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## **Indirect Savings from Public Procurement Centralization**

Clarissa Lotti and Giancarlo Spagnolo

# Indirect Savings from Public Procurement Centralization\*

Clarissa Lotti<sup>†</sup> and Giancarlo Spagnolo<sup>‡</sup>

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## Abstract

An influential study by Bandiera, Prat and Valletti (2009) exploits the introduction of a central purchasing agency in Italy to identify the amount and sources of public waste. Among other findings, it estimates that purchasing through a central agency directly saves 28% on prices. We find that centralized prices also have significant indirect effects, leading to a 17.7% reduction among non-centralized ones. The indirect effects of centralization appear driven by informational externalities – rather than an improved outside option – on less competent public buyers purchasing more complex goods. Accounting for indirect savings also increases the estimate of direct ones.

**Keywords:** Centralization, Informational externalities, Procurement, Public Contracts.

**JEL Classification:** D44, H11, H57, H83, L38, L88.

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<sup>†</sup>University of Rome Tor Vergata. Email: clarissa.lotti@alumni.uniroma2.eu.

<sup>‡</sup>Stockholm University, University of Rome Tor Vergata, EIEF, and CEPR. Email: spagnolo-gianca@gmail.com.

# I Introduction

Public procurement, the governments' purchase of goods and services from private contractors, accounts for around 15% of GDP in most economies (WTO, 2018), up to 20% for developing economies, and is on the rise. The efficiency of the procurement process directly influences the availability and quality of government-provided goods and services that are often crucial to social welfare and growth. Improving this efficiency is important, and there seem to exist large margins in light of the wide performance heterogeneity across and within countries documented by recent research.<sup>1</sup> One organizational lever that can be used for such a purpose is centralization.

The COVID-19 pandemic brought centralization back to the center of the public debate (e.g., American Medical Association (2020, April 14)). Specifically, the devastating experience of the outbreak was accompanied by a crisis in the public procurement of health-related supplies. At various points, different levels of government and public agencies within a country bid against each other, and widespread abuses of increased discretion were allowed by certain emergency regulations (Bandiera, Bosio and Spagnolo, 2021).

In contrast, procurement centralization has the potential to enable speedy and transparent acquisitions without excessive discretion, simultaneously limiting public spending through buyer power/coordination and economies of scale.<sup>2</sup>

Centralization also entails important costs, including difficulties in satisfying or adapting to specific local needs, loss of relationships with local suppliers, possible barriers to entry for small and medium-sized enterprises (SMEs), and a lack of control over non-contractible quality.<sup>3</sup> In light of these potential costs and benefits, it is essential to quantify the effects of centralization empirically.

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<sup>1</sup>See e.g. Best, Hjort and Szakonyi (2017); Bosio et al. (2020); Decarolis et al. (2020); Bandiera et al. (2021).

<sup>2</sup>See U.S. House of Representatives (2006); Bandiera, Prat and Valletti (2009).

<sup>3</sup>See e.g. Dimitri, Dini and Piga (2006); Alonso, Dessein and Matouschek (2008).

This paper focuses on monetary savings in public spending, one of the main arguments in favor of centralizing procurement. In addition to direct savings from public administrations that buy through a central procurement agency, this study identifies sizable *indirect* savings from public administrations that *do not* purchase through the central agency but are still affected by its entry, something that until now has been overlooked, at least to our knowledge.

We build on Bandiera, Prat and Valletti (2009) (henceforth BPV), who skillfully exploit the establishment of the Italian central public procurement agency (Consip) as a quasi-experiment to identify the sources and levels of waste of public funds in Italy. Among other contributions, BPV provide the first causal estimate of the direct effects of centralization on public savings. The authors find that public bodies that purchase through Consip save 28%, on average, on the price of goods and services.<sup>4</sup> Furthermore, the study suggests that indirect effects may be present, as the out-of-Consip price function may differ from the one purchasing managers faced before Consip entered the market.

This paper uses the same policy experiment and the same data on procurement purchases that BPV made publicly available after publication. We implement a difference-in-differences research design, exploiting the fact that Consip's entry into different markets took place at varying points in time. We estimate the indirect savings from centralization in terms of price reductions obtained by public administrations that did not buy from Consip but whose purchases followed its entry in the specific market. Our first main finding is that, when controlling for the characteristics of goods, these indirect effects reduce the price of non-centralized purchases by 17.7%, on average.

We then investigate the origin of the estimated indirect effects, exploring the two most obvious candidate mechanisms: information externalities (benchmarking information) and increased buyers' outside options.

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<sup>4</sup>The estimate is 20% in the baseline specification, but it rises to 28% when the characteristics of goods are also controlled for.

Information externalities stem from the publicly observable lower price that Consip obtains when auctioning framework agreements for a large fraction of Italian public demand (about 40% at the time). This allows public administrations purchasing outside Consip to learn and benchmark their reserve prices against those obtained by Consip (in fact, public bodies were required to use the quality and price standards of Consip’s agreements as a reference when autonomously purchasing comparable goods). Grennan and Swanson (2020) analyze a related informational effect for US hospitals that subscribe to a web-based benchmarking database that provides information on other hospitals’ previous purchases. A publicly observable benchmarking price from a well-informed central buyer may also discourage or limit corruption, as prices can no longer be easily inflated without raising suspicion about the purchase.

The improved outside option, on the other hand, would be linked to the availability of an active Consip agreement from which public bodies can purchase. In this case, if public bodies fail to reach favorable offers in their decentralized acquisitions, they have the option to switch to the centralized agreement. This option should pressure suppliers to reduce decentralized prices.

To disentangle the role of these two plausible mechanisms, we exploit the fact that information externalities only depend on Consip’s having previously entered a specific market. Contrary to the improved outside option, they do not require an active central agreement. Our analysis suggests that the indirect effects we estimate are mainly linked to information externalities: the prices of non-centralized purchases do not seem to fluctuate based upon the presence or the expiration of a centralized agreement, which would create or remove the outside option, respectively.

We then explore the heterogeneity of these indirect effects across different types of purchases and buyers. We find that the indirect savings result mainly from complex goods such as laptops, projectors, and fax machines. This is consistent with the effects being driven by informational externalities that – contrary to the improved outside option – are less

relevant for simple goods such as paper or copper cable.

The second heterogeneity dimension we explore connects our paper to a recent and growing literature on buyers' characteristics as determinants of public procurement outcomes.<sup>5</sup> In line with related studies, we find that heterogeneity among public authorities in terms of governance and competence has important implications. Perhaps surprisingly, we find that most of the indirect savings from centralization are obtained by *less* competent public buyers. Our preferred interpretation is that the most competent administrations are already able to establish plausible prices for complex goods in the absence of a central purchasing body, and therefore learn little from the price it obtains. This would be consistent with Bucciol, Camboni and Valbonesi (2020), who find that the introduction of reference prices by a supervisor in the Italian medical devices market reduces prices for less competent public buyers and increases them for more competent ones.

The price of non-centralized purchases is the benchmark that BPV use to estimate the 28% direct savings from buying from the central agency. Our results imply that this benchmark was significantly deflated by the indirect effects, leading to an underestimation of the direct effects. We show that accounting for the indirect effects lifts the estimate of the direct savings up to 46.8%. However, adding brands to BPV's controls for quality pushes in the opposite direction, leading to a final revised estimate of direct savings of 29%.

