in check by making public officials residual claimants of the value of the public body they manage, so to align their interests with the citizens'. In practice, however, such high powered incentives are unfeasible because of risk aversion and/or limited liability.

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<sup>1</sup>Available at <http://www.dscp.dla.mil/subs/support/specs/mil/44072.pdf> at the time of writing.

Compensating public officials for the risk they would face if their pay were to vary one-to-one with the value of the public body would be extremely costly. Similarly, limited liability would make high-powered incentives impossible due to the large difference between the public officials' wealth and the value of public bodies. In addition, some of the objectives of public bodies are difficult to measure, especially quality, given that the output is not sold. Holmstrom and Milgrom (1991) show that a principal who faces an agent with multiple tasks, some of which cannot be measured, may find it optimal to eschew high-powered incentives even on the tasks that can be measured, and instead restrict the set of actions that the agent takes.<sup>2</sup>

In a second-best world, delegation becomes a key issue: what decisions should the agent be allowed to take? A robust lesson from the optimal delegation literature (e.g., Alonso and Matouschek 2007) is that the agent should have more discretion when his preferences are close to the principal's. Active waste is a sign of preference misalignment: the agent benefits from waste because she acquires a share of the surplus. Indeed, the standard solution is to call for stricter rules and external controls. In contrast, the same kind of policy can have detrimental effects if the key problem is inefficiency as in Kelman (1990, 2005)'s assessment of waste in the US federal government. Fighting this kind of passive waste requires giving public officials more discretion, not less. To decide the optimal delegation policy, it is therefore essential to estimate the relative weights of potential sources of waste.

Identifying active and passive waste from observed costs of public services is challenging as both forms of waste result in high costs and are thus observationally equivalent. Our identification strategy consists in exploiting a policy experiment that affects the behavior of public bodies differently, depending on whether most of their waste is active or passive.

We analyze procurement purchases by a representative sample of Italian public bodies over the period 2000-2005. Our dataset contains very detailed information on the purchase of 21 generic goods. For each purchase, this includes quantity, brand, model, specifications, delivery conditions, and – most importantly – the price paid.

Two features of the data make it well suited for our purposes. First, our generic goods, such as printers and gasoline, are standardized and are bought by most public bodies. The goods are produced by firms who typically operate across Italy. This allows us to measure waste as the difference in prices paid for the same goods across the public sector. Second, Italy is a promising testing ground for theories about public administration, because of the high level of heterogeneity among public bodies.

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<sup>2</sup>The difficulty of using high-powered incentives is not limited to the public sector. It also applies to firms. Jensen and Murphy (1990) argue that it is a serious problem even for CEOs, who are the top-paid agents in our society and whose performance is measured publicly by the share price.

Public bodies differ by geographical location (and hence possibly culture), size and governance systems, all dimensions that can affect both active and passive waste.

To identify active and passive waste we exploit a policy experiment in Italy's public procurement system. In the 2000-2006 period we consider, public bodies can purchase generic goods through two channels: either on their own, according to standard procurement rules or through a central procurement agency. The agency, named Consip, establishes agreements with suppliers of generic goods which commit to selling a specified product at given price to any Italian public body. While Consip exists throughout our sample period, at any given point in time, only a subset of our sample goods are available from the Consip catalog. This is due to the fact that agreements for different goods have different start and end dates, and different durations. Hence, for the same public body and the same good, we observe periods when the public body must purchase the good on its own and periods when it can also buy it from Consip.

We develop a simple theoretical framework to analyze public procurement outcomes. When a Consip agreement is not active, the price that a public body pays for a certain good (controlling for quality and quantity) is an increasing function of: (1) the propensity of that specific public body to engage in active waste and (2) the ability of that public body to avoid passive waste. Thus, with information about prices only, one cannot identify active and passive waste. When a Consip agreement is active, the public body chooses between buying from Consip or outside Consip. As Consip offers no opportunity for active waste, the probability that a public body buys from Consip is a decreasing function of (1) but an increasing function of (2). Putting together information about prices paid when a Consip agreement is not active with decisions to buy from Consip when a Consip is active is enough to establish whether price differences among public bodies are due to differences in active or passive waste. Note that our identification strategy relies exclusively on the fact that, by definition, a public official who engages in active waste derives utility from the price level he chooses while an official who engages in passive waste would be happier with lower prices. Our simple revealed-preference argument is still valid if: Consip is itself affected by active or passive waste (all that matters is that it charges the same price to all public bodies); public bodies are intrinsically reluctant (or eager) to buy from Consip; and the mere presence of a Consip agreement affects prices, or opportunities for active waste, offered by other suppliers.

The empirical analysis exploits two sources of variation. First, we observe the same public body purchasing several goods at several points in time. Second, we observe the same good being bought both when it can be feasibly purchased from Consip and when not. We are thus able to estimate the average price paid by each

public body when buying on the open market and the decision to buy from Consip when it is feasible to do so.

The analysis yields five main findings. First, the average prices paid by different Italian public bodies vary substantially. The public body at the 90th percentile of the fixed effect distribution pays on average 55% more than the one at the 10th percentile. If all public bodies were to pay the same prices as the one at the 10th percentile, sample expenditure would fall by 21%; if we do not include public bodies below the 10th percentile for which savings are negative, sample expenditure would fall by 27%. Since public purchases of goods and services are 8% of GDP, if sample purchases were representative of all public purchases of goods and services, savings would be between 1.6% and 2.1% of GDP.<sup>3</sup>

Second, differences across public bodies are correlated with institutional characteristics rather than geography or size. Semi-autonomous bodies (universities and health authorities) pay the lowest prices. Compared to these, the average town government pays 13% more. The difference increases further for regional governments (21%), social security institutions (22%), while the average ministry tops the list with 40% higher prices. Overall, the results indicate a clear price ranking with semi-autonomous bodies at the bottom, local government in the middle and centralized state administration at the top.

Third, our reduced form estimates indicate that bodies that pay higher prices when buying from Consip is not feasible, are more likely to buy from Consip when they are given the chance. Within our theory, we interpret this finding as an indication that differences in passive waste play a more important role than differences in active waste in explaining price differences among public bodies.

While the reduced form estimates indicate that price differences are mostly due to passive waste, they do not allow us to quantify the magnitudes of active and passive waste. To this purpose we bring our model to the data and, making specific functional form assumptions, estimate the active and passive parameters for each public body. Our fourth finding is that, on average, at least 82% of estimated waste is passive and that passive waste accounts for the majority of waste in at least 83% of our sample public bodies. Recalling that the public body at the 90th percentile paid on average 55% higher prices than the public body at the 10th percentile, our estimates indicate that, at the average values, if passive waste were eliminated the difference would be at most 10%.

Fifth, low active waste is not coupled with high passive waste, implying that in our sample there seems to be no trade-off between rules and discretion. The

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<sup>3</sup>In the conclusion section, we present some (limited) evidence that such wide disparities between prices paid by different public bodies are observed in the UK as well.

comparison across different institutional categories indicates that, relative to central public bodies, autonomous public bodies have less passive waste and the same level of active waste. To the extent that giving autonomy to purchasing managers in central public bodies would make them behave like their counterparts in universities or health authorities, our evidence indicates that more discretion would not lead to higher active waste.

Overall our findings are consistent with the hypothesis that, in aggregate, most waste in the procurement of generic goods by the Italian public sector is not due to corruption but to inefficiency. Our results do not in any way imply that corruption is not an important issue in public procurement in Italy. They just indicate that passive waste seems to have an even larger effect.

Empirical economic analysis of government inefficiency and corruption can be divided into two strands, according to whether it makes use of opinion surveys or direct measurements of outcomes.<sup>4</sup> The second approach, to which our paper belongs, is less developed and more recent. Examples include Di Tella and Schargrotsky (2003), Reinikka and Svensson (2004), Olken (2006, 2007), Bertrand et al. (2007), Fisman et al. (2006), Fisman and Miguel (2006), Hyytinen et al. (2007), and Ferraz and Finan (2007a, 2007b).

The paper that is closest to ours is Di Tella and Schargrotsky (2003), who study prices paid for a number of basic inputs by hospitals in Buenos Aires in 1996-97. During that period there was a crackdown in corruption involving hospital audits. The authors estimate that average prices paid by hospitals went down 10% as a result of the crackdown. The authors also find a significant (and negative) effect of public managers' wages on the prices paid by hospitals, which is consistent with the theory of corruption by Becker and Stigler (1974).

Within the direct-measurement approach, our paper offers a number of original contributions. First, the Consip natural experiment allows us to distinguish empirically between active and passive waste. Second, our data provides comparable measures of waste for a number of public bodies which differ by mode of governance, geographical location, and size. This allows us to see how waste depends on institutional arrangements. Third, our sample is representative of an amount of public spending corresponding to 2.5% of Italy's GDP, and hence our estimates have large-scale implications, even without making claims on their external validity.<sup>5</sup> Lastly, in

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<sup>4</sup>See Rose-Ackerman (1999) and Svensson (2005) for surveys.

<sup>5</sup>Auriol (2006) models the distinction between capture (a firm obtains a trading advantage through corruption) and extortion (a firm makes facilitation payments to avoid being excluded). Auriol proves that capture imposes a deadweight cost while extortion does not: calibration on available international data indicates that the total cost of capture is between 1.2 and 2.9 times the

contrast to most corruption studies, we back out the preference parameters of the utility function of public officials. This is similar in spirit to Goldberg and Maggi (1999), who estimate the utility weights of public welfare and lobby contributions in determining the level of trade protection granted to different sectors.

Our results shed a new light on determinants of public waste. Our estimates of the effect of active waste are not in contradiction with the available direct estimates of the effect of corruption.<sup>6</sup> Where we differ from the rest of the literature is in looking at the effect of pure inefficiency, and in pointing out that passive waste could actually be much larger than active waste – about four times as much in our estimates. As our literature review showed, economists have paid limited attention to the role of pure inefficiency in explaining poor policy outcomes. While we do not play down the role of willful resource diversion, our results indicate that it is also important to measure passive waste.

The remainder of the paper is organized as follows. Section 2 provides information on the context and the policy experiment. Section 3 presents the theoretical framework. Section 4 discusses our identification assumptions and the plausibility of alternative theories. Section 5 describes the data. Section 6 presents the empirical analysis. We start by documenting differences in prices paid by different public bodies for observationally similar goods. We then present reduced form estimates to assess whether differences are mostly due to differences in active waste or differences in passive waste. Finally we bring the model to the data and quantify active and passive waste for each public body in our sample. Section 7 concludes.

## 2 Institutional Background and the Policy Experiment

This section provides background information on public procurement in Italy and describes the key features of the Consip policy experiments.

### 2.1 Types of Public Bodies

The Italian public administration displays a high level of organizational and cultural heterogeneity.

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amount of the bribes.

<sup>6</sup>See the conclusion for a detailed comparison of our corruption estimates with Di Tella and Schargrodsky (2003), Olken (2006), and Ferraz and Finan (2007a). See also the conclusion for a discussion of the external validity of our results.

Broadly, one can identify three models of Public Bodies (PBs) in Italy, with substantial differences in terms of autonomy and accountability:

- Napoleonic bodies. The central administration (PBs for which the national government is responsible) follows a classical top-down, civil-service model. The prototypical Napoleonic body is the ministry, typically headed by a career politician. In practice, the operations of the ministry tend to be controlled by entrenched civil servants.
- US-style local bodies. Namely, regions, provinces, and towns. Since the end of the 90s, the CEOs of local PBs (the region's governor, the province's president, and the town's mayor) have been elected directly and have broad powers. The region/province/town council cannot remove the CEO without calling for new elections. As in the US, local elections tend to focus on practical local issues and candidates' personalities, rather than national ideological positions.
- Semi-autonomous bodies. The most important example comes from the health system. While the system is publicly funded, the provision is delegated to about 200 local health authorities. Each health authority is headed by a director general, appointed by the regional government, who has a standard private law employment contract. Also the other high-level managers working in health authorities have private-sector contracts. The compensation of directors and managers is high by the standards of the Italian public administration and can include a performance-related component. Each health authority enjoys substantial budgetary and administrative autonomy.<sup>7</sup>

Italian PBs may be affected by local culture. Putnam (1993) and several other authors have argued that there are structural differences in the social capital between the South and the North. Ichino and Maggi (2000) have documented systematic output differences for the same private organization (a bank) between branches located in the North and in the South.

Finally, public bodies also vary in size, which can also affect active and passive waste. For instance, bribes might be easier to hide in purchases made by large public bodies but these could also pay lower prices because of bulk discounts. Large public bodies may also be more bureaucratic, which could be correlated with passive waste.

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<sup>7</sup>For the purpose of this research, we put universities in the category of semi-autonomous bodies. While the central government sets nation-wide rules regarding professorial salaries and promotion criteria, individual universities have full control of day-to-day activities and can raise funds. University presidents are elected by the university staff.

## 2.2 Public Procurement and the Policy Experiment

In Italy, public spending for goods and services accounts for about 8% of GDP (€125 billion in 2006) – a figure which is in line with other OECD countries (Audet, 2002). Of this, 40% is spent on generic goods such as desktops, paper, and telephones, which are the focus of this paper.

Public spending for goods and services is regulated by procurement law. The legislation is specific to the type of PB, and it distinguishes between central, local and semi-autonomous bodies.<sup>8</sup> In general, within each PB there is a purchasing manager (or a whole purchasing division) responsible for procuring the goods and services that other members of the public body need.

In the late 90s, the Italian government launched a program to reduce public expenditure for goods and services. A key component of this program was the creation of a central procurement agency, Consip, whose purpose is to coordinate the procurement of commonly purchased goods and services. The rationale behind Consip is twofold. First, since contracts, tender documents, and eventual litigation, are centralized, Consip can save on transaction costs. Second, compared to individual PBs Consip has more buyer power that can be exploited to obtain lower prices.

Consip procures goods and services via *framework agreements*. These are general contracts between a procuring entity and a supplier for the delivery of goods and services within a certain time frame at specified price and conditions. Public bodies can buy the goods or services specified in the contract, at the terms and conditions specified therein. Goods can be purchased on-line from the Consip catalog or ordered via fax or phone.

Consip agreements typically cover the supply of up to  $N$  units of a certain good that can be sold in a certain period, until a final date  $T$ . Within these limits, the agreement is said to be “active” and the selected provider commits to fulfill any order at the terms of the contract. Consip does not commit to buy any units, so that if no public body puts an order, no single unit is sold.

After initial pilots in 2000, Consip established 70 agreements concerning more than 40 product categories in the period up to the end of 2005. Total purchases from the Consip catalog in that period amounted €14 billion, that is 12% of total

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<sup>8</sup>Italian legislation is available at <http://www.normeinrete.it>. For central public administrations see Regio Decreto RD 827/24 (1924). For local administrations see Decreto Legge DLGS 267/00 (2000). For semi-autonomous bodies see Decreto Legge DLGS 502/92 (1992). It is impossible to provide a precise mapping of these transpositions, as they differ by public bodies even within the same institutional class. For instance, within the Central Public Administration there are rules that differ by type of Ministry. For purchases valued at 130,000 euros or above, the procurement market is regulated by a EU Directive.

procurement expenditures in 2005. The value of purchases of the same products and services from other sources was €26 billion, or 22% of total procurement expenditures in 2005. Thus, conditional on a product being offered, the value of Consip purchases accounted for a third of the value of total purchases of that product.

The key feature for our identification strategy is that PBs can choose whether to buy from Consip or on the open market. The precise extent to which they are free to choose varies somewhat by year and by institutional class as specified in the Budget Act. This choice was entirely free for all PBs in 2004 and 2005. Conversely, all PBs were required to buy from Consip if an agreement for an equivalent good was active in 2003. This requirement applied to central PBs also between 2000 and 2002, while all other PBs were free to choose during that period. In practice, even when PBs were formally required to buy from Consip, they could justify off-Consip purchases by claiming that the goods offered by Consip did not satisfy their specific requirements.

### 3 A Model of Active and Passive Waste in Procurement

Consider a purchasing manager working for a PB. He receives requests for goods and services from various parts of the organization and he procures the requested products from commercial producers.