Using our results, we can then calculate the total savings caused by centralization. If our sample was representative, considering that Consip's entry led to about 40% of spending moving through the central agency, the average total (direct and indirect) savings caused by this episode of centralization amounted to 22% of the overall expenditures on goods and services, or to 1.8% of GDP per year (the total expenditures on goods and services was 8% of GDP in the relevant period).

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<sup>5</sup>In addition to BPV, see Best, Hjort and Szakonyi (2017); Bucciol, Camboni and Valbonesi (2020); Chiappinelli (2020); Decarolis et al. (2020, 2021).

In addition to BPV, a number of recent studies have tried to assess the direct effects of public procurement centralization on savings. For example, Clark, Coviello and De Leverano (2021) and Ferraresi, Gucciardi and Rizzo (2021) examine the impact of procurement centralization in the Italian health system.<sup>6</sup> Dubois, Lefouili and Straub (2021) assess the effect of centralized procurement on drug prices in seven low- and middle-income countries.<sup>7</sup> These studies do not consider possible indirect effects but are consistent with our finding that the effect of centralization varies considerably across types of goods and services.

On a different note, Decarolis, Castellani and Rovigatti (2018) exploit the most recent wave of centralization reforms in Italy between 2015 and 2017, which made acquisition using active central contracts compulsory. The authors find evidence that public bodies manipulate the size and timing of acquisitions to avoid delegating the purchase to the central agency (we and BPV do not find these manipulations in our sample, as the institutional context was very different).<sup>8</sup>

The rest of the paper is organized as follows. Section II describes our institutional framework and data. Section III discusses the econometric model. Section IV presents the main results regarding indirect savings. Section V investigates the mechanisms underlying indirect savings, and Section VI explores the heterogeneous effects. Section VII presents the revised estimates for direct savings. Section VIII briefly concludes.

## II Institutional Framework and Data

**Institutional framework.** The Italian central procurement agency, Consip, was established in 2000. It procures goods and services via framework agreements, i.e., general

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<sup>6</sup>Leveraging the staggered implementation of statutory centralization for different medical devices, Clark, Coviello and De Leverano (2021) document a 15% reduction in prices and a 20% increase in delivery times for centralized purchases relative to non-centralized ones. Similarly, using local health authorities' balance sheet data, Ferraresi, Gucciardi and Rizzo (2021) show that the presence of a regional purchasing body is associated with a 2-8% reduction in expenditures but no change in the provision of health services. Moreover, the authors find that savings come from areas that suffer from poor institutional quality.

<sup>7</sup>They find that centralized public procurement leads to 15% lower prices on average. However, the reduction is smaller when the supply side is more concentrated.

<sup>8</sup>See Appendix B for a detailed analysis.

contracts committing the centrally selected supplier to deliver goods or services within a certain time frame at specified prices and conditions to any public administration requesting them. In the period analyzed, public bodies could choose to buy from Consip or on the open market, albeit to a varying extent. The use of Consip framework agreements was mandatory for the central administration from 2000 to 2002, while other public bodies were free to join on a voluntary basis. The compulsory regime was briefly extended to all public bodies in 2003, then replaced by the voluntary use of framework agreements for all public bodies in 2004 and 2005.

In practice, even when public bodies were formally obliged to purchase from Consip, they could justify external purchases by claiming that Consip products did not meet their specific requirements (Bandiera, Prat and Valletti, 2009). Such discretion implies that there was no need for public bodies to manipulate the timing or size of purchases in order to maintain their autonomy.<sup>9</sup>

**Data.** The database used in this paper is the same used in BPV; it covers procurement purchases of generic goods made by a sample of Italian public bodies (PBs) during the period 1999–2005. It is the result of a survey designed and implemented by ISTAT, the Italian statistical agency, and was made publicly available by BPV after publication.<sup>10</sup> It contains 6,068 observations on purchases by 208 PBs for 21 goods, all characterized by comparability, diffusion, and relevance in terms of total spending (e.g., stationery and office furniture, computers, and utilities).

We observe unique, anonymous PB identifiers, together with PB characteristics such as region and governance type. More specifically, PBs include the following: ministries and the central government, social security administrations, regional councils, province and town councils, health centers, mountain village councils, universities, and other bodies. For

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<sup>9</sup>One concern is that public bodies may strategically alter the characteristics of the goods they purchase in order to keep buying out-of-Consip. However, BPV show that there is no evidence of such manipulation. Nevertheless, to avoid possible bias, we carefully control for goods characteristics and quality in our analysis.

<sup>10</sup>The data and code used by the authors can be found on the American Economic Association website at the following link: <https://www.aeaweb.org/articles?id=10.1257/aer.99.4.1278>.



each contract, we observe price, quantity, and goods characteristics such as brand, model, delivery, and maintenance conditions, which allows us to assess the quality of purchases. In addition, we observe the date of the purchase and, for each type of good, the date of Consip's entrance into the market and whether there was an active agreement at the time of the purchase.

For the purpose of our analysis, we focus on a subsample of contracts relating to goods that were purchased both before and after Consip entered the market and for which Consip negotiated at least one deal during the sample period. The resulting sample contains 3,794 observations on purchases of 13 (out of the original 21) goods by the same 208 PBs.

Table 1 summarizes the data for the different PB categories. Spending per year varies dramatically across PB type, ranging from an average of €2 million for mountain village councils to €678 million for province and town councils. PBs in all classes buy the 13 different types of goods with the exception of social security administrations and mountain village councils, which buy, respectively, 11 and 12 different types of goods. Although most of the purchases by PBs took place after Consip entered the market, many of the purchases were made externally. The share of (post) out-of-Consip purchases ranges between 0.47 for ministries and 0.80 for universities. This share decreases if we consider only the out-of-Consip purchases made while a Consip deal was active, but it continues to be heterogeneous between PB classes: in line with BPV, we notice that central PBs are more likely to buy from Consip than local PBs and semi-autonomous bodies. This finding could be due to heterogeneous preferences or the institutional context, and in particular, may result from how central PBs have been subject to the compulsory centralized purchasing regime longer than other PBs (albeit with the possibility of circumventing this obligation).

Table 2 summarizes the data for the 13 goods categories, documenting a substantial dispersion in price: the average coefficient of variation within good-year across PBs is 0.78, but this ranges from a minimum of 0.05 for lunch vouchers to a maximum of 2.06 for mobile

Table 1: Sample characteristics by public body category

	N. of total observations	N. of PBs	N. of different goods purchased	Average yearly expenditure	Share of yearly expenditure	Post-Consip purchases	Out-of-Consip purchases	Purchases while deal active	Out-of-Consip while deal active
Ministries and government	454	12	13	425.71	0.16	0.83	0.47	0.64	0.29
Social security	36	3	11	100.03	0.07	0.94	0.69	0.58	0.33
Regional councils	171	11	13	132.95	0.06	0.88	0.79	0.52	0.43
Province and town councils	952	71	13	678.53	0.31	0.91	0.73	0.56	0.37
Health centers	1,151	81	13	543.20	0.25	0.88	0.69	0.57	0.39
Mountain village councils	102	11	12	2.19	0	0.85	0.67	0.62	0.43
University	516	13	13	165.54	0.10	0.91	0.80	0.52	0.41
Other	412	6	13	77.64	0.04	0.88	0.78	0.56	0.46

*Notes.* Column 1 shows the number of total observations. Column 2 the number of PBs in each class. Column 3 the number of different goods purchased by each PB class. Column 4 the average yearly expenditure in millions of euros. Column 5 the average share of expenditure of each PB class in a year over total expenditure in a year. Column 6 the fraction of post-Consip purchases on total purchases. Column 7 the fraction of post-out-of-Consip purchases. Column 8 the fraction of purchases while a Consip deal is active. Column 9 the fraction of out-of-Consip purchases while a deal is active.