Let us first examine the situation when Consip is not present. Suppose that at a certain time  $t$  the manager working for public body  $i$  must purchase a certain quantity of a fully specified good  $g$ . The total price that the manager pays for this good is denoted with:

$$p_{igt} = f_{gt}(b_{igt}, \mu_i),$$

where  $b_{igt} \geq 0$  is a variable under the control of the manager, which represents the direct benefit (i.e., a “bribe”) that the manager receives for that transaction. The other argument of the price function,  $\mu_i$ , is an exogenous variable which represents the “inefficiency” of the manager in organization  $i$ . The final price  $p_{igt}$  is an increasing function of both  $b_{igt}$  and  $\mu_i$ . We will discuss the nature of  $b_{igt}$  and  $\mu_i$  shortly.

The purchasing manager has the following objective function

$$\Omega_{igt} = -p_{igt} + \beta_i b_{igt},$$

where  $\beta_i$  is the active waste propensity parameter for public body  $i$ .

The purchasing manager feels a pressure to keep prices low. This may be because he is genuinely motivated to save public money or because he knows that he will

face negative consequences if he overpays. The purchasing manager may also like private benefits. That happens when  $\beta_i > 0$  ( $\beta_i$  can also be negative, representing a manager with moral scruples, who will in equilibrium choose  $b_{igt} = 0$ ).

Our two key parameters are  $\beta_i$  and  $\mu_i$ , and it is worth spending some words about their interpretation. We assume that PBs have persistent differences, due to cultural, institutional, or historical characteristics.<sup>9</sup>

In this context, the parameter  $\beta_i$  is best interpreted as a set of norms that is conducive to active waste. For instance, the risk of prosecution may be higher for certain PBs than for others because of a culture of whistleblowing. A higher risk of prosecution means that private benefits are less appealing (for instance  $\beta_i$  can incorporate a probability of getting caught that is linear in the amount of bribe received).

The passive waste parameter  $\mu_i$  may come from a variety of sources. One possibility, following Kelman (1990, 2005), is that red tape may limit flexibility and increase the average price that the public body pays. Red tape in turn depends on the mode of governance of the public body, which – as we argued early – varies greatly within the Italian public administration. Another possibility is that the human capital of purchasing managers varies across PBs. Finally, passive waste might also be due to ‘laziness’. Purchasing managers in certain PBs face less incentive or more cost to exerting effort for finding good deals. Such possibility is best explored by assuming that efficiency is endogenous and depends on the effort exerted by the purchasing manager. In Appendix 1, we extend our model to let passive waste be endogenous, in which case the purchasing manager would decide both the amount of private benefit that he gets and the amount of effort that he puts in. The results are qualitatively the same. In particular, the identification strategy is unchanged.

What is the equilibrium when Consip is not present? The manager determines the private benefit  $\hat{b}_{igt}$  and thereby the price  $\hat{p}_{igt}$  through the first-order condition (we

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<sup>9</sup>Manager  $i$ 's objective function contains a normalization. One could add a multiplicative parameter  $\pi_i$  in front of the price, as follows:

$$-\pi_i f_{gt}(b_{igt}, \mu_i) + \beta_i b_{igt}.$$

Such parameter indicates the relative strength of the price reduction component. This objective function is equivalent to one where

$$-f_{gt}(b_{igt}, \mu_i) + \frac{\beta_i}{\pi_i} b_{igt}.$$

Therefore, we can normalize  $\pi_i$  to one without loss of generality. Our active waste parameter  $\beta_i$  must then be interpreted as the active waste propensity relative to price reduction propensity.

make the standard assumptions on differentiability and concavity of the function  $f_{gt}$ , and suppose that the non-negativity constraint on the private benefit is not binding):

$$\frac{\partial}{\partial b_{igt}} f_{gt}(b_{igt}, \mu_i) = \beta_i.$$

The equilibrium payoff for the manager is

$$\hat{\Omega}_{igt} = -\hat{p}_{igt} + \beta_i \hat{b}_{igt}.$$

We then have our first result:

**Proposition 1** *If there is no Consip deal, the price paid by public body  $i$  is an increasing function of both the passive waste parameter  $\mu_i$  and the active waste parameter  $\beta_i$ .*

This result highlights the inability to identify the cause of waste from price data alone. A high price can be due to passive waste or active waste.

How do things change when we add Consip to the picture? We make two assumptions: (i) The price that Consip charges for good  $g$  at time  $t$  is the same for every public body (and it is denoted with  $p_{gt}^c$ ); (ii) If manager  $i$  buys from Consip, he receives no private benefit. We do not make any assumption on the process through which the Consip price  $p_{gt}^c$  is generated or whether the Consip price is better or worse than the off-Consip prices. In particular, our results are valid as stated even if Consip itself is subject to active and passive waste. Our identification strategy relies exclusively on the fact that Consip treats all public bodies in the same way.

Manager  $i$ 's payoff if he buys from Consip is

$$\hat{\Omega}_{igt}^c = -p_{gt}^c + \nu_{igt},$$

where  $\nu_{igt}$  is some idiosyncratic preference for Consip with continuous distribution over the real line.

When Consip is present, the purchasing manager has the option to buy outside Consip. However, the off-Consip price function may be different from the price function that the manager faced before Consip appeared. This could be due to a number of reasons. The presence of a Consip reference price may make off-Consip prices more competitive. Also, the bargaining power in the active waste relation may be altered (the purchasing manager may have to agree to a lower price in order to obtain the same private benefit). We take the most general view and we assume that the new price function is different from the previous one (we denote it as  $\tilde{f}_{gt}$  instead

of  $f_{gt}$ ). The only maintained assumption is that  $\tilde{f}_{gt}$  is increasing in both  $b_{igt}$  and  $\mu_i$ . Hence, the total price that the manager pays if he buys outside Consip is

$$p_{igt} = \tilde{f}_{gt}(b_{igt}, \mu_i).$$

The presence of Consip may also create additional payoff effects that do not work through price. For instance, a purchasing manager may feel pressured into buying from Consip in order not to appear corrupt. Or the risk of getting caught taking a bribe is now higher. We capture this through an additional term  $h(p_{gt}^c, b_{igt})$  (which is likely to be negative). In particular, it could be the case that  $h(p_{gt}^c, b_{igt}) = -\delta_g - \theta b_{igt}$ , indicating that a manager who chooses to buy outside Consip incurs a fix stigma plus an additional risk of prosecution that is increasing in the amount of kickbacks he receives.

In sum, the utility of a manager who buys outside Consip when a Consip deal is available is

$$\Omega_{igt}^n = -\tilde{f}_{gt}(b_{igt}, \mu_i) + h(p_{gt}^c, b_{igt}) + \beta_i b_{igt}.$$

As before, the manager chooses  $b_{igt}$  to maximize  $\Omega_{igt}^n$ . We assume that  $\tilde{f}$  and  $h$  are smooth and satisfy the standard conditions for the existence and uniqueness of an interior solution. The maximal payoff is denoted with  $\hat{\Omega}_{igt}^n$ .

Thus, when Consip is present, the manager chooses between buying from Consip and getting payoff  $\hat{\Omega}_{igt}^c$  or buying outside Consip and receiving payoff  $\hat{\Omega}_{igt}^n$ . We can now state:

**Proposition 2** *If a Consip deal is active, the probability that public body  $i$  buys from Consip is an increasing function of the passive waste parameter  $\mu_i$  and a decreasing function of the active waste parameter  $\beta_i$ .<sup>10</sup>*

**Proof:** The manager buys from Consip if  $\hat{\Omega}_{igt}^c \geq \hat{\Omega}_{igt}^n$ . The probability that he buys from Consip is then given by

$$\Pr \left[ \nu_{igt} \geq p_{gt}^c + \hat{\Omega}_{igt}^n \right].$$

Note that  $p_{gt}^c$  does not depend on  $\mu_i$  and  $\beta_i$ . It is enough to prove that  $\hat{\Omega}_{igt}^n$  is increasing in  $\beta_i$  and decreasing in  $\mu_i$ . To see this, apply the envelope theorem to

$$\hat{\Omega}_{igt}^n = -\tilde{f}_{gt}(\hat{b}_{igt}, \mu_i) + h(p_{gt}^c, \hat{b}_{igt}) + \beta_i \hat{b}_{igt}.$$

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<sup>10</sup>The probability of switching is a constant function of  $\beta_i$  when  $\beta_i < 0$ .

We have

$$\begin{aligned}\frac{\partial \hat{\Omega}_{igt}^n}{\partial \mu_i} &= -\frac{\partial}{\partial \mu_i} \tilde{f}_{gt}(\hat{b}_{igt}, \mu_i) < 0; \\ \frac{\partial \hat{\Omega}_{igt}^n}{\partial \beta_i} &= \hat{b}_{igt} > 0\end{aligned}$$

which proves the statement. ■

Proposition 2 captures the essence of the distinction between active and passive waste, and it can be understood as a classical revealed-preference result. A higher  $\beta_i$  denotes a situation where the manager can benefit more from active waste. This corresponds to an improvement of his choice set, which can only make him better off. Instead, a higher  $\mu_i$  corresponds to a worsening of the manager's choice set: for every  $b_{igt}$  he chooses he gets less utility. Thus, an increase in  $\beta_i$  makes off-Consip purchases more appealing and an increase in  $\mu_i$  makes them less appealing. Our basic argument requires only an assumption on the monotonicity of the choice sets and it applies to a class of models that is much larger than the one which we consider in this simple set-up.

Proposition 2, combined with Proposition 1, permits identification of the source of waste. Take a public body that used to overpay for a certain good  $g$  before Consip arrived. If the body buys from Consip, we should be more likely to conclude that it was passive rather than active waste.

We can make this point more precise. Suppose that, in the population of PBs, the parameters  $\beta_i$  and  $\mu_i$  are distributed according to a joint normal distribution  $N(\beta_i, \mu_i | \bar{\beta}, \bar{\mu}, \sigma_\beta^2, \sigma_\mu^2, \rho)$ . Assume that  $\rho$  is bounded away from  $-1$  and  $1$ .

For simplicity, suppose that every public body  $i$  makes one purchase when Consip is not present (at time 1) and one purchase when Consip is present (at time 2). Let  $p_{i1}$  denote the price that PB  $i$  pays at time 1 and  $s_{i2}$  the decision to buy from Consip in period 2 ( $s_{i2} = 1$  if  $i$  buys from Consip). In the equilibrium of our model, both  $p_{i1}$  and  $s_{i2}$  are stochastic variables that depend on  $\beta_i$  and  $\mu_i$  (and on other stochastic variables). One can study the joint equilibrium distribution of those two variables. In particular, one can ask whether those variables are positively or negatively correlated.

**Proposition 3** *Hold fixed  $\bar{\beta}$ ,  $\bar{\mu}$  and  $\rho$ . For any given  $\sigma_\beta^2$ ,  $Cov[p_{i1}, s_{i2}]$  is increasing in  $\sigma_\mu^2$  and there exists a  $\bar{\sigma}_\mu^2$  such that  $Cov[p_{i1}, s_{i2}] \geq 0$  if and only if  $\sigma_\mu^2 \geq \bar{\sigma}_\mu^2$ .*

*Conversely, for any given  $\sigma_\mu^2$ ,  $Cov[p_{i1}, s_{i2}]$  is decreasing in  $\sigma_\beta^2$  and there exists a  $\bar{\sigma}_\beta^2$  such that  $Cov[p_{i1}, s_{i2}] \geq 0$  if and only if  $\sigma_\beta^2 \leq \bar{\sigma}_\beta^2$ .*

**Proof:** The variable  $p_{i1}$  is increasing in both  $\beta_i$  and  $\mu_i$  (Proposition 1). The variable  $s_{i2}$  is decreasing in  $\beta_i$  and increasing in  $\mu_i$  (Proposition 2). Hold the variance

$\sigma_\beta^2$  constant. If  $\sigma_\mu^2 \rightarrow 0$ ,  $Cov[p_{i1}, s_{i2}]$  is determined by  $\beta_i$  only. Hence,  $Cov[p_{i1}, s_{i2}] < 0$ . If instead  $\sigma_\mu^2 \rightarrow \infty$ ,  $Cov[p_{i1}, s_{i2}]$  is determined by  $\mu_i$  only and  $Cov[p_{i1}, s_{i2}] > 0$ . Conversely, hold the variance  $\sigma_\mu^2$  constant. If  $\sigma_\beta^2 \rightarrow \infty$ ,  $Cov[p_{i1}, s_{i2}]$  is determined by  $\beta_i$  only. Hence,  $Cov[p_{i1}, s_{i2}] < 0$ . If instead  $\sigma_\beta^2 \rightarrow 0$ ,  $Cov[p_{i1}, s_{i2}]$  is determined by  $\mu_i$  only and  $Cov[p_{i1}, s_{i2}] > 0$ . Given that all the functions involved are smooth, it is easy to check that  $Cov[p_{i1}, s_{i2}]$  is continuous in  $\sigma_\mu^2$  and  $\sigma_\beta^2$ . Given the monotonicity implied by Propositions 1 and 2,  $Cov[p_{i1}, s_{i2}]$  is increasing in  $\sigma_\mu^2$  and decreasing in  $\sigma_\beta^2$ . By a fixed-point argument, there must exist values  $\bar{\sigma}_\mu^2$  and  $\bar{\sigma}_\beta^2$  that satisfy the statement in the Proposition. ■

Proposition 3 will guide our empirical analysis. It characterizes an observable statistics,  $Cov[p_{i1}, s_{i2}]$ , in terms of the underlying distribution of active and passive waste parameters. To understand the proposition, consider two extreme cases illustrated in Figure 1. Suppose first that all PBs are equally corruption-prone ( $\beta_i = \beta$  for all  $i$ ). Any pre-Consip difference between the prices that PBs pay is due to the ability parameter  $\mu_i$ . When a Consip deal is available, the most efficient bodies will tend to buy outside Consip while the less efficient ones will buy from Consip. The covariance term is positive. If instead all PBs are equally efficient ( $\mu_i = \mu$  for all  $i$ ), price differences are due to preferences for private benefits. The bodies that like private benefits are least likely to buy from Consip and the covariance term is negative.

According to the proposition, this result holds also between the two extreme cases. More heterogeneity in  $\mu_i$  makes the covariance term more likely to be positive, while more heterogeneity in  $\beta_i$  makes the covariance term more likely to be negative.

The proposition has a clear limit, which will inform the reduced-form analysis. The observed relationship between pre-Consip prices and switching decision is informative on the variance of  $\mu$  and  $\beta$  but not on their absolute value. For instance, finding that the public bodies that pay the highest prices are more likely to purchase from Consip, is consistent both with all public bodies being equally corrupt and with them being all equally clean. In other words, the reduced form analysis will only allow us to assess whether price differences are due to differences in  $\mu$  or differences in  $\beta$ . The issue is of interest because there are very large systematic differences in prices paid by different public bodies. This limit will be overcome, in the structural estimates, at the cost of making explicit assumptions on what reference price we should expect an efficient and non-corrupt public body to pay.

## 4 Alternative Theories

Our empirical strategy depends on the validity of Proposition 2, namely on the fact that the probability of buying from Consip is increasing in the passive waste parameter  $\mu_i$  and decreasing in the active waste parameter  $\beta_i$ . Biases in the estimates of  $\beta_i$  and  $\mu_i$ , if any, derive from the term

$$h(p_{gt}^c, b_{igt}).$$

Recall that  $h$ , defined in Section 3, represents the additional benefit or cost that a purchasing manager faces if he buys outside Consip when a Consip deal is available. We let this cost be a function of the Consip price and of the private benefit that the purchasing manager receives. This encompasses a large number of cases. In particular, it covers a situation where the risk of prosecution is higher for purchasing managers who do not use Consip.

Also, recall that the price function  $f$  is allowed to be different in a generic way ( $\tilde{f}$ ) just because Consip is present, which takes care of a number of other situations, including: (i) A change in the bargaining power between supplier and purchasing manager (both in terms of prices and private benefits); (ii) A stronger desire to keep prices under control; (iii) The ability to get better prices from other suppliers.

However, there is a potentially relevant situation that is not covered by our set-up and which may give rise to a bias. Assume that the term  $h$  depends *directly* on the active waste parameter, namely

$$h(p_{gt}^c, b_{igt}, \beta_i),$$

and that this dependence is negative. The more corruption-loving a public body is, the less utility it receives from buying outside Consip *holding the private benefit level  $b_{igt}$  constant*. If that is the case, Proposition 2 is no longer valid: the probability of using Consip may be increasing in the parameter  $\beta_i$ . The following section suggests two scenarios where that can occur.