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Table 2: Sample characteristics by good type

	N. of total purchases	N. of different PBs	Post-Consip purchases	Out-of-Consip purchases	Purchases while deal active	Out-of-Consip while deal active	Average quantity per order	Average price	Coefficient of variation (price)
Laptop	752	190	0.99	0.86	0.40	0.26	5.88	1,209.02	0.36
Office desk	245	111	0.60	0.93	0.58	0.51	11.95	232.12	0.73
Office chair	280	122	0.70	0.96	0.70	0.66	30.40	96.61	0.54
Landline contracts	143	89	0.97	0.13	0.92	0.06	125,272.10	1.90	0.31
Projector	191	103	0.89	0.84	0.36	0.20	1.82	1,437.94	0.41
Local network: switch	215	99	0.65	0.95	0.65	0.60	164.36	138.75	1.86
Local network: cable	101	52	0.67	0.82	0.67	0.50	8,704.67	3.35	1.44
Lunch vouchers	231	131	0.97	0.50	0.97	0.47	665,895.50	70.05	0.05
Paper	755	195	0.96	0.96	0.42	0.38	6,546.51	2.40	0.38
Fax	249	148	0.85	0.71	0.69	0.41	6.89	338.16	0.44
Mobile phone contracts	183	121	0.92	0.54	0.79	0.32	1,244,620.00	0.04	2.07
Office software	155	119	0.95	0.82	0.91	0.73	151.07	233.17	0.39
Printer	294	148	0.96	0.82	0.38	0.20	22.58	483.95	1.15

*Notes.* Column 1 shows the number of total purchases. Column 2 the number of different PBs purchasing each good. Column 3 the fraction of post-Consip purchases on total purchases. Column 4 the fraction of out-of-Consip purchases. Column 5 the fraction of purchases while a Consip deal is active. Column 6 the fraction of out-of-Consip purchases while a deal is active. Column 7 the average quantity per order: quantity equals the number of items in a single purchase, except cables, where quantity is measured in meters, and landline, mobile, and lunch vouchers, where quantity is measured as total yearly outlay. Column 8 reports the average price: for goods purchases, price equals the cost of one unit; cables are measured in meters; 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. Column 9 shows the coefficient of variation of price within good-year across PBs.

phone contracts.<sup>11</sup> Table 2 also shows that when a deal is active, all the goods in the sample are purchased both from Consip and externally, but with considerable variation, potentially reflecting a variation in the relative attractiveness of the Consip deal.

Table 3 lists the number of days a deal has been active for each good. In most cases, Consip has only negotiated one deal in the sample period; however, for a few goods, there is also a second deal and, for two goods only, a third deal.

Table 3: Number of days a Consip deal was active

	First deal	Second deal	Third deal
Laptop	120	865	-
Office desk	222	-	-
Office chair	549	-	-
Landline contracts	729	364	-
Projector	287	-	-
Local network: switch	730	-	-
Local network: cable	730	-	-
Lunch vouchers	729	1,009	-
Paper	691	-	-
Fax	1,158	-	-
Mobile phone contracts	319	918	-
Office software	406	365	456
Printer	304	271	358

*Notes.* Each column shows the number of days a Consip agreement has been active for each type of good: the first column refers to the first deal, the second column to the second deal and the third to the third deal – if a second or third deal had been negotiated.

### III Empirical Strategy

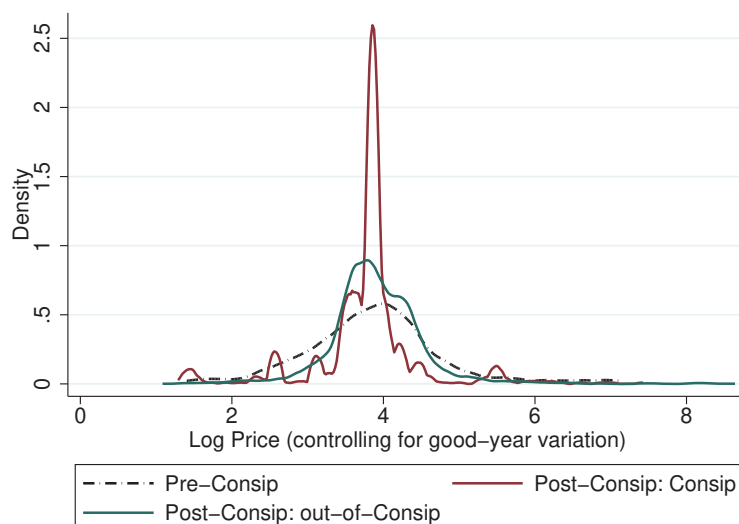
The treatment considered in this paper is Consip’s entry into the relevant market, that is, PBs’ ability to access centrally negotiated framework agreements for the purchase of the specific good or service and the possibility to observe the centrally negotiated price.

Figure 1 provides a preview of our approach and results, displaying the distribution of the logarithm of prices (controlling for good-year variation) paid by PBs for their purchases,

<sup>11</sup>To ensure comparability across different months and years, each price is normalized according to the monthly consumer price index.

distinguishing between pre-Consip, Consip, and (post) out-of-Consip purchases. We note that the price distribution of Consip purchases is characterized by a lower dispersion and by a clear reduction in the average price compared to the pre-Consip distribution. This first result confirms that the central purchasing agency generates significant direct savings. The preliminary evidence on indirect savings is less sharp, but it is important to consider that the reported distributions do not control for the quality of the goods purchased, which may be important if, for example, PBs make external purchases to procure goods of higher average quality.

Figure 1: Price Distribution Pre- and Post-Consip



*Notes.* The figure shows price distributions (after controlling for good-year variation) for: pre-Consip, Consip and (post) out-of-Consip purchases.

In what follows, we discuss the research designs and regression specifications that allow us to comprehensively identify the indirect effects and the mechanisms behind them.

**Research design.** Consip’s entrance into different markets took place at different points in time, and the data provide us with information on this timing for each market. Simultaneously, the data allow us to observe the prices paid by PBs for the various goods before

and after Consip’s entrance into the specific market and whether or not PBs chose to use the agreements negotiated by the central purchasing agency.<sup>12</sup> We exploit this variation by means of a difference-in-differences research design.

Let  $p_{igt}$  denote the price paid by PB  $i$  in period  $t$  for good  $g$ , and let  $PostConsip_{gt}$  be an indicator variable equal to one from the moment  $t$  when Consip enters the market for good  $g$ . Let  $X_{igt}$  denote a vector of good characteristics and  $Q_{igt}$  a vector of quantities (allowed to be different for each type of goods). We remove from the sample all purchases made through Consip and estimate the regression model:

$$\ln p_{igt} = \alpha + \beta PostConsip_{gt} + X_{igt}\gamma + \rho_g Q_{igt} + \theta_g + w_i + \eta_t + \epsilon_{igt}, \quad (1)$$

where  $\theta_g$ ,  $w_i$ , and  $\eta_t$  are, respectively, goods fixed effects, PBs fixed effects, and time effects. The treatment effect  $\beta$  captures the indirect savings generated by procurement centralization.