It is important to reiterate that *the possibility that the presence of a Consip deal makes purchasing managers more afraid to take bribes is immaterial to our identification strategy*. As seen above, our model incorporates the possibility that managers are more reluctant to seek private benefits when they could be buying the good from Consip and our revealed-preference argument is still valid (more corrupt managers are still less likely to buy from Consip than their honest counterparts). In order for there to be a bias, the fear of getting caught must depend not only on the observable decisions that the PB makes (and hence, in equilibrium, on the public body's taste for private benefits  $\beta_i$ ) but also directly on the parameter  $\beta_i$ . This of

course is a much stricter requirement because  $\beta_i$  is a preference parameter rather than an observable decision.

## 4.1 Endogenous Monitoring

The expression  $h(p_{gt}^c, b_{igt})$  allows for the risk of prosecution to be a function of the decision to buy from Consip, of the price, and of the amount of bribe paid for that purchase, but it does not consider the possibility that the risk of prosecution is a function of the public body's taste for private benefits directly. There are two sets of circumstances under which this can happen:

1. Targeted enforcement. Suppose that there exists a monitoring authority and that it has soft information about the private type of purchasing managers, i.e. their taste for private benefits, but this is not enough to initiate action. When a Consip deal is present, the monitoring authority can punish corrupt purchasing managers directly if they choose not to use Consip. This makes the cost of buying outside Consip higher for purchasing managers with high  $\beta$ 's. In equilibrium, corrupt managers are more likely to buy from Consip and our estimates of  $\beta$  are biased downward.<sup>11</sup>
2. Selective auditing. Suppose instead that, unlike in the case above, the monitoring authority does not have soft information about  $\beta$ 's. However, it could still use the decision to buy outside Consip as a signal that the purchasing manager is corrupt. The monitoring authority could be more likely to audit all the purchasing managers who do not use Consip and, importantly, such audits would not be restricted to the current purchase but they would also extend to purchases made when a Consip deal was not active. A purchasing manager with a high  $\beta$  has more to lose from an audit because he has engaged in active waste in past purchases. He therefore chooses to buy from Consip in order to avoid a selective audit. Again, our estimates of  $\beta$  are biased downward.<sup>12</sup>

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<sup>11</sup>The classical example of targeted enforcement is the prosecution of the Prohibition Era gangster Al Capone. For years the US federal authorities suspected that Al Capone was involved in racketeering but they were never able to collect sufficient evidence. They later decided to switch tactics and in 1931 they secured a conviction on tax evasion charges. This is a situation where the monitoring authority had reliable soft information and was looking for a way to “nail” the suspect on other charges. In such a situation Al Capone should have been extremely diligent in filing his tax returns – more so than other taxpayers.

<sup>12</sup>If the monitoring authority's strategy is endogenous, it is unclear what the features of the equilibrium of such a signaling model would be. If high- $\beta$  PBs find it too dangerous to buy off-Consip, then the only ones who buy off-Consip are honest PBs (for idiosyncratic reasons or because

To evaluate the practical importance of these two alternative theories, let us start by discussing who the monitoring authority is in Italy. In principle, a bad public employee faces both administrative and judicial review. However, there is a general consensus that the risk of administrative punishment is minimal. According to Ichino (2006), no public employee has been dismissed in the regular administrative way (“scarso rendimento”) in the last ten years. Even when employees are found guilty of a crime against the public administration, they are not automatically fired. According to existing guidelines, they are dismissed only if they are sentenced to a prison term of at least three years.

On the other hand, judicial prosecution is a serious risk. For instance, between 1992 and 2002, the Milan district attorney secured convictions on corruption charges for 1254 different individuals (847 through plea bargains, 407 in trials). So, for our purposes it is reasonable to regard the judiciary as the key monitoring authority.

In this context, the targeted enforcement story is implausible. Given that poor performance is not cause for penalty or dismissal, employees can only be punished for criminal acts. Not buying from Consip is not a crime in itself nor is it evidence of a crime. So, there is no sense in which prosecutors can make use of the decision not to buy from Consip to “nail” corrupt purchasing managers, even assuming that they know *ex ante* who the corrupt ones are.

The selective auditing theory is potentially more promising and cannot be completely ruled out. In Section 6.2.2 we present a test based on the fact that the legal requirement to buy from Consip and hence the relevance of selective auditing varies both across public bodies and over time. Here we discuss three serious practical arguments against its plausibility.

First, if the district attorney wanted to use information on who buys from Consip to decide who to investigate, she would be faced with a very noisy signal. Very few of the goods typically purchased by public bodies are available from Consip at any given point in time, and Consip agreements for different goods have different length and different start and end dates. In addition, public bodies do not commit to Consip, so that the same public body can buy some goods from Consip and others outside, or even buy the same good both from Consip and outside at different points in time. Indeed, almost all public bodies (all but one in our sample) buy both from Consip and outside Consip when a deal is present, and the vast majority of them is in the 30/70% band.

Second, even if the district attorney could use the decision to buy from Consip as a signal that the purchasing manager is corrupt, auditing past purchases or monitoring

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they can get a better price). But then, the monitoring authority should not use the decision to buy off-Consip as a signal of corruption.

future purchases is unlikely to be a fruitful line of investigation. Auditing past purchases is both very costly as processing statistical evidence is not what the district attorney is trained for. Even more importantly, price analysis is unlikely to be useful in court, since evidence that a manager pays too much for purchases is neither necessary nor sufficient to secure a corruption conviction.

In line with this, there are no reports of judicial use of Consip information. More generally, to the best of our knowledge, there are no reports of corruption investigations in Italy started with collection of statistical evidence on prices. District attorneys focus their resources on gathering another kind of information: evidence of payments between suppliers and public officials. Indeed, a recently published anti-corruption manual focuses almost exclusively on methods for tracking financial flows (OECD Ministero dell'Economia e delle Finanze 2007). The typical anti-corruption probe begins with the interception of a payment, either by chance or because of whistleblowing. This is typically sufficient evidence to secure convictions for the individuals involved. Next, the district attorney offers a plea deal to suspects if they can provide evidence –typically proof of payment– against other people. The cycle can be repeated and the inquiry can end up involving hundreds of people.

## **4.2 Active Waste through Consip**

One key identifying assumption is that the private benefit that purchasing managers derive from buying from Consip is zero. If that were not the case, namely if managers were to receive higher bribes on Consip purchases our estimates would be biased because more corrupt purchasing managers would prefer to buy from Consip to enjoy the higher bribes.

This possibility is extremely unlikely in practice. All Consip deals are signed with large national or international companies. The purchasing managers send their orders directly to a national supplier so that transfers, if any, would have to come directly from the national supplier. For obvious auditing reasons, it is difficult to conceive that a large national company, or the Italian headquarter of an international company, is in a position to make large and systematic hidden cash payments. In contrast, when buying off Consip, purchasing managers can procure the goods from local agents as large suppliers rely on a network of regional distributors. Such agents may develop long-term relationships with purchasing managers and they are in a better position to make hidden cash transfers or offer other benefits.

## 5 Data Description

We analyze data on procurement purchases of generic goods made by a sample of Italian PBs between 2000 and 2005. The data was collected in a survey designed and implemented by the Italian Statistical agency (ISTAT) in three rounds, administered yearly between 2003 and 2005.

The survey covers a broad range of generic goods, such as office supplies and furniture, computers and utilities. Sample goods were chosen on the basis of three criteria: (i) comparability, that is homogeneous goods whose price depends on a few observable characteristics, (ii) diffusion, that is goods that are purchased by most PBs, and (iii) relevance, that is goods that account for a sizeable share of the budget for most PBs.

The survey was administered to the office clerk responsible for receiving, paying and filing invoices in each PB. The respondent was asked to report the unit price, the date of purchase, the quantity purchased and several characteristics of each good.<sup>13</sup> A list of the sample goods and the available characteristics is reported in Appendix 2. For durable goods, e.g., computers, the manager was asked to report each purchase made in the five years before the survey. For non-durable goods and for services, e.g., landline contracts, the manager was asked to report information on the last purchase only.

The survey was administered to five hundred PBs. Of these, 447 were selected by cut-off sampling on expenditures and account for 80% of the expenditure in goods and services by the Italian public sector as a whole. The remaining 53 PBs were added to the sample to represent institutional categories with small budgets, e.g., mountain town councils. The survey response rate was over 70%. Respondents and non-respondents do not differ on observable characteristics such as location, annual expenditure and institutional category.

In the analysis we exploit two key sources of variation. First, we observe the same PB purchasing several goods at several points in time. Second, we observe the same good being purchased both when a Consip agreement is active and when not. We are thus able to estimate the average price paid by each PB when buying on the open market and the decision to buy from Consip when Consip agreements are active. Figure A1 shows that, importantly, agreements for different goods are switched on and off at different points in time; this allows us to control for time specific unobservables that affect price and purchasing decisions.

Three rules define our working sample. First, as the identification relies on within

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<sup>13</sup>Copies of invoices were collected from a sub-sample of public bodies to cross-check the accuracy of responses.

PB variation, we include in the analysis only PBs for which we have data on at least ten purchases.<sup>14</sup> Second, to maintain comparability across PBs we exclude goods that are purchased exclusively by a few PBs.<sup>15</sup> Finally, we eliminate price outliers by dropping the bottom and top centile of the price distribution of each good. Our final sample contains 6,068 observations on purchases of 21 goods by 208 PBs over the period 2000-2005. On average 52% of purchases are made when a Consip agreement is active and 48% when there is no active agreement.

Table 1a illustrates the sources of variation at the PB level. We classify sample PBs by the three governance classes discussed in Section 2.1, plus a residual class of PBs whose governance structure does not clearly fall in any of the three categories. PBs' size, measured by annual expenditure in 2000, ranges from an average euro 3 million for mountain village councils to over 1000 million for ministries. Since the sampling strategy oversamples larger PBs, the share of total expenditure accounted for by PBs in our sample is proportional to the average PB size in a given class. Thus, ministries in the sample account for 92% of the total expenditure by the universe of ministries in Italy, sample universities account for 43% and sample mountain village councils for 13%.

PBs in all classes buy on average 11 different types of goods. Table 1a shows that PBs in all institutional classes buy at least some goods from Consip when feasible. Central PBs are more likely to buy from Consip than local PBs and semi-autonomous bodies, a pattern we will analyze in more detail in Section 6.1.2. At the single PB level, 96% of the sample PBs buy from Consip at least once, and all PBs buy outside Consip at least once when there is an active agreement.

Table 1b shows the average price paid and quantity purchased for each good. To ensure comparability across different months and years, price is normalized by the monthly consumer price index. Table 1b highlights that, unconditionally, there is substantial variation in price, as for all goods the standard deviation is at least half the mean and for some it is larger than the mean. Our aim in the next section is to assess how much of this variation can be explained by observed characteristics and to exploit information on the decision to buy from Consip to shed light on the reasons for the residual price variation. In line with wide variation in the size of different PBs, Table 1b also illustrates that the quantity bought in a single purchase exhibits considerable variation and that for most goods, periods with and without active

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<sup>14</sup>This restriction eliminates 1612 observations. Compared to the sample PBs, the excluded PBs have lower annual expenditure but are equally likely to purchase when a Consip agreement is active and equally likely to purchase from Consip.

<sup>15</sup>Excluded goods are buses, refuse trucks, and bio-fuel, which are purchased by fewer than 20 PBs each, and CAT scanners, which are purchased exclusively by health authorities.

Consip agreements are of equal length. The last Column in Table 1b shows that when an agreement is active, all the sample goods are purchased both from Consip and outside. The variation in the share reflects variation in the relative attractiveness of the Consip deal.

Our identification strategy throughout relies on the fact that we observe the same PBs making purchases when Consip agreements are active and when they are not. While the timing of agreements is plausibly exogenous to the individual PBs, the purchasing manager might affect the timing of purchases. The identification then relies on the assumption that timing of purchases, that is whether to purchase when an agreement is active, is not correlated with the parameters that determine the purchasing manager’s behavior ( $\mu_i$  and  $\beta_i$  in the model). This assumption would be violated if corrupt managers anticipate or postpone purchases to avoid periods when agreements are active, so to avoid having to justify paying higher prices than Consip. Likewise, our identifying assumption would be violated if managers wait or delay purchases to wait for an active agreement, for instance to minimize search effort. In Appendix 3, we present evidence on timing of purchases to check whether strategic timing is a concern in this setting. We rely on the intuition that if managers were to time purchases strategically, we should observe a spike or drop either just before or just after the start and/or the end of an agreement. Appendix 3 shows evidence against strategic timing, thus providing support for our identifying assumption.

## 6 Empirical Analysis

Our empirical analysis is organized in three complementary parts. We first document the differences in prices paid by different PBs for observationally identical goods and we exploit the cross-sectional variation in PB characteristics to shed light on the correlates of price differences. Public bodies in our sample vary on three dimensions that can potentially affect both active and passive waste: (i) mode of governance, (ii) size and (iii) geography.

Second, we estimate the average price paid by each PB when Consip agreements are not available and, informed by Proposition 3 we analyze the correlation between price differences and the decision to buy from Consip to shed light on the nature of waste. Proposition 3 shows that if most of the difference in prices across PBs is due to differences in passive waste, PBs that pay higher prices when goods are not available from Consip should be more likely to buy from Consip when feasible. In contrast, if most of the price difference is due to differences in active waste, PBs that pay higher prices when goods are not available from Consip should be less likely to buy from Consip as this would imply forgoing private benefits.

Third, we fit our model to the data to back out the parameters of the purchasing manager’s objective function. This allows us to retrieve the active and passive waste parameters for each public body and provide evidence on the magnitude of the two forms of waste. This also allows us to establish whether there is a trade-off between the two forms of waste, namely whether public bodies that have lower passive waste also have higher active waste and viceversa.

## 6.1 Part 1. Price Differences

### 6.1.1 Average Prices

Our first step is to estimate the average price paid by each PB for all goods purchased as the PB fixed effect in a regression of price paid by PB  $i$  for good  $g$  at time  $t$  ( $p_{igt}$ ) when no Consip agreement is active for good  $g$ . The log-price equation is:

$$\ln p_{igt} = X_{igt}\gamma + \rho_g \ln Q_{igt} + \eta_g t + \theta_g + w_i + \varepsilon_{igt} \quad (1)$$

where  $X_{igt}$  is a vector of good specific characteristics,  $Q_{igt}$  is the quantity purchased,  $t$  is the time trend,  $\theta_g$  are goods fixed effects, and  $w_i$  are public bodies fixed effects.<sup>16</sup> We allow the effect of quantity and of the time trend to be different for different goods.<sup>17</sup> We control for quantity purchased to capture possible bulk discounts. We control for good specific trends to capture price changes faced by all PBs at the same time. Therefore, the assumption needed to identify  $\rho$  as the causal effect of quantity on price is that all PBs face the same price schedule at any given point in time. To account for price differences due to transportation costs and market accessibility, we have also added several geographical control variables to our baseline specification of (1).<sup>18</sup> None of these significantly affected price, in line with the fact that our sample goods are produced by large firms and easily available at retail stores across the country.

Our coefficients of interest throughout are the estimated PB fixed effects,  $\hat{w}_i$ , as  $\omega_i = \exp(\hat{w}_i)$  is the average price paid by PB  $i$  on all the goods it buys. The

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<sup>16</sup>To select the characteristics to be included in  $X_{igt}$ , we estimate price regressions for each of the goods that include all available characteristics and a time trend. We then choose the characteristics whose coefficients are significantly different from zero at the 10% level or higher. We thus drop characteristics for which there is little or no variation (e.g., all paper weighs 80g/m<sup>2</sup>) and characteristics that are highly correlated with others. Included characteristics are indicated with a (\*) in the list in Appendix 2.

<sup>17</sup>The results are robust to controlling for yearXgood fixed effects instead of good specific time trends.

<sup>18</sup>Controls included regional dummies, town size, driving distance from either Milan or Rome, both in kilometers and in hours.

distribution of PB fixed effects reported in Figure 2 indicates that different PBs pay considerably different prices for similar goods. For instance, the PB at the 90th percentile pays, on average, 55% higher prices than the PB at the 10th percentile. A back of the envelope calculation suggests that if all PBs were to pay the same prices as the one at the 10th percentile, sample expenditure would fall by 21%. If we do not include public bodies below the 10th percentile for which savings would be negative, sample expenditure would fall by 27%. Since public purchases of goods and services are 8% of GDP, if sample purchases were representative of all public purchases of goods and services, savings would be between 1.6% and 2.1% of GDP.

To show that  $\hat{w}_i$  captures PB specific features as opposed to pure noise, we exploit the fact that we observe almost all of the same PBs buying at least some of the same goods from Consip. We use these observations to estimate a “placebo”  $\hat{w}_i^P$  as the PB fixed effect in the equivalent of (1) from Consip purchases. Since individual PBs have no influence over the Consip price,  $\hat{w}_i^P$  by construction does not capture PB specific features. Reassuringly,  $\hat{w}_i$  and  $\hat{w}_i^P$  are not correlated (correlation coefficient=-.07). Appendix Figure A3 show that  $\hat{w}_i^P$  exhibits considerably lower variation than  $\hat{w}_i$ , and the Kolmogorov-Smirnov test rejects the null of equality of distributions (p-value .001).<sup>19</sup>

### 6.1.2 Correlates of Prices

The evidence above indicates that different PBs pay considerably different prices for similar goods. The purpose of this section is to identify the PB characteristics that are correlated with these differences. PBs in our sample differ along three dimensions: (i) geography, (ii) size (expenditures) and (iii) institutional class.

Geography can proxy for cultural factors that might affect both active and passive waste. Following Putnam (1993), several authors have argued that differences in social capital across Italian regions affect a wide range of economic outcomes, including the performance of the public sector. In what follows we analyze whether prices differ systematically by geography and whether they are correlated to the standard social capital measures used in the literature.

The size of the public body might affect prices paid for several reasons. Private benefits might be easier to hide in purchases made by large PBs but these could also pay lower prices because of bulk discounts. Large PBs may also be more bureaucratic, which could be correlated with passive waste.

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<sup>19</sup>We compare the fixed effect model (1) to a random effects model for both out-of-Consip and Consip purchases. The Hausman test rejects the null in the out-of-Consip sample but fails to reject in the sample of Consip purchases.

Finally, PBs also differ by governance structure. As discussed in Section 2, Italian PBs can be broadly grouped in three institutional classes: Napoleonic bodies, local governments and semi-autonomous bodies. These three categories are subject to different procurement laws and they differ by the level of autonomy and by the rigidity of their budget constraint. Procurement laws and the degree of autonomy should affect waste.

In Table 2 we analyze how the price paid when Consip agreements are not active depends on PB characteristics. We group PBs in four geographical areas: North, Center, and Southern regions with and without high prevalence of organized crime.<sup>20</sup> Column 1 shows the correlation between prices, geography and PB size. Column 2 shows the correlation with the social capital variables and Column 3 with governance type. Finally we include all variables together in Column 4.

Column 4 shows that once we control for institutional class, neither geography nor size nor social capital are significantly correlated with prices. The coefficients of these variables remain precisely estimated and not significantly different from zero. Only the coefficient on the blood donations variable is marginally significant (at the 11% level) but very small: a one standard deviation increase in donations is correlated with 2.4% lower prices. In contrast, the estimates imply that compared to semi-autonomous bodies, the average town government pays 13% more. The difference increases further for regional governments (21%), social security institutions (22%), and ministries (40%).<sup>21</sup>

Overall, the evidence in Table 2 clearly indicates that price differences are due to differences in governance structure rather than geography, culture or size: we find that central PBs pay more than local government and these pay more than semi-autonomous bodies. Differences could thus be driven by either passive or active waste since governance structure might affect both. The next section provides evidence as to whether price differences are driven by differences in active or passive waste across public bodies.

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<sup>20</sup>We classify Campania, Sicilia, Puglia and Calabria as having high prevalence of organized crime, based on extensive evidence from the crime literature and news reports. Results are robust to redefining the group to only include Campania and Sicilia, the two most affected regions.

<sup>21</sup>We can reject the null of equality between ministries and the highest paying type in the other two categories (regions and health centres) at conventional levels. We cannot reject the null of equality among the coefficients of PBs belonging to the same institutional class.

## 6.2 Part 2. Reduced Form Estimates: Differences in Active and Passive Waste

### 6.2.1 Methodology and Baseline Findings

Next, informed by Proposition 3 we analyze the correlation between price differences and the decision to buy from Consip to shed light on the nature of waste. To do so, we analyze data on purchases of all goods  $g$  at times  $t$  when Consip agreements are active for the good in question and assess whether the decision to buy from Consip, depends on the average price paid when there are no active agreements by each PB. We estimate:

$$C_{igt} = \alpha \hat{w}_i + \eta_g t + \psi_g + v_{igt} \quad (2)$$

where  $C_{igt} = 1$  if PB  $i$  buys good  $g$  at time  $t$  from Consip, 0 otherwise.  $\hat{w}_i$  is PB  $i$ 's fixed effect estimated in (1) above,  $t$  is the time trend, and  $\psi_g$  are goods fixed effects. As above, we allow the effect of the time trend to be different for different goods. The residuals  $v_{igt}$  are clustered at the PB-good level to account for interdependence of purchases of the same good made by the same PB, findings are also robust to clustering at the PB or good level separately.

Throughout the coefficient of interest is  $\alpha$ , which captures the relationship between the estimated price differential and the probability to buy from Consip. The coefficient  $\alpha$  sheds light on the rationale for waste in our sample. A positive coefficient indicates that PBs that pay more in the absence of Consip gain more from buying from Consip when feasible. This suggests that the difference in prices paid by different PBs for observationally equivalent goods is due to differences in passive waste. On the other hand, a negative coefficient indicates that PBs that pay more gain less from buying from Consip, thus providing evidence for differences due to differences in active waste.

Table 3 reports estimates of (2). The simple correlation between the probability of buying from Consip and estimated waste reported in Column 1 indicates that PBs that on average pay more when no agreement is active are more likely to buy from Consip when an agreement is active. The point estimates and standard errors are unchanged when we add goods fixed effects (Column 2) and good-specific trends (Column 3). An increase in waste from the 10th to the 90th percentile increases the probability of buying from Consip by 9.7 percentage points, 25% of the sample mean (.37).<sup>22</sup>

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<sup>22</sup>We estimate (2) by linear probability to facilitate the interpretation of the coefficients. Given that the mean of the dependent variable is .37, that is far from both 0 and 1, estimating (2) by probit or logit yields similar results.

The discussion in Section 2 highlights that the requirement to buy from Consip varies both across PBs and through time. PBs belonging to the Central Public Administration were required to buy from Consip if there was an active agreement for an equivalent good between 2000 and 2003. The requirement was extended to all PBs in 2003 and eliminated for all PBs in 2004 and 2005. In practice, even if PBs were required to buy from Consip they could easily circumvent this, and indeed we do observe that 58% of purchases were made out of Consip even when PBs were nominally obliged to purchase from Consip. Nevertheless, the mandatory requirement might have made it more difficult to buy out of Consip. The coefficient of waste will be biased upward if the mandatory requirement is correlated with the PB fixed effects, for instance because Central Administration PBs pay higher prices and are also more likely to be required to buy from Consip. The Compulsory Regime indicator in Column 4 shows that, indeed, PBs were more likely to buy from Consip when required to do so, but this leaves our estimates of  $\alpha$  unchanged.

A related issue arises if the slope of the relationship between the probability to buy from Consip and off-Consip prices depends on whether PBs are formally required to buy from Consip. In principle, if the requirement were enforced, there should be no relationship between off-Consip prices and the probability to buy from Consip, as all PBs would have to buy from Consip. In this case, our estimates of  $\alpha$  would be biased towards zero, as we would be using observations from a period where the relationship is muted. To address this issue we allow the slope to differ depending on whether the compulsory regime is in place or not. Results in Column 5 indicate that the interaction term has the expected sign but it is not significant at conventional levels, and the confidence interval for the new estimate of  $\alpha$  overlaps with the previous specification.

Perhaps more interestingly, this finding sheds further light on the plausibility of the endogenous monitoring interpretation. Indeed, if results were driven by the fact that the most corrupt PBs bought from Consip for fear of being audited, this effect should be stronger when purchasing from Consip was mandated by law. The fact that the relationship between off-Consip prices and the probability to buy from Consip is, if anything, weaker casts further doubt on the practical relevance of this interpretation.

On the basis of Proposition 3, we view the finding that the coefficient  $\alpha$  is positive as broadly supportive of the hypothesis that differences in passive waste are more important than differences in active waste in explaining differences in prices among Italian public bodies. To quantify the relative importance of active and passive waste, we will have to wait for the model estimates in Section 6.3. In the meantime, we address a number of potential issues regarding our current findings.

### 6.2.2 Estimation Concerns and Robustness Checks

The analysis raises two classes of estimation concerns: measurement error in  $\hat{w}_i$  and omitted variables correlated with  $\mu_i$  that might lead us to overstate the role of inefficiency.

Measurement error in this setting can arise from two sources, namely from unobservable good characteristics and from the fact that  $\hat{w}_i$  are estimated rather than directly observed. Below we argue that both types of measurement error would lead us to underestimate  $\alpha$ , thus making it more difficult to find evidence for passive waste.

First, if unobservable quality differences explain part of the price differential between PBs, the “true”  $w_i^*$  is lower for PBs with high estimated  $\hat{w}_i$ , and higher for PBs with low estimated  $\hat{w}_i$ . Other things equal, substituting  $w_i^*$  for  $\hat{w}_i$  in (2) would yield higher estimates of  $\alpha$ , providing further support for the hypothesis that differences in prices are due to differences in passive waste.

The second source of measurement error derives from the fact that  $\hat{w}_i$  are estimated rather than directly observed. This introduces noise that can lead to an attenuation bias in  $\alpha$ , thus making it more difficult to find evidence for passive waste as above. The spurious variation introduced by the use of estimated  $\hat{w}_i$  however, also reduces the standard errors thus making it more difficult to reject the null hypothesis that  $\alpha = 0$ . Reassuringly, we can show that a 1000 replication bootstrap of the system of equations (1) and (2) yields similar standard errors as in Table 3.

Our identification relies on the assumption that the nature of waste is the same for all goods. To address this concern we first check whether our estimates of  $\hat{w}_i$  are driven by one good by re-estimating  $\hat{w}_{i-g}$  excluding good  $g$  from the estimates of (1). This exercise reveals that the  $\hat{w}_{i-g}$  are highly correlated, thus ruling out that previous findings were driven by outliers. A related concern is that the identifying assumption would be violated if differences in prices were due to differences in active waste only for some goods and not for others. Our estimates might then hide these good-specific differences in active waste because we use all sample goods together to estimate  $\alpha$ . For instance, it might be easier to hide bribes in “complex” goods, whose price might be more sensitive to unobservable characteristics, which can then be used to justify paying higher prices. To assess the practical relevance of this concern we split goods into “simple” and “complex”, where “simple” include goods for which unobserved quality differences are unlikely determinant of price, and allow the coefficient of waste to differ by complexity.<sup>23</sup> We then re-estimate (1) and (2)

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<sup>23</sup>Simple goods are: photocopier paper, MS office software, heating diesel, landline and cellular line rental contracts, lunch vouchers, office chairs and office desks. Results are robust to excluding

using the complex good sample only where we expect to find stronger evidence that price differences are due to differences in active waste. Column 6 in Table 3 rules out the possibility our findings were driven by simple goods, as the coefficient of waste is of the same magnitude and precisely estimated when we restrict the sample to complex goods only.

A different class of concerns derives from the possibility that omitted variables might lead us to overstate the role of passive waste. One possibility is that results might instead be driven by differences in the extent of price discrimination faced by different PBs. If indeed price differences were due to differences in discrimination, we would observe PBs that suffer from discrimination to be more likely to buy from Consip when feasible. To assess the potential relevance of this alternative explanation, consider that sellers should be able to charge higher prices to: (i) buyers with low bargaining power and (ii) buyers with a low elasticity of substitution among varieties of the same good. To the extent that bargaining power is positively related to the size of the average purchase, our results do not fit with (i) because, as shown in Table 2, there is no correlation between prices and PB size, measured by yearly expenditures. Our regressions also control for the size of each purchase. If anything, PBs that tend to make smaller purchases, such as mountain communities, pay on average much lower prices than the largest PBs in the sample—ministries and social security institutions. Regarding the second point, we note that the range of product variety available on the Consip catalogue is necessarily smaller than the range available on the market. By revealed preference, PBs that buy from Consip must have a weakly higher elasticity of substitution among varieties compared to PBs that do not buy from Consip. This casts doubt on the explanation that PBs who buy from Consip previously paid higher prices because they faced stronger price discrimination.

Another cause for concern is that if more inefficient managers are also lazier, they might be more likely to buy from Consip to save time even if Consip were to offer higher prices/lower quality goods. Note that this does not invalidate our identification strategy but it does have efficiency implications. To assess whether this is the case, we restrict the sample to PBs that buy a given good from Consip when feasible and we estimate the following regression:

$$\ln p_{igt} = \beta C_{igt} + X_{igt}\gamma + \rho_g \ln Q_{igt} + \eta_g t + \theta_g + w_i + \varepsilon_{igt} \quad (3)$$

where  $C_{igt}$  equals 1 if PB  $i$  buys good  $g$  from Consip at time  $t$  and 0 otherwise,  $X_{igt}$  is a vector of good specific characteristics,  $Q_{igt}$  is the quantity purchased,  $t$  is the time trend,  $\theta_g$  are goods fixed effects and  $w_i$  are PB fixed effects. We allow the

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lunch vouchers, office desks and office chairs from the simple goods category.

effect of quantity and of the time trend to be different for different goods. To assess whether Consip purchases are systematically correlated with goods characteristics, Columns 1 and 2 in Table 4 report estimates of (3), without and with the vector of goods characteristics  $X_{igt}$ . The findings indicate that Consip prices are on average 20% lower if characteristics are not included, whereas the point estimates increases to 28% when characteristics are included. Overall, the results indicate that, if anything, PBs who buy from Consip pay *lower* prices for goods with *better* characteristics.

The fact that purchasing managers might be able to adjust on the quality margin raises the issue that PBs who do not buy from Consip might strategically alter the characteristics of the goods purchased in order to justify buying outside. To assess whether purchasing managers change the characteristics of the goods when buying out of Consip, we restrict the sample to PBs that do not buy from Consip when feasible and we estimate the following regression:

$$\ln p_{igt} = \varphi A_{igt} + X_{igt}\gamma + \rho_g \ln Q_{igt} + \eta_g t + \theta_g + w_i + \varepsilon_{igt} \quad (4)$$

where  $A_{igt}$  equals 1 if good  $g$  purchased by PB  $i$  on the market is available from Consip at time  $t$  and 0 otherwise. All other variables are as defined above. To assess whether Consip purchases are systematically correlated with goods characteristics, Columns 3 and 4 in Table 4 report estimates of (4), without and with the vector of goods characteristics  $X_{igt}$ . The coefficient  $\varphi$  is precisely estimated and very close in magnitude across columns. The findings thus indicate that the existence of a Consip agreement is not systematically correlated with goods characteristics; that is, there is no evidence that PBs who do not buy from Consip change the characteristics of the goods they buy when there is an active agreement.

Another question of interest is whether PBs who do not buy from Consip, do so because they pay lower prices or buy higher quality goods at higher prices. To shed light on this issue we compare the prices paid by PBs who buy from Consip and PBs who do not. To do so, we restrict the sample to periods when a Consip agreement is active for the relevant good and estimate:

$$\ln p_{igt} = \delta C_{igt} + X_{igt}\gamma + \rho_g \ln Q_{igt} + \eta_g t + \theta_g + \varepsilon_{igt} \quad (5)$$

where  $C_{igt}$  equals 1 if PB  $i$  buys good  $g$  from Consip at time  $t$  and 0 otherwise and all other variables are as defined above. Column 5 indicates that PBs who buy from Consip pay on average 17% less. Controlling for goods characteristics, however, Column 6 shows that the point estimate falls to 12%, suggesting that, if a significant difference exists, it is PBs who do not buy from Consip that buy higher quality goods. The results in Columns 5 and 6 thus highlight imperfect substitutability across goods

with different characteristics as a possible reasons why some PBs choose not to buy from Consip.<sup>24</sup>

### 6.3 Part 3: Model Estimates

Our findings so far indicate that price differences across different PBs are due to differences in passive waste more than to differences in active waste. The reduced form estimates, however, do not allow us to measure the impact of active and passive waste. In this section we bring our model to the data and provide a structural estimate of active and passive waste for each PB. This allows us to quantify the contribution of both sources to total waste and to uncover whether the reduced form estimates hide that active waste is an important component for several PBs in the sample.