Public bodies fixed effects are a fundamental part of our identification strategy because they allow us to control for time-invariant unobserved individual characteristics that may be relevant in determining the choice to buy externally. Indeed, the purchasing manager’s choice to buy without using Consip, provided that there is an active Consip agreement in the market, may be motivated by specific characteristics or preferences, such as a preference for quality – if the goods available in the Consip catalog are not deemed adequate – or conversely, a preference for corrupt practices. It is also important to stress that there is no endogeneity concern related to quantity in the regression because out-of-Consip there is no choice of how much to buy based on price – when running a procurement auction, PBs must state upfront the quantity they are purchasing.

Finally, with regard to goods characteristics, we observe a large number of potential covari-

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<sup>12</sup>In our sample, all goods at a certain point were subject to a Consip framework agreement that all PBs could access.

ates, including good-specific variables (e.g., for laptops: processor type, RAM size, hard drive size, screen size, included CD reader/DVD reader/CD writer/floppy disk/software) and delivery and maintenance conditions.<sup>13</sup> We select the characteristics to be included in  $X_{igt}$  using the post-double-selection (PDS) lasso procedure introduced in Belloni, Chernozhukov and Hansen (2014). This machine learning method implements the lasso estimator to select the controls in the presence of a large set of potential control variables in a consistent manner that does not lead to wrong estimates of the standard errors. Specifically, the lasso is used twice. The first step predicts the dependent variable based on all potential covariates. This helps select variables that are good predictors of the dependent variable and therefore obtain robust and consistent estimates and increase the power. The second step performs the lasso to predict the treatment variable based on all potential covariates. The final choice of controls to be included in the regression model is the union of the variables selected in these two steps.

## IV Indirect Savings Estimates

Estimates of indirect savings are shown in Table 4. Each column refers to a different specification. In column 1, we control for quantity purchased, good fixed effects, PB fixed effects, and year and month effects. Since the price that a public body pays for a certain good depends on the quality of that good, in column 2, we also control for goods characteristics, which are selected using the PDS lasso methodology. In column 3, we replace time effects with PB-specific linear time (month-year) trends, which help us to control for the possibility of differential growth trajectories in prices for distinct PBs. Finally, in column 4, we add goods characteristics to this specification, once again selecting them with the PDS lasso methodology.

Across specifications, the estimates are consistently negative and statistically and economically significant. In detail, if we focus on the specification in column 4, which includes

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<sup>13</sup>We assign the sample mean (or the mode in case of categorical or dummy variables) to missing goods characteristics.

Table 4: Indirect Effects of Centralization

	(1)	(2)	(3)	(4)
Post Consip	-0.199*** (0.066)	-0.183*** (0.066)	-0.168** (0.071)	-0.177*** (0.067)
Good characteristics	No	Yes	No	Yes
Quantity purchased	Yes	Yes	Yes	Yes
Good fixed effects	Yes	Yes	Yes	Yes
PB fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	No	No
Month dummies	Yes	Yes	No	No
Linear PB trends	No	No	Yes	Yes
Observations	3,101	3,101	3,101	3,101
R-squared	0.947		0.951	

*Notes.* The dependent variable is the logarithm of price. Good characteristics are selected by the PDS lasso procedure. Robust standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

PB-specific linear time trends, this implies that Consip's entrance into the market led to a price reduction for public administrations that did not buy from the central purchasing agency of 17.7%.

## V Mechanisms Behind Indirect Savings

Our results establish that public procurement centralization leads to lower prices in purchases made external to the central agency. In this section, we assess the strength of the mechanisms behind these indirect effects, focusing on information externalities and the improved outside option. We argue that while information externalities depend exclusively on Consip having entered the market, the outside option effect requires the presence of an active deal.

Based on this consideration, a preliminary way to disentangle information and outside option effects is by exploring the heterogeneous effect of *PostConsip* between periods

when a deal is active and periods when a deal is not active in the relevant market. These results are reported in Table 5 and show that, although the effect on price is negative in both periods, as expected, the greatest savings are generated when there is no active deal. This finding could be interpreted as evidence that the most relevant mechanism behind the indirect savings is informational externalities from the price obtained by the central purchasing authority.

Table 5: Mechanisms underlying Indirect Savings

	(1)	(2)	(3)	(4)
Post Consip $\times$ Active Deal	-0.264*** (0.068)	-0.205*** (0.067)	-0.220*** (0.072)	-0.190*** (0.066)
Post Consip $\times$ No Active Deal	-0.600*** (0.098)	-0.472*** (0.098)	-0.473*** (0.093)	-0.388*** (0.086)
Good characteristics	No	Yes	No	Yes
Quantity purchased	Yes	Yes	Yes	Yes
Good fixed effects	Yes	Yes	Yes	Yes
PB fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	No	No
Month dummies	Yes	Yes	No	No
Observations	3,101	3,101	3,101	3,101
R-squared	0.948		0.952	

*Notes.* The dependent variable is the logarithm of price. Good characteristics are selected by the PDS lasso procedure. Robust standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

It is puzzling, however, that the price reduction is lower when a deal is active – as if the outside option reduced indirect savings. We try to understand this puzzle by considering possible confounding effects, such as “time to market” and “time to learn.” On the one hand, it takes time from when PBs identify the procurement need and prepare the call for a tender to the point where the tender is carried out and awarded. It is possible that Consip’s entry into the market occurs only after the tender process has begun, and for this reason, it may not exert any influence on the auction outcome. On the other hand, PBs may need time to learn how to extract the benefits from centralization in their decentralized purchases. These effects could bias downwards savings in the short run, and consequently,



while a Consip agreement is active. Another confounding factor that could have the same implications is product obsolescence. If we assume that the degree of obsolescence is good-specific and time-invariant, this should be captured by goods fixed effects. If not, either way, it should be accounted for by the time-varying characteristics of the goods that we include in our model.<sup>14</sup>

## V.I Event-Study Analysis

We now develop an event-study analysis to observe directly and in greater depth the evolution of out-of-Consip prices over time. This approach should help us to understand the mechanisms behind indirect effects better, and in particular, the possible role played by the two confounding effects just mentioned.

The first event we consider is Consip’s entry into the market. Since only for some goods will Consip sign a second or a third deal during the period, we focus on the first entry episode, which is also in line with our definition of the treatment variable in the regression analysis. We include observations in a window around the time  $t_0$  of Consip’s entry into the market, aggregating time in quarters, and estimate the following equation:

$$\ln p_{igt} = \alpha + \sum_{t=t_0-n}^{t_0+N} \beta_{1,t-t_0} PostConsip_{gt} + X_{igt}\gamma + \rho_g Q_{igt} + \theta_g + w_i + \epsilon_{igt}. \quad (2)$$

The coefficients  $\beta_{1,t-t_0}$  capture changes in prices at different leads and lags to and from the time of first entry. Since we cannot identify all the coefficients, we restrict the coefficient in the quarter before entry to zero.