To do so, we must first re-visit the model with a view to making it amenable to structural estimation. We will make functional assumptions on the price function, the manager’s objective, and the distribution of errors.

Let us begin by assuming that the price function takes the following quadratic form:

$$f_{gt}(b_{igt}, \mu_i) \equiv (1 + \mu_i + b_{igt}^2)\bar{p}_{gt}\varepsilon_{igt},$$

where  $\bar{p}_{gt}$  is a ‘reference price’ (to be discussed later) and  $\varepsilon_{igt}$  is a lognormally independently distributed error. The error is realized *after* the manager makes his decision. This captures price shocks that cannot be anticipated by the purchasing manager at the time when he decides how much personal benefit  $b_{igt}$  to seek: the unforeseen changes the manager may experience have to do with changes in market conditions, the outcome of the bargaining process with the suppliers, and the exact definition of the characteristics of the good.

We assume that the objective function for manager  $i$  (for a single good  $g$  purchased at time  $t$ ) is:

$$\Omega_{igt} = -\frac{f_{gt}(b_{igt}, \mu_i)}{\bar{p}_{gt}} + 2\beta_i b_{igt}.$$

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<sup>24</sup>While the findings in Column 6 are an interesting aside, they obviously do not impinge on the validity of our estimate of the coefficient  $\alpha$  because they are based on observable quality variables, which are controlled for in equation (1) (we compare the switching decisions of public bodies that were buying goods of the same quality before Consip arrived). We can also show that PBs that stay out of Consip buy better goods for “complex” goods only. In the “complex” goods sample, savings are 22% without quality controls and 15% with controls. In the “simple” goods sample they are 7%, both with and without controls. This is consistent with our previous argument that the price of “complex” goods is more sensitive to changes in quality/characteristics.

The active waste component is the same as before (multiplied by two) and hence it deserves no further discussion. The price component says that the cost in terms of payoff of paying price  $p_{igt}$  depends on the reference price  $\bar{p}_{gt}$ . The higher the reference price, the lower the stigma or pressure associated with paying a high price.

In our formal set-up, the reference price is the price paid by a public body which is efficient ( $\mu_i = 0$ ) and has no taste for private benefits ( $\beta_i = 0$ ). Of course, the reference price is not observed directly. However, it is reasonable to assume that a useful benchmark is one that is sometimes reached by at least some PBs (it is hard to imagine that a principal holds her agent to a standard that no other agent meets). In the empirical part we shall assume that the reference price is given by the average price paid by the most efficient PBs (those who pay low prices on average) or by the price paid by Consip, or perhaps the minimum of the two.

The objective function can be re-written as

$$\Omega_{igt} = -(1 + \mu_i + b_{igt}^2)\varepsilon_{igt} + 2\beta_i b_{igt}.$$

The parameters  $\mu_i$  and  $\beta_i$  denote, as before, the propensity to active and passive waste. Note that  $\mu_i \in (-1, \infty)$  and  $\beta_i \in (-\infty, \infty)$  (a negative  $\beta_i$  denotes a manager who receives a negative utility from private benefits).

If we want to use this model for structural estimation, we need to allow public bodies to buy multiple goods. We shall do this in the simplest way, by assuming that there is no direct payoff interaction between purchases. Namely, we assume that the overall payoff of manager  $i$  (over a certain period of time, say a year) is given by

$$\Omega_i = \sum_{g,t} q_{igt} \Omega_{igt},$$

where the  $\Omega_{igt}$ 's are specified above and the weights  $q_{igt}$  represent the amount spent on purchasing good  $g$  at time  $t$ . Such amount is evaluated not at the actual price but rather at the reference price  $\bar{p}_{gt}$ . Given this linear structure, the manager maximizes every  $\Omega_{igt}$  separately.<sup>25</sup>

When Consip is not present, the maximal expected payoff for good  $g$  at time  $t$  is attained when

$$b_{igt} = \begin{cases} \beta_i & \text{if } \beta_i \geq 0 \\ 0 & \text{if } \beta_i < 0 \end{cases}$$

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<sup>25</sup>The no-interaction assumption fails when the purchasing manager is concerned about the overall spending level. Then, paying a high price for good  $g'$  makes him more reluctant to pay a high price for good  $g''$ . However: (1) the importance of this kind of interaction tends to zero as the number of purchases by a public body tends to infinity; (2) There is no obvious reason why this issue would lead to biased estimates.

The equilibrium price is

$$\hat{p}_{igt} = \begin{cases} \bar{p}_{gt} (1 + \mu_i + \beta_i^2) \varepsilon_{igt} & \text{if } \beta_i \geq 0 \\ \bar{p}_{gt} (1 + \mu_i) \varepsilon_{igt} & \text{if } \beta_i < 0 \end{cases}$$

and the maximal expected payoff is

$$\hat{\Omega}_{igt} = \begin{cases} -(1 + \mu_i - \beta_i^2) & \text{if } \beta_i \geq 0 \\ -(1 + \mu_i) & \text{if } \beta_i < 0 \end{cases}$$

When a Consip deal is active, the Consip price is given by  $p_{gt}^c = \gamma_g \bar{p}_{gt}$ , where  $\gamma_g$  may be greater or smaller than one. The manager's payoff if he buys from Consip is:

$$\Omega_{igt}^c = -\frac{p_{gt}^c}{\bar{p}_{gt}} + \nu_{igt},$$

where  $\nu_{igt}$  is normally distributed and i.i.d. and represents the PB's idiosyncratic preference for buying good  $g$  from Consip at time  $t$ . This preference is known when the choice of buying in-Consip or outside Consip is made (because it relates to characteristics of the particular Consip good on sale that are observable on the Consip catalog).

The manager's payoff if he buys outside Consip is:

$$\Omega_{igt}^n = -\frac{f_{gt}(b_{igt}, \mu_i)}{\bar{p}_{gt}} - \delta_g + 2\beta_i b_{igt}^2,$$

where  $\delta_g$  captures a direct (positive or negative) effect of the presence of Consip on incentives.

**Proposition 4** *With the functional forms above, the price equation is*

$$\log p_{igt} = \log \bar{p}_{gt} + \omega_i + \log \varepsilon_{igt} \quad (6)$$

and the switching equation is

$$\Pr(\text{Consip}) = \Pr(-\nu_{agt} < \sigma_i + c_g). \quad (7)$$

**Proof:** The maximal expected payoff for a manager who buys outside Consip when a deal is active is

$$\hat{\Omega}_{igt}^n = -(1 + \mu_i - \beta_i^2) - \delta_g.$$

The manager buys from Consip if and only if  $\hat{\Omega}_{igt}^n \leq \Omega_{igt}^c$ , namely,

$$\nu_{agt} \leq (1 + \mu_i - \beta_i^2) + \gamma_g - \delta_g.$$

Define

$$\omega_i = \log(1 + \mu_i + \beta_i^2) \tag{8}$$

and

$$\sigma_i = \mu_i - \beta_i^2 \tag{9}$$

When a deal is not active, the price equation (in logarithms) yields:

$$\log p_{igt} = \log \bar{p}_{gt} + \log(1 + \mu_i + \beta_i^2) + \log \varepsilon_{igt}. \tag{10}$$

When a deal is active, solving the manager's choice problem yields:

$$\Pr(\text{Consip}) = \Pr(\nu_{agt} \leq (\mu_i - \beta_i^2) + (1 + \gamma_g - \delta_g)) = \Pr(-\nu_{agt} < \sigma_i + c_g). \tag{11}$$

Equations (10) and (11) yield the statement of the proposition. ■

We assume that  $\varepsilon_{igt}$  and  $\nu_{agt}$  are independent and normally distributed, hence we estimate (10) and (11) separately by ordinary least squares and by probit, respectively. This yields estimates of  $\omega_i$  and  $\sigma_i$ .

To illustrate our identification strategy consider that for any given level of waste  $\bar{\omega}$  equation (8) pins down all the combinations of  $\mu_i$  and  $\beta_i$  that yield  $\bar{\omega}$ . In the  $(\mu_i, \beta_i)$  space, this yields “iso-waste” curves that are downward sloping since to keep the same level of waste, an increase in active waste  $\beta_i$  must be compensated by a decrease in passive waste  $\mu_i$ . Likewise, for any given probability of buying from Consip  $\bar{\sigma}$  equation (9) pins down all the combinations of  $\mu_i$  and  $\beta_i$  that yield  $\bar{\sigma}$ . These “iso-probability” curves slope upwards, since to keep the probability unchanged a decrease in  $\beta_i$  that makes buying from Consip more appealing must be compensated by a decrease in  $\mu_i$  that makes it less appealing. The intersection of the two curves identifies  $\mu_i$  and  $\beta_i$ . Combining these with the non-negativity constraint on  $b$ , we can retrieve an estimate of  $\mu_i$  and  $b_i$  for each PB in our sample.

Note that, however, to estimate  $\omega_i$  from (10) we need data on the reference price  $\bar{p}_{gt}$ . As discussed earlier, this should be measured as the price paid by a non-corrupt ( $\beta_i = 0$ ) and efficient ( $\mu_i = 0$ ) PB for a good with the same exact specification purchased at exactly the same time. Since, however, this is unobservable, we estimate the reference prices under two alternative assumptions. First, we assume that an efficient PB would face the same prices as on the Consip catalogue. Since Consip does not cover all specifications of all goods at all points in time, we use observed Consip purchases to impute Consip prices for all goods that were on the catalogue

at some point in time. To be precise, using data on Consip purchases, we estimate price as a function of good characteristics, quantity purchased and time trends. We then use the estimated coefficients to calculate the counterfactual Consip price for all purchases made out of Consip.<sup>26</sup>

It is important to note that under the assumption that Consip is non-corrupt ( $\beta_i = 0$ ) and efficient ( $\mu_i = 0$ ), this strategy yields an upper bound on the estimates of waste. Indeed, to the extent that discounts are proportional to purchase size, even a non-corrupt and efficient PB might not be able to obtain the same prices as Consip because producers expect to sell much larger quantities through a Consip deal than to any single PB.

An alternative strategy is to assume that the sample PBs that pay the lowest prices are effectively non-corrupt and efficient. Again, since we do not observe all specifications of all goods being purchased at every point in time, we follow the same methodology as above to impute counterfactual reference prices. To do so we rank PBs in ascending order of the average price paid as estimated in Section 6.1 and we estimate the prices paid by the PBs in the bottom decile as a function of good characteristics and time trends. We then use the estimated coefficients to calculate the counterfactual reference price for all purchases made by PBs in the top nine deciles.<sup>27</sup> Compared to the first strategy, this yields a lower bound on the estimates of waste since also the best PBs might be inefficient or corrupt to some extent.

Finally, we compare the reference prices computed under the two assumptions, and since, in some instances, the counterfactual Consip price is higher than the counterfactual based on the bottom decile PBs, we adopt the most conservative strategy and use the minimum of the two as reference price. This last reference price

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<sup>26</sup>For each good  $g$  we use Consip purchases to estimate  $p_{gt} = a_g + X_{gt}\mathbf{b}_g + c_g t$ , where  $X_{gt}$  is the same vector of goods characteristics as in (1) and  $t$  is a linear time trend. For each out of Consip purchase we compute the counterfactual price as  $\hat{p}_{gt} = \hat{a}_g + X_{gt}\hat{\mathbf{b}}_g + \hat{c}_g t$ , using the observed  $X_{gt}$  and  $t$  and the estimated coefficients ( $\hat{a}_g; \hat{\mathbf{b}}_g; \hat{c}_g$ ). By design we can only compute counterfactual prices for goods that were on the Consip catalogue at least once and for which we observe variation in  $X_{gt}$ . The former requirement rules out the following: motoroil, refuse bins, servers and car purchases. The latter rules out local networks (cable and switch) for which only one variety exists, workstation desktops, inkjet faxes and inkjet printers. Out of 2920 out of Consip purchases we are able to compute reference prices for 1477 of them. As discussed in section 6.2, however, the average out of Consip prices are not sensitive to excluding any of the sample goods.

<sup>27</sup>In contrast to the previous strategy, this allows us to estimate a reference price for all of the 2920 out of Consip purchases since the bottom decile PBs buy all sample goods. While to compare the findings with the ones obtained with the Consip reference price we need to restrict the sample to observations for which we have both reference prices, we note that the estimates of the relative size of active and passive waste are identical in the larger sample. This is further evidence in favor of the assumption that waste is a PB specific parameter.

can be seen as a robustness check: any reference price lower than this would be a price that is not actually attained, either by Consip or by the set of most efficient PBs.

Table 5 reports the descriptive statistics of  $\mu_i$  and  $b_i$  under alternative assumptions on the reference price  $\bar{p}_{gt}$ . As expected, the estimated waste is higher when the reference price is based on Consip prices rather than on the cheapest prices paid by sample PBs. In the former case, the average PB pays 43% more than the reference price, in the latter, 21% more. Columns (2) and (3) show that, consequently, both active and passive waste are higher when Consip prices are used as reference. Most importantly, Column (4) shows the share of passive waste is independent of the reference price used. On average, at least 82% of waste is passive and passive waste accounts for more than half of total waste for at least 83% of sample PBs. Finally, Column (5) reports the share of PBs for which we obtain a positive estimate of  $b_i$ . In the most conservative scenario, the non-negativity constraint does not bind for 28% of sample PBs, while active waste is zero in 72% of the sample. Thus, while passive waste accounts for most of the cost differences in our setting, a substantial number of PBs exhibit some active waste. Concentrating on the case when the reference price is set at the Consip price, in Figure 3 we plot our estimate of active and passive waste, where each dot represents a different PB. Figure 3 illustrates that the range of  $\mu_i$  is wider than the range of  $b_i$  and that, interestingly, active and passive waste are uncorrelated. This indicates that there appears to be no trade-off between the two forms of waste, namely we find no evidence that low passive waste comes at the price of high passive waste and vice-versa.

Using our estimates of  $\mu_i$  and  $b_i$  for each PB we can compute the average active and passive waste by governance type. In line with the findings in Section 6.1.2, this exercise reveals that waste is significantly higher for PBs belonging to the central administration (ministries and social security) compared to local governments and autonomous bodies. Using the Consip price as reference, we find that the average central administration PB pays 78% more than the reference price, the average local body pays 37% more and the average autonomous body pays 34% more. In line with the reduced form estimates, differences among PBs belonging to different institutional categories are due to passive rather than active waste. The average passive waste parameters are .71, .43 and .42 for central, local and autonomous and the difference between the first and the latter two is statistically significant. In contrast, the average active waste parameters are .06, .08 and .10, and none of the differences is statistically significant. In line with Figure 3, this suggests that in our sample there seems to be no trade-off between rules and discretion. Compared to central PBs, more autonomous PBs have less passive waste and the same level of active

waste. To the extent that giving autonomy to purchasing managers in central PBs would make them behave like their counterparts in universities or health authorities, our evidence indicates that more discretion would not lead to higher active waste. Finally, it is also important to stress that the differences in managerial behavior across governance types might be due to sorting if, for instance, jobs that grant the manager more autonomy attract managers with better skills.

## 7 Conclusion

Our findings indicate that excessive procurement prices paid by Italian public bodies for standardized goods are due to passive waste rather than to active waste. In addition, there is no trade-off between the two forms of waste, namely public bodies with lower passive waste do not have higher active waste. The key driver of passive waste appears to be the mode of governance, with Napoleonic public bodies performing worst, US-style local authorities in the middle, and autonomous agencies as the winners.