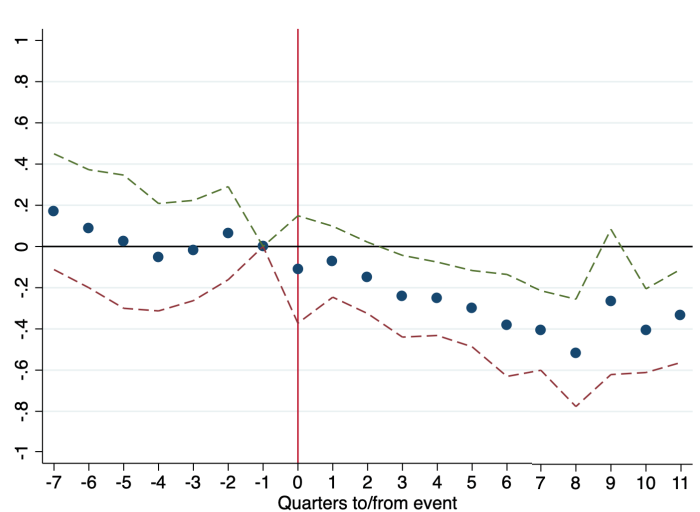
Figure 2 shows the estimated coefficients for prices together with 95% confidence intervals.<sup>15</sup> The vertical line refers to the quarter of the first entry  $t_0$ . We can verify that there are no pre-trends in prices, which allows us to exclude anticipation effects and to confirm

<sup>14</sup>The variables we control for are precisely those found relevant in previous studies, such as Doms et al. (2004) in the case of personal computers. The event study analysis below and the one in Appendix C, specific for technologically complex goods, confirm that our model accurately controls for obsolescence.

<sup>15</sup>Standard errors are clustered by public body type, good, and year.

the validity of our difference-in-differences estimation strategy. We can also see that the estimated coefficients turn negative exactly at the time of entry and continue to decrease over time until two years after the event. Then we observe a trend reversal, though the coefficients remain negative. The evidence of a progressive reduction of prices over time (until the trend reversal) is compatible with the hypotheses that time to learn and time to market effects are present, making it more difficult to distinguish between information externalities and an improved outside option.

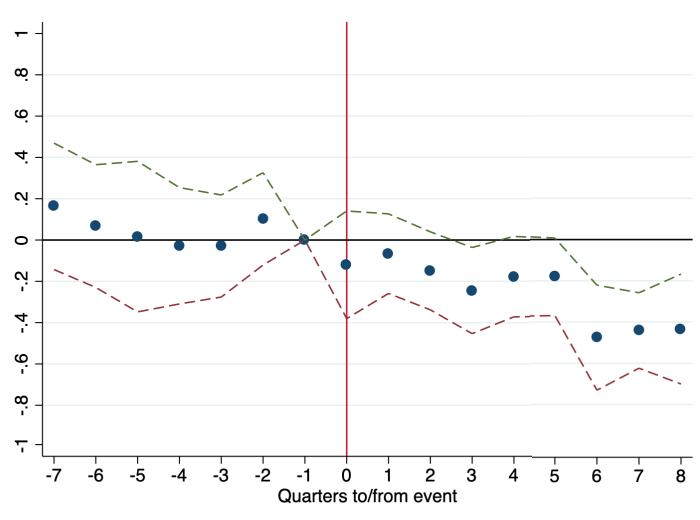
Figure 2: Event-Study Analysis: Out-of-Consip Prices – Entry



*Notes.* The figure displays estimated change in log prices at different lags and leads since the time of first Consip's entry (denoted by a vertical line). All coefficients are expressed relative to the effect in the year before entry; 95 percent confidence intervals are reported. See text for details.

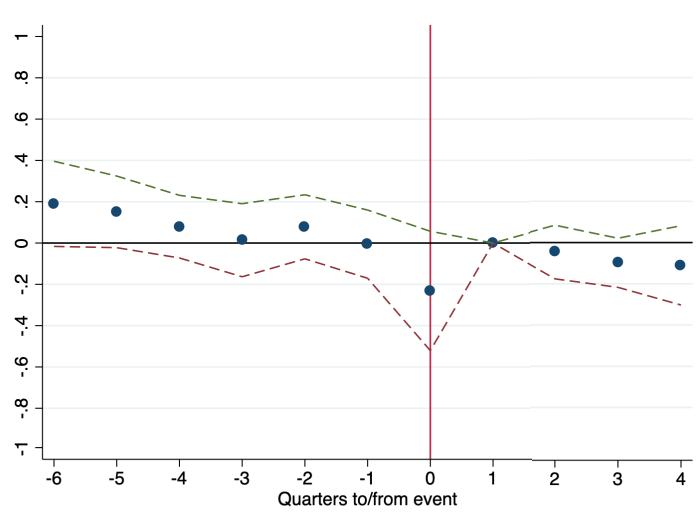
Figure 3 attempts to shed more light on the relative importance of these mechanisms by replicating the event study analysis around Consip's entry into the market but restricting the post-Consip period only to when there is an active agreement. Since the information externalities and the improved outside option can only operate simultaneously as long as there is an active agreement, we should see greater price reductions in this case. However, no major differences emerge with respect to the analysis for the entire post-Consip period.

Figure 3: Event-Study Analysis: Out-of-Consip Prices – Entry (while Active Deal)



*Notes.* The figure displays estimated change in log prices at different lags and leads since the time of first Consip's entry (denoted by a vertical line) and as long as there is an active deal. All coefficients are expressed relative to the effect in the year before entry. See text for details.

Figure 4: Event-Study Analysis: Out-of-Consip Prices – Exit



*Notes.* The figure displays estimated change in log prices at different lags and leads since the time of first end of a deal (denoted by a vertical line). All coefficients are expressed relative to the effect in the year after exit; 95 percent confidence intervals are reported. See text for details.

Finally, in Figure 4, we perform an event study analysis around the end of the first Consip deal, restricting the coefficient in the quarter after exit to zero. If the improved outside option is relevant, we should observe that prices rise after the end of the deal. However, we find that there are no significant changes. Taken together, these results confirm that the improved outside option mechanism does not seem to play an important role in generating indirect savings.

## VI Heterogeneity Analysis

We extend our regression model to allow for various types of heterogeneity in the treatment effect depending on the market and PB type. To identify heterogeneous effects by market, we interact the *Post Consip* indicator with dummy variables for each good. Table 6 reports the results and highlights remarkable heterogeneity. We observe that significant indirect savings emerge only in markets with technologically complex goods, such as laptops, projectors, and fax machines (for which the coefficient is significant at 5% at least). A possible interpretation is that simpler goods are more easily comparable, leave less room for price heterogeneity or differentiation, and are therefore already rather competitive before centralization takes place. If a market is more transparent and competitive (which is captured by good fixed effects), it is plausible that Consip’s entry into the market does not generate strong information externalities and the connected indirect savings.

The second dimension of heterogeneity we investigate relates to the type of PB. In Table 7, we interact the *Post Consip* indicator with dummy variables for each PB institutional class.<sup>16</sup> We find that only some classes of PBs generate significant indirect savings: social security administrations, regional councils, universities, and health authorities. The result is particularly significant and consistent across the different specifications for health authorities and universities, which is in line with BPV’s finding that waste is significantly lower for autonomous bodies.

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<sup>16</sup>The model specification is different from that considered so far because we cannot include PB fixed effects but only PB type fixed effects.

Table 6: Heterogeneous Indirect Effects by Market

	(1)	(2)	(3)	(4)
Post Consip×Laptop	-0.215 (0.152)	-0.262** (0.132)	-0.439*** (0.160)	-0.436*** (0.150)
Post Consip×Desk	-0.274*** (0.105)	-0.124 (0.084)	-0.242** (0.112)	-0.185* (0.098)
Post Consip×Chair	-0.097 (0.086)	-0.119 (0.082)	-0.122 (0.100)	-0.165* (0.097)
Post Consip×Landline	-0.224 (0.370)	-0.157 (0.345)	-0.700* (0.396)	-0.636* (0.385)
Post Consip×Projector	-0.459*** (0.103)	-0.408*** (0.079)	-0.394*** (0.104)	-0.378*** (0.095)
Post Consip×Switch	-0.284 (0.197)	-0.293 (0.199)	-0.293 (0.205)	-0.237 (0.200)
Post Consip×Cable Copper	0.067 (0.296)	0.049 (0.234)	0.117 (0.322)	0.044 (0.281)
Post Consip×Lunch Vouchers	-0.018 (0.154)	0.018 (0.099)	-0.622* (0.377)	-0.572 (0.366)
Post Consip×Paper	-0.073 (0.107)	-0.029 (0.061)	-0.065 (0.164)	-0.092 (0.165)
Post Consip×Fax	-0.275** (0.139)	-0.361*** (0.127)	-0.184 (0.127)	-0.271** (0.125)
Post Consip×Mobile	0.278 (0.575)	0.305 (0.565)	0.379 (0.638)	0.285 (0.637)
Post Consip×Software	-0.039 (0.299)	-0.103 (0.263)	0.420 (0.358)	0.179 (0.349)
Post Consip×Printer	-0.407 (0.301)	-0.524** (0.211)	0.009 (0.311)	-0.081 (0.318)
Good characteristics	No	Yes	No	Yes
Quantity purchased	Yes	Yes	Yes	Yes
Good fixed effects	Yes	Yes	Yes	Yes
PB fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	No	No
Month dummies	Yes	Yes	No	No
Linear PB trends	No	No	Yes	Yes
Observations	3,101	3,101	3,101	3,101
R-squared	0.948	0.953	0.951	0.960

*Notes.* The dependent variable is the logarithm of price. To best ensure comparability, good characteristics are the ones selected by the PDS lasso methodology in the model in Table 4 column 4. Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 7: Heterogeneous Indirect Effects by PB Institutional Class

	(1)	(2)	(3)	(4)
Post Consip×Ministries and government	0.092 (0.133)	0.108 (0.124)	0.133 (0.146)	0.165 (0.133)
Post Consip×Social security	-0.597 (0.611)	-0.670*** (0.254)	-0.666 (0.583)	-0.719** (0.316)
Post Consip×Regional councils	-0.522** (0.242)	-0.467* (0.243)	-0.481* (0.250)	-0.440* (0.253)
Post Consip×Province and town councils	-0.223 (0.144)	-0.160 (0.138)	-0.166 (0.150)	-0.126 (0.142)
Post Consip×Health centers	-0.131 (0.083)	-0.196** (0.079)	-0.163** (0.082)	-0.239*** (0.077)
Post Consip×Mountain village councils	-0.107 (0.212)	-0.153 (0.201)	0.197 (0.217)	0.162 (0.197)
Post Consip×Universities	-0.387*** (0.114)	-0.330*** (0.106)	-0.305** (0.128)	-0.268** (0.116)
Post Consip×Other	-0.392*** (0.139)	-0.285** (0.127)	-0.264* (0.144)	-0.191 (0.128)
Good characteristics	No	Yes	No	Yes
Quantity purchased	Yes	Yes	Yes	Yes
Good fixed effects	Yes	Yes	Yes	Yes
PB type fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	No	No
Month dummies	Yes	Yes	No	No
Linear PB trends	No	No	Yes	Yes
Observations	3,101	3,101	3,101	3,101
R-squared	0.943	0.953	0.946	0.956

*Notes.* The dependent variable is the logarithm of price. To best ensure comparability, good characteristics are the ones selected by the PDS lasso methodology in the model in Table 4 column 4. Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Another interesting way to explore the heterogeneity in indirect effects among PBs is to consider their competence levels. We can envisage (at least) two contrasting hypotheses: the first is that the most competent PBs are better able to exploit the potential indirect benefits of centralization and thus generate savings; the second is that the presence of a central agency offers benefits to be exploited by the least efficient PBs, which were previously unable to buy at competitive prices, while more competent ones were already able to obtain competitive prices independent of centralization. A way to capture the effects of the competence of PBs is to look at each PB's place in the price distribution for different products before Consip's entry into the market. However, it is important to consider that a high pre-Consip price is not necessarily a signal of inefficiency but rather could depend on a preference for higher quality goods. We, therefore, proceed in a similar way to BPV and first estimate the average price paid by each PB for all goods purchased as the PB fixed effect in a regression model that controls for the characteristics and quantity of the goods, restricting the sample to the pre-Consip period. The log-price equation is:

$$\ln p_{igt} = \alpha + X_{igt}\gamma + \rho_g Q_{igt} + \theta_g + w_i + \eta_{gt} + \epsilon_{igt}, \quad (3)$$

where our coefficients of interest are the estimated PB fixed effects  $\hat{w}_i$ . We mark each PB based on its pre-Consip average price  $\omega_i = \exp(\hat{w}_i)$  relative to the percentiles of the PB fixed effects distribution. Finally, we identify the heterogeneous indirect effects of centralization depending on PB competence by estimating an extension of the model at Equation 1, in which we interact the *Post Consip* indicator with dummy variables for each pre-Consip PB fixed effect quartile.

The results are reported in Table 8. Our preferred specification shows that indirect effects are statistically different from zero only in the upper quartile of the pre-Consip price distribution, where they are equal to  $-66.7\%$  of the purchase price. This evidence supports the hypothesis that indirect savings come from the least efficient public bodies.<sup>17</sup>

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<sup>17</sup>Appendix Table A.3 depicts a heterogeneity analysis of the pre-Consip distribution of quantities pur-

Table 8: Heterogeneous Indirect Effects by PB Competence

	(1)	(2)	(3)	(4)
Post Consip×1st Price Quartile	0.223** (0.093)	0.160* (0.089)	0.275** (0.133)	0.155 (0.126)
Post Consip×2nd Price Quartile	-0.122 (0.082)	-0.084 (0.081)	-0.093 (0.091)	-0.062 (0.087)
Post Consip×3rd Price Quartile	-0.418*** (0.105)	-0.284*** (0.102)	-0.223 (0.136)	-0.112 (0.129)
Post Consip×4th Price Quartile	-0.688*** (0.147)	-0.668*** (0.143)	-0.659*** (0.163)	-0.667*** (0.158)
Good characteristics	No	Yes	No	Yes
Quantity purchased	Yes	Yes	Yes	Yes
Good fixed effects	Yes	Yes	Yes	Yes
PB fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	No	No
Month dummies	Yes	Yes	No	No
Linear PB trends	No	No	Yes	Yes
Observations	3,101	3,101	3,101	3,101
R-squared	0.949	0.958	0.952	0.960

*Notes.* The dependent variable is the logarithm of price. To best ensure comparability, good characteristics are the ones selected by the PDS lasso methodology in the model in Table 4 column 4. Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.