Our findings do not imply that corruption is not a serious problem in Italy. Our structural estimates indicate that active waste can generate an additional cost which is up to 11% of the reference price. In the paper that is closest to ours, Di Tella and Schargrodsky (2003) estimate that procurement officers in Argentinian hospitals overprice by 10%.

The figure is also not far from estimates of corruption obtained in settings other than public procurement, such as the 18% loss rate for subsidized rice in Indonesia (Olken 2006); the 9.5% of diverted resources documented in audits of Brazilian local government (Finan and Ferraz 2006a); the 24% of missing expenditures in Indonesian road construction observed by Olken (2007); and the 18/20% of diverted education funds reported by Reinikka and Svensson (2005) in Uganda.<sup>28</sup>

However, our stark results about the importance of passive waste also indicate that economists should not limit their attention to active waste, but they should view sheer inefficiency as a problem which is potentially even more important than corruption.<sup>29</sup>

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<sup>28</sup>The only direct estimate of corruption we are aware of that is clearly larger than ours is by Reinikka and Svensson (2004). It refers to the same program they study in Reinikka and Svensson (2005). The diversion rate they found in 1998 (reported in their 2004 article) was 76%. The figure was down to 18/20% in 2002 (reported in their 2005 article).

<sup>29</sup>Another obvious conclusion from our work is that agencies like Consip can produce considerable public savings. The cost of running Consip is limited (160 people are employed in the procurement department). Public bodies that switch to Consip save 28% of the purchase price. Public bodies

To what extent do these findings provide guidance on related issues? First, our results are obtained for standardized goods, which account for about 40% of Italy’s procurement expenditure.<sup>30</sup> The remaining 60% is spent on one-of-a-kind goods, which range from specialized software to road construction. It is reasonable to expect that both active and passive waste are greater for specialized than for standardized goods. Corruption opportunities increase as those goods are often supplied by local producers and their price is more difficult to compare. Also passive waste may increase as the object to be procured becomes more complex and standard procurement contracts become less efficient (See Bajari and Tadelis (2001) for a model of the trade-off between incentive provision and transaction costs when procurement contracts are incomplete).

Second, it would be interesting to know to what extent our results apply to other countries. Besides the above cited study by Di Tella and Schargrotsky (2003), we are unaware of other analyses of public procurement prices. In Britain the National Audit Office (NAO, 2006) is in the process of collecting information on prices paid by public bodies for standard office goods. So far, the only data available on price disparities covers four categories of goods: toner cartridges, electricity, A4 sheets, and post-it notes.<sup>31</sup> The price disparities (for a homogenous good) between different PBs are high. The good with the lowest disparity is electricity (the highest price is only 73% higher than the lowest price), while the highest dispersion is observed for post-it notes (139%, same size, same brand). While these data are very preliminary, they suggest that the price variation that we observe is not unique to the Italian context.

Third, according to Transparency International’s corruption perception rankings, Italy, with a score of 5/10, is one of the two most corrupt nations in Western Eu-

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that do not switch pay on average 12% more than the price of similar items on the Consip catalog. There are other savings in terms of reduced litigation and reduced administrative costs, which we are unable to quantify.

<sup>30</sup>Likewise, active waste might be more important in other spheres of the public sector, such as public employment (Alesina et al., 2000).

<sup>31</sup>See Table 27 (NAO, 2006). For cartridges and post-it notes, a particular brand was specified. The range represents the difference between the highest price and the lowest price. The data covers purchases by 121 public bodies. “Outliers” were eliminated.

	Price Range	% Variation
Toner cartridge (per cartridge)	£41 to £89	117
Electricity (day rate kWh)	4.8p to 8.3p	73
Box of 5x500 sheet A4 (80g/m2) 100% recycled	£6.95 to £14.95	115
Post-it notes (pack of 12)	£4.41 to £10.55	139

rope and it ranks alongside developing countries such as Malaysia and Tunisia. If corruption perceptions correspond to corruption practices, our findings suggest that passive waste may be an important, if not the dominant, factor to explain government inefficiency for a wide range of countries.

Fourth, it would be interesting to compare public procurement with private procurement. The goods in our sample are bought by firms too. Our same methodology could be applied to study waste and its causes in the private sector and it might provide a new angle to study corporate governance.

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## 8 Appendix 1: Endogenous Passive Waste

In the baseline model in Section 3, active waste is endogenous, in that the purchasing manager chooses the level of private benefit  $b_{igt}$ , but passive waste is exogenously given. For public body  $i$ , it is determined by its inefficiency level  $\mu_i$ .

One may object that purchasing managers can do a lot to overcome institutional barriers. Conversely, even in the best regulatory environment a manager can just shirk. In the present section, we endogenize the level of effort that the manager puts into finding good prices.

If there is no active Consip deal, the price paid by PB  $i$  for good  $g$  at time  $t$  is:

$$p_{igt} = f_{gt}(b_{igt}, m_{igt})$$

where:  $b_{igt} \geq 0$  represents active waste as discussed earlier;  $m_{igt} \geq 0$  represents the quality of the search effort undertaken by public body  $i$  to procure good  $g$  (e.g., searching for best supplier, bargaining, finding creative solutions). The price  $p_{igt}$  is increasing in  $b_{igt}$  and decreasing in  $m_{igt}$ .

The manager has the following objective function

$$-f_{gt}(b_{igt}, m_{igt}) + \beta_i b_{igt} - \mu_i m_{igt}.$$

As before, the parameter  $\beta_i$  denotes public body  $i$ 's active waste propensity. Instead, the parameter  $\mu_i$  captures the cost in terms of effort/risk for the purchasing manager to engage in price-reducing activities.

For instance, suppose that one of the activities that can reduce price is to engage in direct bargaining with potential suppliers. Any PB that undertakes this activity for good  $g$  saves on average 10% of the price of good  $g$ . However, for certain PBs this activity is more expensive than for others. It may be because of regulation (the rules may prohibit the type of informal contacts between public officials and suppliers that are customary in bargaining), because of human capital (the human capital of purchasing managers, who are hired through written scholarly exams, may be skewed towards administrative tasks rather than more entrepreneurial ones), or cultural (suppliers are perceived as 'enemies' that must be kept at arm's length). We assume that the parameter  $\mu_i$  captures the overall cost effect of these elements.

As before, the purchasing manager solves a maximization problem, except that now there are two first-order conditions (as before we focus on interior solutions):

$$\begin{aligned} \frac{\partial}{\partial b_{igt}} f_{gt}(\hat{b}_{igt}, \hat{m}_{igt}) &= \beta_i, \\ -\frac{\partial}{\partial m_{igt}} f_{gt}(\hat{b}_{igt}, \hat{m}_{igt}) &= \mu_i. \end{aligned}$$

The equilibrium payoff for the manager is:

$$\hat{\Omega}_{igt} = -\hat{p}_{igt} + \beta_i \hat{b}_{igt} - \mu_i \hat{m}_{igt}.$$

As before, it is immediate to see that

**Proposition 5** *The off-Consip equilibrium price is an increasing function of both  $\mu_i$  and  $\beta_i$ .*

Suppose now that a Consip deal is active. The Consip price is  $p_{gt}^c$ , and the payoff from buying from Consip is

$$\hat{\Omega}_{igt}^c = -p_{gt}^c + \nu_{igt},$$

where  $\nu_{igt}$  is some idiosyncratic preference for Consip.

If instead the manager buys off Consip he maximizes

$$\delta_g - f_{gt}(b_{igt}, m_{igt}) + \beta_i b_{igt} - \mu_i m_{igt},$$

which yields a certain maximal payoff  $\hat{\Omega}_{igt}^n$ . The manager buys from Consip if and only if  $\hat{\Omega}_{igt}^c \geq \hat{\Omega}_{igt}^n$ .

**Proposition 6** *The probability that the PB switches to Consip is an increasing function of  $\mu_i$  and a decreasing function of  $\beta_i$ .*

**P proof.** The probability of buying from Consip is

$$\Pr \left[ \nu_{igt} \geq p_{gt}^c + \hat{\Omega}_{igt}^n \right].$$

By applying the envelope theorem, we see that  $\hat{\Omega}_{igt}^n$  is increasing in  $\beta_i$  and decreasing in  $\mu_i$ . ■

As before, the result is supported by an economic intuition that applies to a much more general set-up. The active waste parameter  $\beta_i$  expands the purchasing manager's choice set while the passive waste parameter  $\mu_i$  reduces it. Hence, the former makes the Consip option less attractive and the latter makes it more attractive.

## 9 Appendix 2: Goods Characteristics

For each of the sample goods, we list the characteristics we have information on, in addition to price, quantity and date of purchase. Starred variables are significant determinants of price and are included as controls in all regressions. We report the unit of measure in parenthesis for continuous variables. Discrete or indicator variables are equal to 1 if the price includes the service/characteristics, and 0 otherwise.

1. Car Rental: brand, model, rental agreement duration (months)\*, allowed mileage (km)\*, engine size (cc)\*, vehicle class (large sedan, medium sedan, compact car, large van, medium van, small van)\*, insurance deductible (euros), price per extra km above allowance (euros), fuel type, maintenance indicator, car pick up for repairs indicator, replacement car indicator, car replacement days (minimum number of repair days to obtain replacement car), full insurance (kasko) indicator, car wash indicator, leather seats indicator,\* navigator indicator, air conditioning indicator, radio indicator,\* tyre replacement indicator.
2. Photocopier Rental: brand, model, rental agreement duration (months)\*, rental payment frequency (months)\*, speed (pages per minute)\*, number of copies included in rental price\*, cost of extra copies above allowance (euros)\*, printer indicator, fax indicator, sorter indicator, finisher indicator, two sided copies indicator, autofeed indicator\*, autofeed with two sided copies indicator,\* waste collection service indicator, number of hours required to obtain repair assistance, machine replacement indicator, number of hours required to get delivery of paper, ink and other inputs.
3. Laptop Computer: brand, model, processor type, ram size,\* hard drive size,\* screen size,\* cd reader indicator, dvd reader indicator,\* cd writer indicator,\* floppy disk drive indicator, included software, maintenance included indicator,\* maintenance agreement duration (months).
4. Desktop Computer: brand, model, processor type, ram size,\* hard drive size,\* screen size,\* flat screen indicator,\* screen included indicator,\* cd reader indicator, dvd reader indicator, cd writer indicator, dvd writer indicator, wi-fi indicator, floppy disk drive indicator, workstation indicator,\* included software, maintenance included indicator,\* maintenance agreement duration (months).
5. Office Desk: brand, model, shape (rectangular or l-shaped), width (cm), depth (cm),\* drawers indicator, drawers type (fixed or on wheels), drawers price if not included in desk price, desk cover material, desk frame material,\* safety certificate indicator,\* fire hazard classification, warranty (number of months), delivery included indicator,\* assembly included indicator,\* fitting included indicator.
6. Office Chair: brand, model, armrest indicator, armrest type (fixed or adjustable),\* backrest type (height adjustable, reclinable, both), safety certificate indicator,\* fire hazard classification, warranty (number of months), delivery included indicator,\* assembly included indicator.\*

7. Landline Contract: billing frequency.
8. Projector: brand, model, type (LCD or DLP),\* brightness level (5 categories),\* contrast level (5 categories),\* resolution level (3 categories),\* maintenance indicator, duration of maintenance contract (months), maintenance location indicator (in shop or on site).
9. Switch Network: brand, model, inspection indicator, customized design indicator, installation indicator, configuration indicator, trial indicator, maintenance indicator, duration of maintenance contract (months), maintenance parts included indicator.
10. Cable Network: brand, model, type, inspection indicator,\* customized design indicator,\* installation indicator,\* configuration indicator, trial indicator,\* labelling indicator, system management indicator,\* certification indicator,\* number of fibers,\* maintenance indicator, duration of maintenance contract (months), maintenance parts included indicator.
11. Heating Diesel: supplier, transport included indicator, payment due date.
12. Motoroil: oil type (synthetic, semi-synthetic, mineral),\* office delivery indicator, oil use (for petrol engines, small diesel engines, large diesel engines), payment due date.
13. Lunch Voucher: brand, model, contract duration,\* e-voucher indicator,\* invoice mode (upon delivery, upon use),\* payment due date.\*
14. Refuse Bin: brand, model, office delivery indicator, material (zinc, polyethylene, other), size (cubic meters).\*
15. Paper: brand, producer, type (natural or recycled),\* format (A3, A4, Letter),\* color indicator,\* delivery mode (to premises, at street level, warehouse collection), contract duration (months), delivery delay indicator, payment due date (days), forest sustainable indicator, low chlorine content indicator, weight (grams per square meter).
16. Mobile Phone Contract: service provider.\*
17. MS Office Software: type (standard, professional, premium),\* version (97, 2000, xp),\* license type (education/government).\*

18. Printer: brand, model, type (needle, inkjet, laser),\* color indicator, speed (pages per minute),\* two-sided indicator,\* netlink indicator,\* finisher indicator, drawer indicator,\* materials included indicator.
19. Server: brand, model, os system indicator (windows, linux, unix),\* shape (desk, rack, tower),\* number of processors\*, type (entry level, mid-range, advanced),\* ram size,\* number of slots,\* back up facility indicator,\* number of back up facilities, maintenance indicator, duration of maintenance contract (months)
20. Car Purchase: brand, model, type (car, van, suv)\*, class (large sedan, medium sedan, compact car, large van, medium van, small van),\* engine size,\* fuel type, maintenance included indicator, police car indicator,\* security car indicator, rescue car indicator, custom design indicator, design included indicator, beaming light indicator, siren indicator,\* two-way radio indicator, custom color indicator,\* navigator indicator\*, air conditioning indicator,\* radio indicator.\*
21. Fax Machine: brand, model, type (inkjet, laser),\* speed (page per minute),\* modem speed,\* automatic charge indicator, maintenance indicator, duration of maintenance contract (months).

## 10 Appendix 3: Strategic Timing

To test whether purchasing managers strategically alter the time of purchases to avoid the periods with active agreements or to buy while an agreement is active, we analyze how the probability of making a purchase changes as the start of an agreement approaches and just after the end of the agreement. Purchasing managers may know when each agreement is due to start as this is publicized on the Consip website, although this is unlikely to be announced with much advance. They also know the latest date at which each agreement is due to end, although agreements could end earlier than the expiry date if the entire quantity the supplier committed to is exhausted before the expiry date.<sup>32</sup>

If managers time purchases strategically, we expect their strategy to differ depending on whether they want to avoid or wait for agreements. Managers who want to avoid agreements periods, would want to purchase just before the start or just

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<sup>32</sup>Note, however, that most purchasing managers were not very familiar with the inner workings of Consip. Moreover, a purchase typically requires a complex appropriation decision. Bringing forward the appropriation decision is difficult (and usually outside the control of the purchasing manager). Delaying a purchase once the appropriation decision is made may have budgetary consequences (and may leave the public body without the good in question).

after the end of an agreement. Viceversa, managers who want to wait, would not purchase just before the start or just after the end. To take into account this difference, we analyze the timing of purchases separately for PBs that buy from Consip and PBs that do not.

Figure A2 shows the distribution of purchases in the 60 days that precede and the 60 days that follow the agreement. The figure shows no evidence of strategic timing, namely the timing of purchases is not affected by the fact that the start of an agreement is approaching or an agreement just ended.

Table A1 is the regression equivalent of Figure A2. We divide the sample by PBs that buy from Consip and PBs that do not and estimate:

$$B_{gt} = \alpha_0 + \alpha_1 D_{gy} + \eta_g t + \eta_m + \eta_y + \eta_g + \varepsilon_{gt},$$

where  $B_{gt} = 1$  if we observe a purchase of good  $g$  on day  $t$ ,  $\eta_m$ ,  $\eta_y$ , and  $\eta_g$  are month, year and good fixed effects and  $t$  is the time trend, which we allow to vary by good.

Our variable of interest is  $D_{gy}$ , which measures the time until the start of the agreements in columns (1), (2), (5) and (6), and the time after the end of an agreement in the remaining columns. In the odd-numbered columns  $D_{gy}$  is measured in number of days, in the even columns we use splines at ten days interval. Throughout  $\alpha_1$  is small and not significantly different from zero, thus supporting our assumption that purchasing managers do not alter the timing of their purchases to avoid or wait for Consip agreements.