## VII Revised Estimates for Direct Savings

As we mentioned, BPV estimate that public bodies purchasing through the central agency save on average 28% of price. To derive this result, they restrict the sample to PBs that buy a given good from Consip when feasible, keeping in the control group not only purchases made before Consip’s entrance into the market but also purchases made on the open market *post-Consip* when there is no active agreement. Not accounting for indirect effects, the authors use prices that are lower because of the establishment of the central purchasing agency as a benchmark, thereby likely underestimating the direct savings from centralization. Here we provide a revised estimate of direct savings in our subsample of contracts accounting for the indirect effects.<sup>18</sup>

We evaluate both direct and indirect savings in a single regression model over the entire sample, with the variables of interest being the interactions between  $PostConsip_{gt}$  and an indicator for Consip purchases. The results are reported in Table 9, where we consider versions of controls analogous to those discussed for the estimation of indirect effects (columns 1, 2, 4, and 5). Across specifications, the estimates are consistently negative and statistically significant at conventional levels for both savings components. If we focus on the specification in column 5, this suggests that, after accounting for indirect savings, direct savings from purchasing from Consip jump to 46.8%. As expected, our estimate is larger than that of BPV, confirming that their choice of control group leads to an underestimation of the direct effects of centralization due to the presence of indirect effects. Such large direct savings could be plausible because of the enormous economies of scale associated with the nationwide size of centralized purchases, accompanied by extensive disintermediation (discounts on the order of 40-50% of the already tight reserve price were not unusual).

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chased. We find that the indirect effects are statistically different from zero in the lower quartiles, confirming our interpretation that savings emerge where public buyers have less purchasing experience.

<sup>18</sup>As discussed in Section II, our sample is different from that of BPV as we focus only on contracts relating to goods that were purchased both before and after Consip entered the market, and for which Consip negotiated at least one deal during the sample period.

Still, an additional source of bias could be present. If the goods in the Consip catalog were of lower quality than those purchased externally, the prices in the control group would be higher and, consequently, the direct savings overestimated. In our previous estimates we followed BPV in controlling quality through goods' characteristics, but not through their brand. In columns 3 and 6, we also consider the various brands as potential covariates – to be selected through the PDS lasso procedure, along with goods characteristics. The specification in column 6 suggests that, controlling for brands, the estimate of direct savings falls from 46.8% to 29.3% of the purchase price. This result highlights that part of the direct savings generated by centralized purchases stem from a tendency of Consip to buy lower value brands, an issue that had not been pointed out until now. Importantly, on the other hand, the estimate of indirect savings remains unchanged compared to our analysis in Section IV, amounting to 17.3% of the purchase price.

Table 9: Direct and Indirect Effects of Centralization

	(1)	(2)	(3)	(4)	(5)	(6)
Post Consip $\times$ Consip	-0.437*** (0.075)	-0.458*** (0.085)	-0.329*** (0.083)	-0.443*** (0.076)	-0.468*** (0.083)	-0.293*** (0.080)
Post Consip $\times$ Out-of-Consip	-0.239*** (0.063)	-0.228*** (0.063)	-0.253*** (0.063)	-0.199*** (0.065)	-0.191*** (0.062)	-0.173*** (0.061)
Good characteristics	No	Yes	Yes	No	Yes	Yes
Good brands	No	No	Yes	No	No	Yes
Quantity purchased	Yes	Yes	Yes	Yes	Yes	Yes
Good fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
PB fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	No	No	No
Month dummies	Yes	Yes	Yes	No	No	No
Linear PB trends	No	No	No	Yes	Yes	Yes
Observations	3,794	3,794	3,794	3,794	3,794	3,794
R-squared	0.951			0.952		

*Notes.* The dependent variable is the logarithm of price. Good characteristics and good brands are selected by the PDS lasso procedure. Robust standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

## VIII Conclusions

This paper shows that public procurement centralization generates large indirect savings for contracting authorities that do not buy centrally in addition to the direct savings for those that do. Our analysis suggests that the indirect savings from the introduction of the Italian central purchasing agency are 17.7% on average.

These indirect effects mainly result from the information externalities generated by the centrally determined price on decentralized purchases rather than an improved outside option for buyers. When we explore the heterogeneity of these effects, we find that they stem primarily from less competent public buyers purchasing more complex goods.

Taking indirect effects and product quality into account, we also document that switching to Consip enables public bodies to save 29% of the purchase price – a close estimate to that of BPV, resulting from the offset of the two opposing sources of bias.

While these findings have clear and important policy implications, we must stress that we are only looking at the monetary benefits of centralization. We do not measure its many possible costs, for example, standardization and the resultant mismatch with heterogeneous buyers' preferences, a lack of control over non-contractible quality through local relationships, or barriers to entry for small and medium-sized firms. Centralization may also generate other benefits that we are unable to quantify, such as reduced litigation, administrative costs, and corruption. To obtain a complete picture of the effects of public procurement centralization, future studies should address these other important aspects.

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## A Additional tables

Table A.1: Descriptive Statistics around the Start of a Consip Deal

Days to/from start	Observations	Number of PBs	Ever Consip	Consip
-360 to -331	15	11	0.133 (0.352)	0 (0)
-330 to -301	20	10	0.25 (0.444)	0 (0)
-300 to -271	38	20	0.289 (0.459)	0 (0)
-270 to -241	28	15	0.393 (0.497)	0 (0)
-240 to -211	30	15	0.20 (0.407)	0 (0)
-210 to -181	41	18	0.146 (0.358)	0 (0)
-180 to -151	28	18	0.286 (0.460)	0 (0)
-150 to -121	29	20	0.276 (0.455)	0 (0)
-120 to -91	36	21	0.222 (0.422)	0 (0)
-90 to -61	41	25	0.317 (0.471)	0 (0)
-60 to -31	75	7	0.293 (0.458)	0 (0)
-30 to -1	68	32	0.368 (0.486)	0 (0)
0 to 29	134	79	0.515 (0.502)	0.418 (0.495)
30 to 59	110	68	0.518 (0.501)	0.409 (0.494)
60 to 89	138	72	0.485 (0.502)	0.283 (0.452)
90 to 119	162	87	0.370 (0.484)	0.204 (0.404)
120 to 149	177	91	0.655 (0.476)	0.553 (0.498)
150 to 179	112	68	0.25 (0.435)	0.161 (0.369)
180 to 209	112	56	0.321 (0.469)	0.152 (0.360)
210 to 239	134	65	0.291 (0.456)	0.142 (0.350)
240 to 269	111	67	0.396 (0.491)	0.198 (0.400)
270 to 299	126	70	0.270 (0.446)	0.119 (0.325)
300 to 329	90	48	0.367 (0.484)	0.155 (0.364)
330 to 359	95	62	0.474 (0.502)	0.368 (0.485)

*Notes.* Descriptive statistics are calculated around the start of a Consip deal. *Ever Consip* identifies PBs that do buy from Consip: it is a dummy equal to 1 if a PB has purchased a certain good at least once through Consip. *Consip* is a dummy equal to 1 for Consip acquisitions. For these variables, the table presents the mean and the standard deviation in parentheses.