Figure 1: Model Prediction

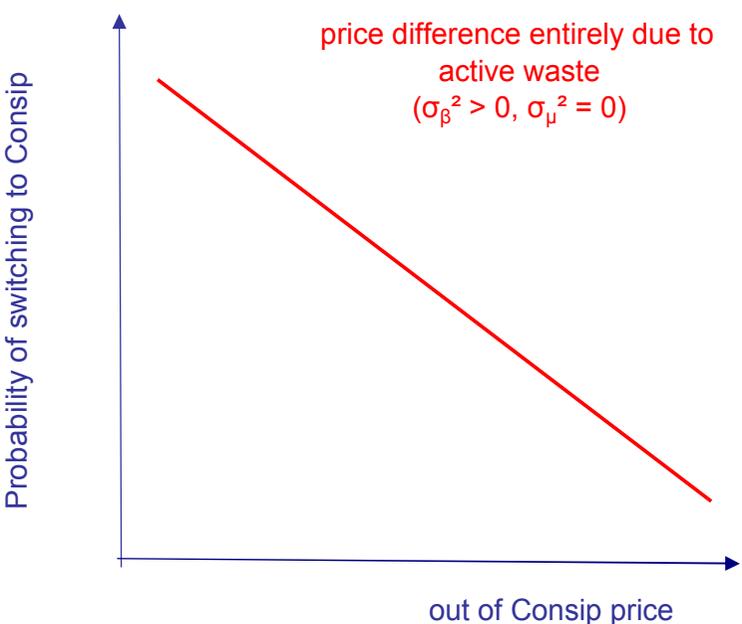
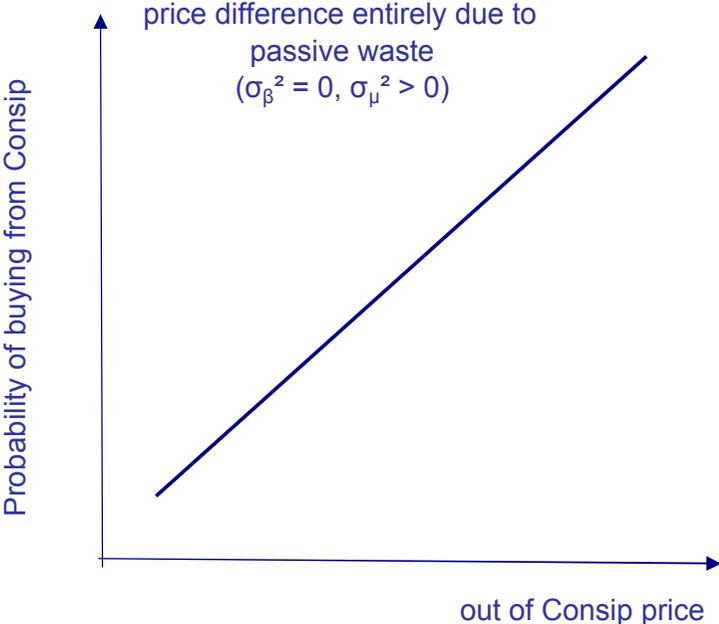
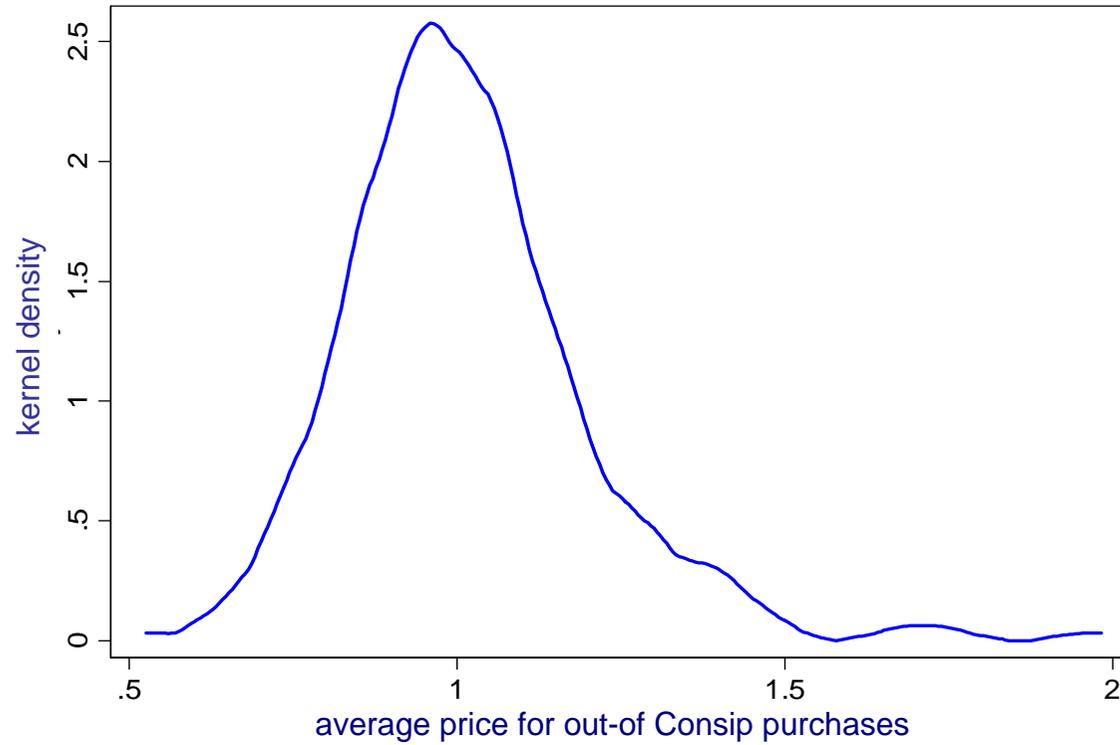


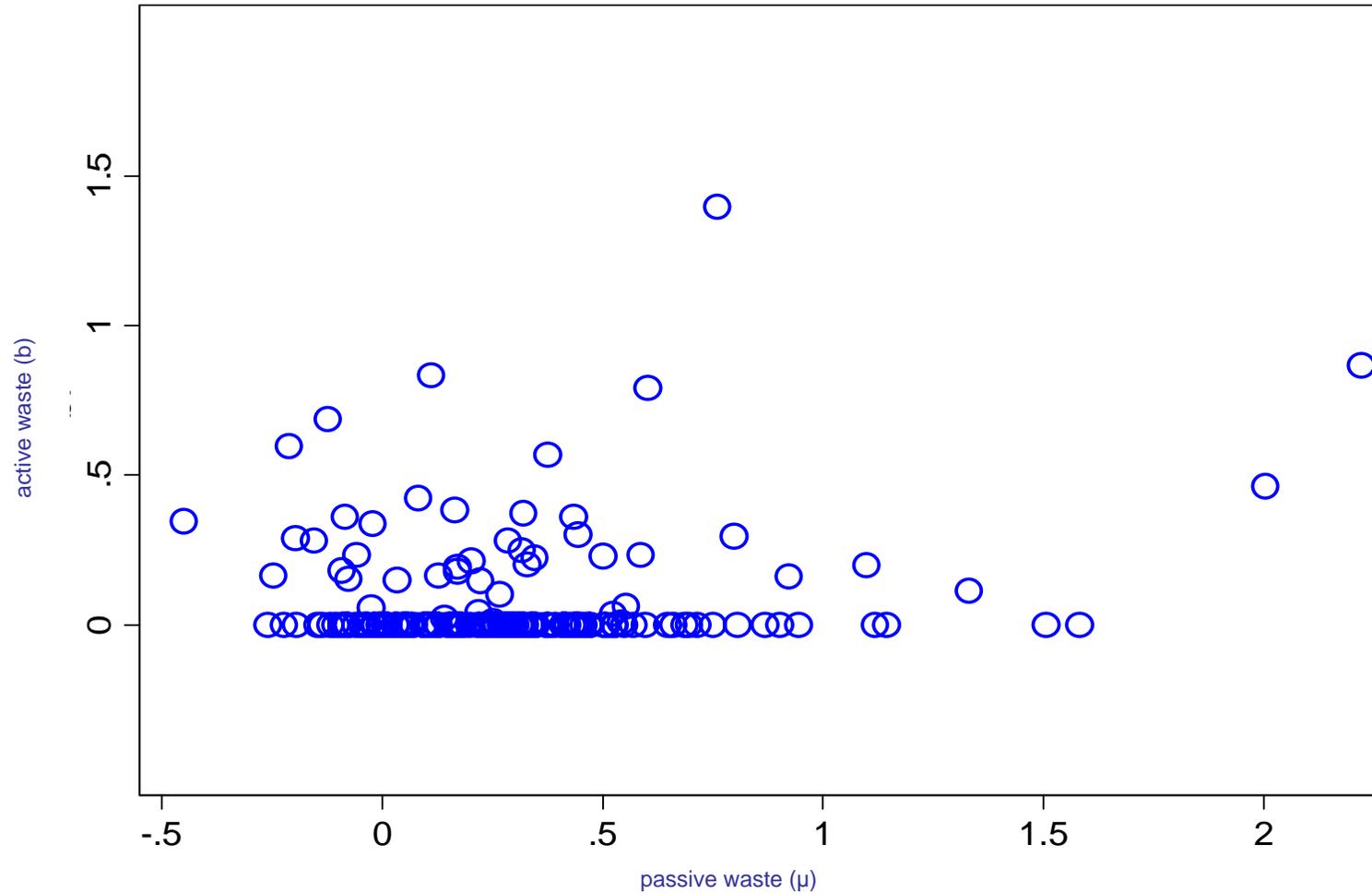
Figure 2: Average Prices of Goods not Purchased from Consip



percentile	1	10	50	90	99
average price	0.67	0.79	1	1.23	1.68

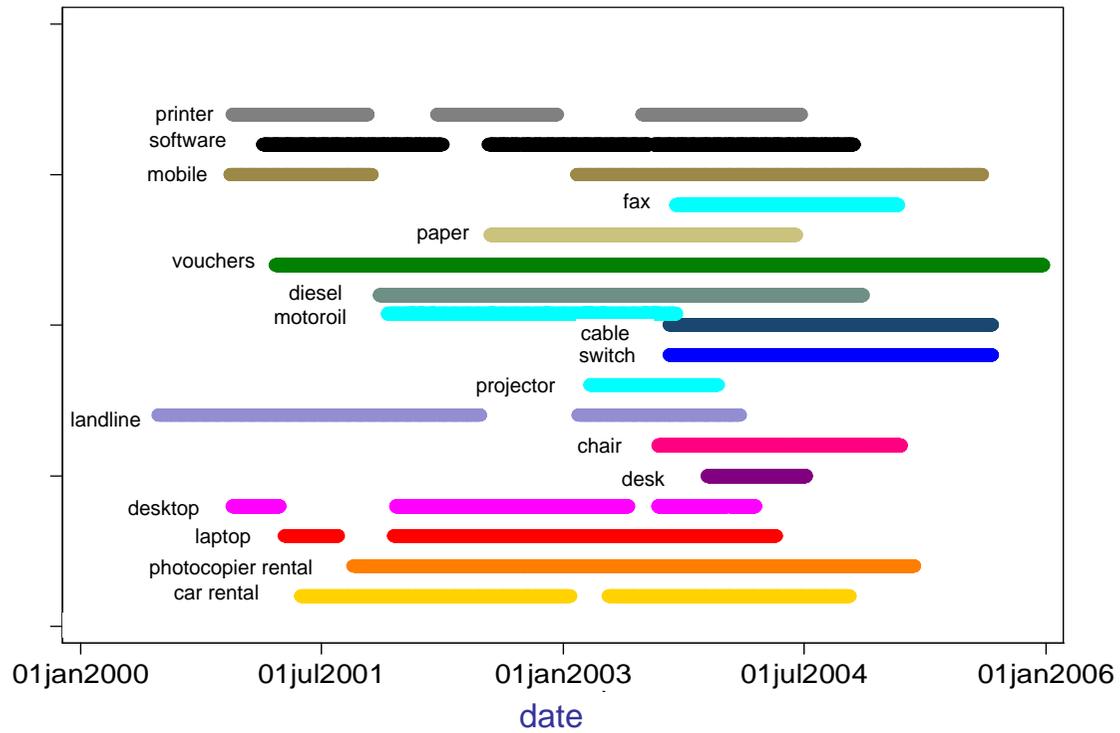
**Note:** The average price for out-of Consip purchases is estimated for each PB as the exponent of PB i's fixed effect in the regression of log price on: goods fixed effects, good specific trends, good specific quantities and good specific characteristics, using the sample of purchases made when a Consip agreement was not active.

Figure 3: Active and Passive Waste



**Note:** Each point represents a different PB. For each PB, passive and active waste are estimated from the price equation (6) and the selection equation (7) as explained in Section 6.3 under the assumption that the reference price is the estimated Consip price for a good with the same characteristics.

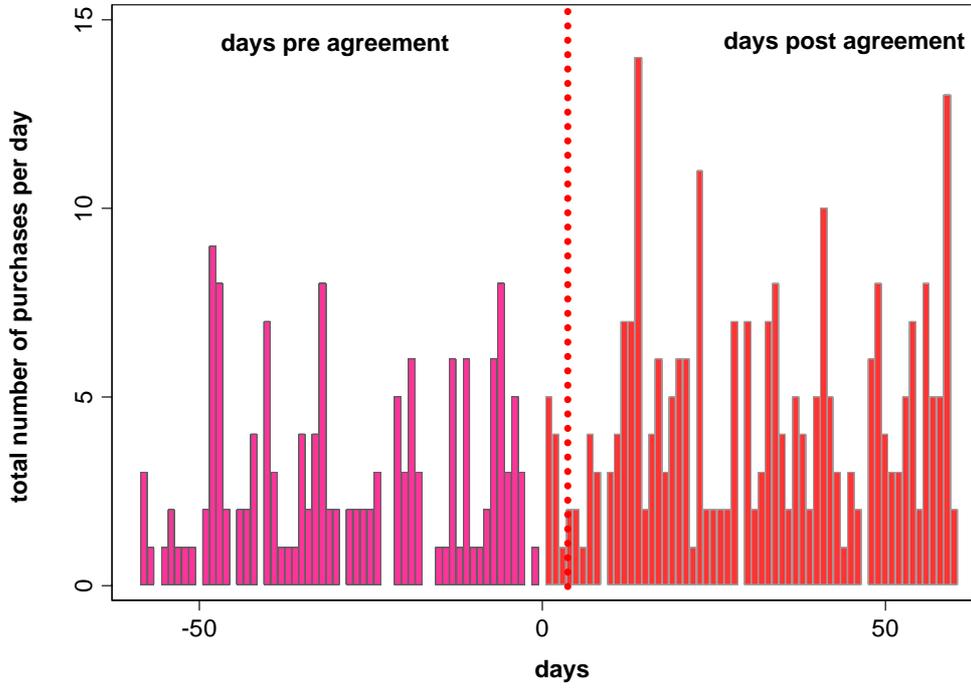
Figure A1: Timing of Consp Agreements, by Good



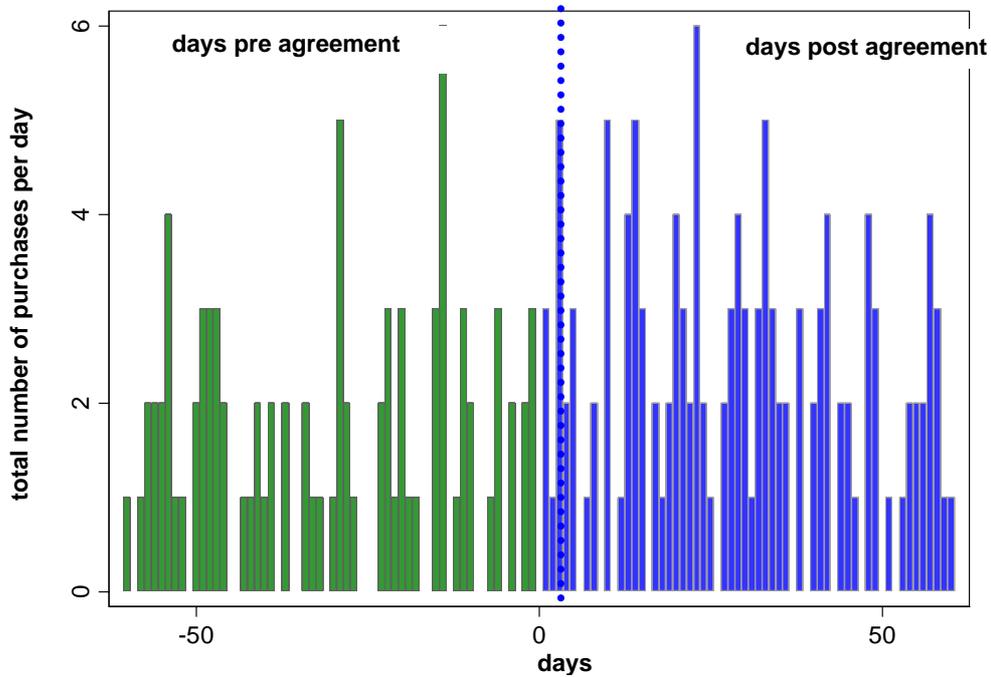
Note: For each good, the line is full on dates when an agreement is active, blank when there is no active agreement.

Figure A2: Timing of Purchases

Panel A: PBs that do not buy from Consip

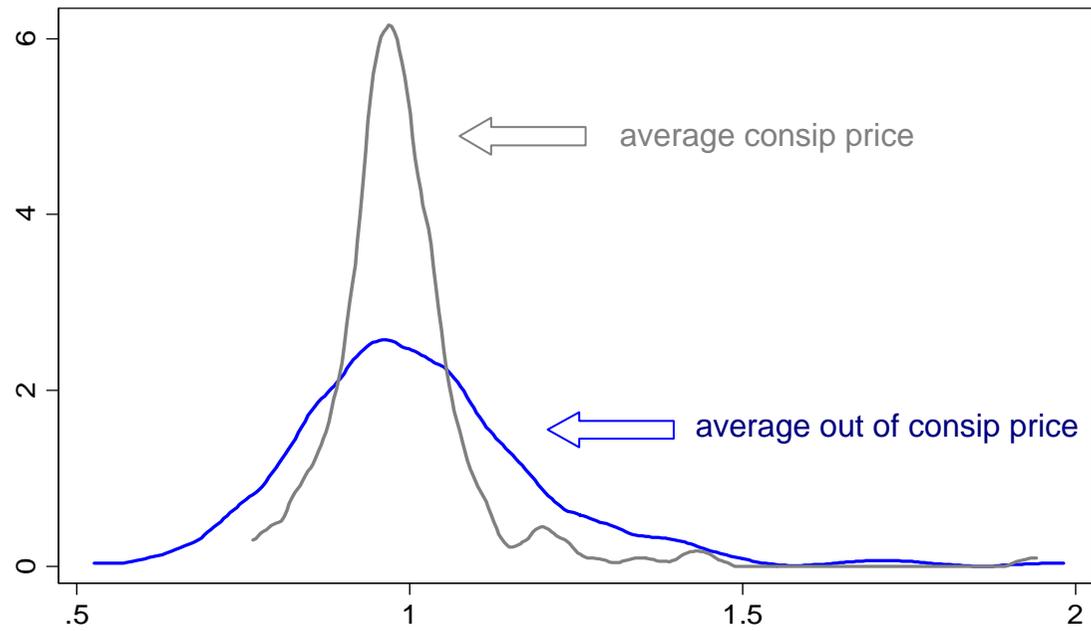


Panel B: PBs that do buy from Consip



**Note:** The figure illustrates the number of purchases of all goods on the 60 days before the start of a consip agreement and on the 60 days after the end of the agreement. For each good, panel A only includes purchases by PB that do not buy the good from Consip when the agreement is active, whereas panel B only includes purchases by PB that buy the good from Consip when the agreement is active.

Figure A3: Average Price of Consip and Out of Consip Purchases



**Note:** The average price for out of consip purchases is estimated for each PB as the exponent of PB i's fixed effect in the regression of log price on: goods fixed effects, good specific trends, good specific quantities and good specific characteristics, using the sample of purchases made when a Consip agreement was not active. The average price for consip purchases is estimated following the same procedure, using the sample of purchases made from the Consip catalogue.

Table 1: Sample Description

1a: Public Bodies Sample

Governance Class	Number of PBs	Total Expenditure by Sample PBs in 2000 (E million)	Total Expenditure by Sample PBs over Total Expenditure by All PBs in 2000 (E million)	Average Number of Goods Purchased	Percentage of Total Purchases Made when a Consip Agreement is Active	Percentage of Consip Purchases Made when a Consip Agreement is Active
<b>1. napoleonic bodies</b>						
Ministries and Government	12	13,368	0.92	12.2	59	62
Social Security Administration	3	1,952.90	0.78	10.5	61	57
<b>2. local governments</b>						
Regional Councils	12	1,683.90	0.61	10.6	51	26
Province and Town Councils	70	4,162.20	0.21	11.9	51	39
<b>3. semi-autonomous bodies</b>						
Health Centres	81	6,894.20	0.48	11.8	56	35
Mountain Village Councils	11	34.2	0.13	10.5	54	33
Universities	13	354.5	0.43	12	53	34
<b>4. other</b>						
	6	462.3	0.29	11.8	44	45

**Note:** The "other" category includes: The National Statistical Institute (ISTAT), the Institute for International Trade (ICE), the Higher Institute of Health (ISS), the National Research Institute (CNR), a Veterinary Research Center, and a Regional Research Institute. Total Expenditure by Sample PBs equals yearly expenditure for goods and services summed over all sample PBs in a given class. Total Expenditure by All PBs equals yearly expenditure for goods and services summed over all the PBs belonging to that institutional class. Source: ISTAT

### 1b: Goods Sample

	(1)	(2)	(3)	(4)	(5)
Good Type	Observations	Average Price	Average Quantity per Order	Percentage of Days when a Consip Agreement is Active	Percentage of Consip Purchases when an Agreement is Active
Car Rental	160	399.5 (208.6)	4.81 (9.58)	53	68
Photocopier Rental	466	510.69 (844.52)	13.06 (30.18)	58	64
Laptop	775	1219.7 (458.52)	6.5 (30.1)	45	35
Desktop	648	992.5 (587.5)	16.0 (62.84)	39	47
Office Desk	245	232.1 (171.9)	11.9 (26.02)	10	11
Office Chair	280	96.6 (52.7)	30.4 (86.2)	25	5
Landline Contracts	143	1.89 (.74)	125272 (292636)	50	94
Projector	191	1438.0 (647.3)	1.82 (2.44)	13	44
Local Network: Switch	215	138.7 (269.9)	164.4 (298.5)	33	7
Local Network: Cable	102	3.33 (4.71)	8631.1 (3245.3)	33	26
Motoroil	23	5.19 (2.01)	681.34 (1155.1)	41	0
Heating Diesel	248	3.85 (13.81)	293583 (504625)	50	30
Lunch Vouchers	231	70.04 (4.57)	665895 (1418723)	79	52
Refuse Bins	63	152.63 (184.94)	290.76 (768.58)	0	0
Paper	755	2.40 (.922)	6546.5 (22626.2)	32	9
Mobile Phone Contracts	183	.041 (.102)	1244620 (5011294)	57	59
MS Office Software	155	233.2 (91.5)	151.1 (483.1)	56	20
Printer	294	483.95 (576.7)	22.6 (96.9)	43	47
Server	297	5967.5 (6772.6)	3.45 (9.24)	0	0
Car Purchases	345	10710.3 (6112.7)	4.02 (11.23)	0	0
Fax	249	338.16 (158.85)	6.89 (18.02)	45	41
<b>Total</b>	<b>6068</b>				

**Note:** For goods purchases, price equals the cost of one unit. Motor oil and Heating Diesel are measured in liters, Cables are measured in meters. For goods rentals, price equals the monthly rent for one unit of the good. For Landline contracts, price equals the per-minute charge for national calls. For Mobile contracts, price equals the per-minute charge for calls to landlines. Quantity equals the number of items in a single purchase, except Heating Diesel and Motoroil, where quantity is measured in liters, Cables, where quantity is measured in meters, and Landline, Mobile and Lunch Vouchers where quantity is measured as total yearly outlay. Column (4) reports the number of days during which an agreement was active over the total number of days in our sample. During our sample Consip did not make agreements for refuse bins, car purchases and servers. Column (5) reports the number of purchases from the Consip catalogue divided by the total number of purchases made while an agreement is active for the good in question.

Table 2: Prices and PB Characteristics

Dependent Variable is the Average Price for Out of Consip Purchases  
Linear Model- Standard Errors in Parenthesis

	(1)	(2)	(3)	(4)
<b>geography</b> (omitted: north)				
south-oc	.019 (.050)			-.036 (.095)
south	-.005 (.034)			-.062 (.059)
centre	.082** (.034)			.008 (.036)
<b>size</b>				
log expenditure	.024** (.011)			-.010 (.018)
<b>social capital variables</b>				
donations		-2.43** (.856)		-1.23 (.758)
referenda voter turnout		.172 (.268)		-.145 (.482)
share of people who trust		.024 (.143)		.147 (.158)
<b>governance types</b> (category omitted: university)				
<b>napoleonic bodies</b>				
Ministries and Government			.397*** (.103)	.394*** (.138)
Social Security			.229*** (.036)	.224*** (.076)
<b>local bodies</b>				
Regional Councils			.184*** (.054)	.207*** (.069)
Province and Town Councils			.109*** (.029)	.126*** (.034)
<b>semi-autonomous bodies</b>				
Health Centres			.038 (.028)	.063* (.037)
Mountain Village Councils			.030 (.065)	.065 (.074)
Adjusted R-squared	.0689	.0592	.2320	.2515
Observations	202	189	202	189

**Notes:** (\*\*\*) (\*\*) (\*), indicate significance at the 1, 5, and 10% respectively. The omitted category for the type variable is "Universities". The omitted category for the geographical variable is "North". South-oc identifies the southern regions with high prevalence of organized crime (Campania, Puglia, Calabria and Sicilia). Six PBs that do not belong to any of the three governance classes are excluded from the sample. Donation is the number of blood bags (each bag contains 16oz of blood) per million inhabitants in province collected by AVIS, the Italian association of blood donors, in 1995 among its members. Referenda voter turnout covers participation in all referenda between 1946 and 1987 averaged through time at the province level. Share of people who trust is measured at the province level from the World Value Survey for Italy 1990 and 1999. Sample size falls because these variables are not available for eight provinces. More details on the construction of the social capital variables can be found in the appendix of Guiso et al. (2004), who kindly provided the data.

Table 3: Buying from Consip as a Function of Out of Consip Prices  
 Dependent Variable =1 if good purchased via Consip  
 Linear Probability Model-Standard Errors Clustered by PB-Good Type in parenthesis

	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline	Good FE	Trends	Different Regimes	Regimes Interaction	Complex Goods Sample
Out of Consip Price	.228***	.232***	.219***	.193***	.253***	.182**
	(.078)	(.063)	(.059)	(.057)	(.083)	(.068)
Compulsory Regime (=1 if yes)				.240***	.240***	
				(.028)	(.028)	
Out of Consip Price X Compulsory Regime					-.107	
					(.105)	
Good FE	No	Yes	Yes	Yes	Yes	Yes
Good Specific Trends	No	No	Yes	Yes	Yes	Yes
R-squared	.0060	.2429	.2753	.3037	.3040	.1630
Observations	3122	3122	3122	3122	3122	1579

**Notes:** (\*\*\*) (\*\*) (\*), indicate significance at the 1, 5, and 10% respectively. Out of Consip Price is estimated as PB i's fixed effect in the regression of log price on: goods fixed effects, good specific trends, good specific quantities and good specific characteristics, using the sample of purchases made when a Consip agreement was not active. The Compulsory Regime variable equals 1 when PBs were required to buy from Consip if there was an active agreement for an equivalent good. This regime applied to PBs belonging to the Central Public Administration between 2000 and 2002 and to all PBs in 2003. "Complex" goods are cars (purchases and rental), desktops, laptops, fax machines, printers, photocopiers, servers, projectors and local cable networks. "Simple" goods are: photocopier paper, MS office software, heating diesel, landline and cellular line rental contracts, lunch vouchers, office chairs and office desks.

**Table 4: Price Savings and the Quality Margin**  
 Dependent Variable is Log(Price)  
 Linear Model- Robust Standard Errors in Parenthesis

	(1)	(2)	(3)	(4)	(5)	(6)
<i>sample:</i>	<i>PBs that buy from Consip</i>		<i>PBs that do not buy from Consip</i>		<i>All PBs, while agreement is on</i>	
Agreement Purchase (=1 yes)	-0.199*** (.040)	-0.276*** (.038)			-0.171*** (.027)	-0.125*** (.028)
Agreement Active (=1 if yes)			.017 (.030)	-.013 (.026)		
PB FE	Yes	Yes	Yes	Yes	No	No
Good Characteristics	No	Yes	No	Yes	No	Yes
R-squared	.9611	.9769	.9529	.9663	.9447	.9553
Observations	3764	3764	4632	4632	2873	2873

**Note:** (\*\*\*), (\*\*), (\*), indicate significance at the 1, 5, and 10% respectively. All regressions include good and year fixed effects, good specific trends, and good specific quantities. The sample in Columns (1) and (2) is restricted to PBs that buy the good from Consip when an agreement is active for that good. The sample in Columns (3) and (4) is restricted to PBs that do not buy the good from Consip when an agreement is active for that good. The sample in Columns (5) and (6) includes all PBs but is restricted to days when an agreement is active for that good.

Table 5: Estimates of Passive and Active Waste

reference price	(1) average waste ( $1+\mu+b^2$ )	(2) average passive waste ( $\mu$ )	(3) average active waste ( $b^2$ )	(4) share of passive waste ( $\mu/(\mu+b)$ )	(5) share of PBs for which ( $\mu/(\mu+b)$ )>0.5	(6) share of PBs for which $b>0$
consip	1.43	.320	.093	.833	.838	.226
bottom decile PBs	1.21	.148	.053	.822	.828	.192
minimum (consip, bottom decile)	1.56	.425	.113	.829	.843	.288

**Note:** passive and active waste are estimated from the price equation (6) and the selection equation (7) as explained in Section 6.3. The reference prices in rows 1, 2, and 3 are respectively the estimated Consip price for a good with the same characteristics, the estimated price paid by PBs in the bottom decile of the distribution of average out of Consip prices for a good with the same characteristics, and the minimum of the two.

Table A1: Purchase Timing

Dependent Variable =1 if good is purchased on day, 0 otherwise

OLS estimates; robust standard errors in parenthesis

	PBs that do not buy from Consip				PBs that buy from Consip			
	60 days before agreement		60 days after agreement		60 days before agreement		60 days after agreement	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>continuous measures</b>								
number of days before agreement	.016				.001			
	(.017)				(.011)			
number of days after agreement			-.0002				.015	
			(.023)				(.015)	
<b>splines</b>								
number of days before/after agreement:								
11-20		.004		.111		.017		.016
		(.023)		(.042)		(.016)		(.029)
21-30		-.002		.040		.003		.024
		(.024)		(.036)		(.013)		(.030)
31-40		.015		.074		-.023		.018
		(.026)		(.038)		(.020)		(.030)
41-50		.003		.042		-.007		.009
		(.029)		(.038)		(.032)		(.028)
51-60		-.042		.074		-.020		-.004
		(.029)		(.039)		(.021)		(.030)
good FE	yes	yes	yes	yes	yes	yes	yes	yes
good specific trend	yes	yes	yes	yes	yes	yes	yes	yes
year and month FE	yes	yes	yes	yes	yes	yes	yes	yes
observations	1338	1338	858	858	1338	1338	858	858
R-squared	.1431	.1303	.2939	.2765	.1497	.1427	.2649	.2557

**Notes:** (\*\*\*) (\*\*) (\*), indicate significance at the 1, 5, and 10% respectively. The omitted category for the number of days before/after agreement is 1-10. The sample in Columns (1)-(4) is restricted to PBs that do not buy from Consip when it is feasible to do so. The sample in Columns (5)-(8) is restricted to PBs that do buy from Consip when it is feasible to do so. In addition, the sample in columns (1),(2), (5) and (6) is restricted to 60 days before the start of each agreement for each good. The sample in Columns (3), (4), (7) and (8) is restricted to 60 days after the end of each agreement for each good.