Table A.2: Descriptive Statistics around the End of a Consip Deal

Days to/from end	Observations	Number of PBs	Ever Consip	Consip
-359 to -330	105	55	0.438 (0.498)	0.295 (0.458)
-329 to -300	91	52	0.571 (0.497)	0.374 (0.486)
-299 to -270	119	70	0.512 (0.502)	0.302 (0.461)
-269 to -240	162	93	0.438 (0.498)	0.265 (0.443)
-239 to -210	193	94	0.705 (0.457)	0.611 (0.489)
-209 to -180	55	48	0.60 (0.494)	0.454 (0.502)
-179 to -150	60	37	0.533 (0.503)	0.25 (0.437)
-149 to -120	55	39	0.509 (0.504)	0.236 (0.429)
-119 to -90	55	34	0.364 (0.485)	0.182 (0.389)
-89 to -60	99	57	0.414 (0.495)	0.091 (0.289)
-59 to -30	117	65	0.376 (0.486)	0.094 (0.293)
-29 to 0	145	77	0.393 (0.490)	0.124 (0.331)
1 to 30	102	52	0.323 (0.470)	0 (0)
31 to 60	84	57	0.297 (0.460)	0 (0)
61 to 90	82	41	0.390 (0.491)	0 (0)
91 to 120	57	35	0.298 (0.461)	0 (0)
121 to 150	71	40	0.296 (0.459)	0 (0)
151 to 180	71	35	0.380 (0.489)	0 (0)
181 to 210	107	51	0.187 (0.391)	0 (0)
211 to 240	66	36	0.363 (0.484)	0 (0)
241 to 270	56	37	0.196 (0.401)	0 (0)
271 to 300	80	40	0.225 (0.420)	0 (0)
301 to 330	66	34	0.348 (0.480)	0 (0)
331 to 360	76	38	0.329 (0.473)	0 (0)

*Notes.* Descriptive statistics are calculated around the end of a Consip deal. *Ever Consip* identifies PBs that do buy from Consip: it is a dummy equal to 1 if a PB has purchased a certain good at least once through Consip. *Consip* is a dummy equal to 1 for Consip acquisitions. For these variables, the table presents the mean and the standard deviation in parentheses.

Table A.3: Heterogeneous Indirect Effects by Pre-Consip Quantity

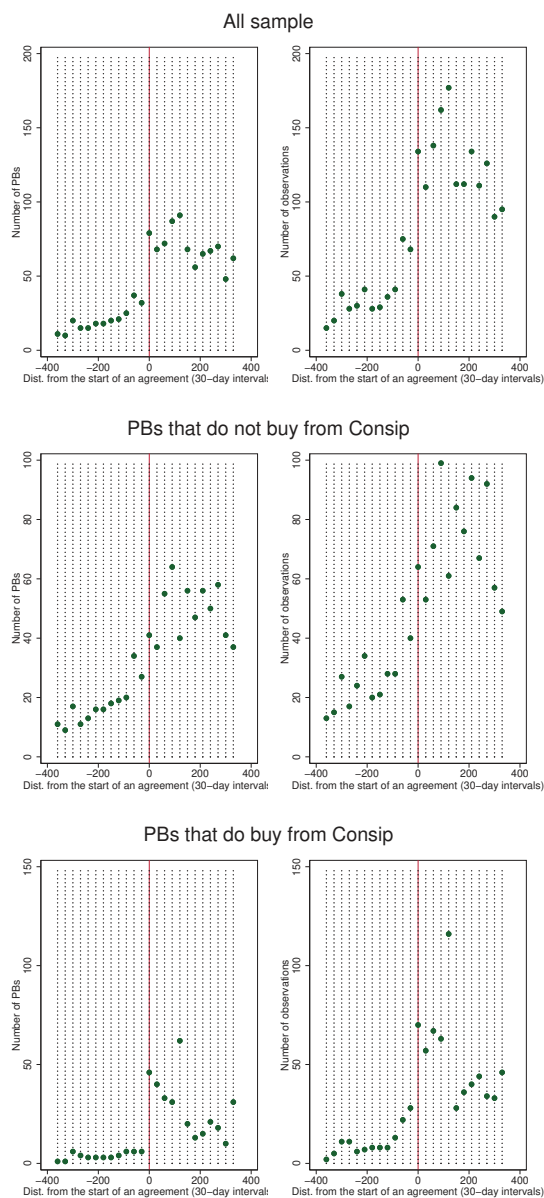
	(1)	(2)	(3)	(4)
Post Consip×1st Quantity Quartile	-0.217** (0.085)	-0.176** (0.086)	-0.154* (0.089)	-0.145 (0.089)
Post Consip×2nd Quantity Quartile	-0.403*** (0.150)	-0.393*** (0.145)	-0.384** (0.192)	-0.368** (0.185)
Post Consip×3rd Quantity Quartile	-0.120 (0.125)	-0.111 (0.118)	-0.089 (0.162)	-0.124 (0.154)
Post Consip×4th Quantity Quartile	-0.053 (0.121)	-0.111 (0.115)	-0.098 (0.166)	-0.156 (0.150)
Good characteristics	No	Yes	No	Yes
Quantity purchased	Yes	Yes	Yes	Yes
Good fixed effects	Yes	Yes	Yes	Yes
PB fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	No	No
Month dummies	Yes	Yes	No	No
Linear PB trends	No	No	Yes	Yes
Observations	3,101	3,101	3,101	3,101
R-squared	0.948	0.957	0.951	0.960

*Notes.* The dependent variable is the logarithm of price. To best ensure comparability, good characteristics are the ones selected by the PDS lasso methodology in the model in Table 4 column 4. Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

## **B Strategic Timing**

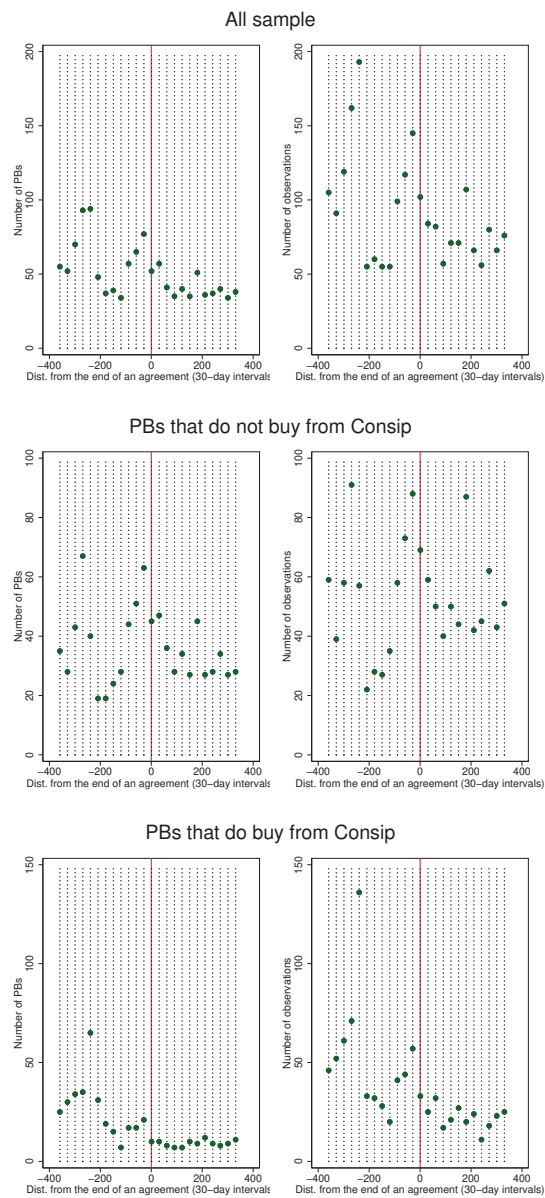
The following figures investigate whether there are manipulations in the timing of acquisitions to avoid delegating a purchase to the central body. Managers who want to elude agreement periods would purchase just before the start or just after the end of a Consip deal. However, we find no evidence of such behavior when we analyze the timing of purchases among public bodies, even when separating between PBs that buy from Consip and those that do not.

Figure B.1: Number of PBs and Number of Purchases around the Start of a Consip Deal



*Notes.* The figure shows the number of public bodies and the total number of purchases around the start of a Consip deal, distinguishing between: all sample, PBs that do not buy from Consip, and PBs that do buy from Consip.

Figure B.2: Number of PBs and Number of Purchases around the End of a Consip Deal

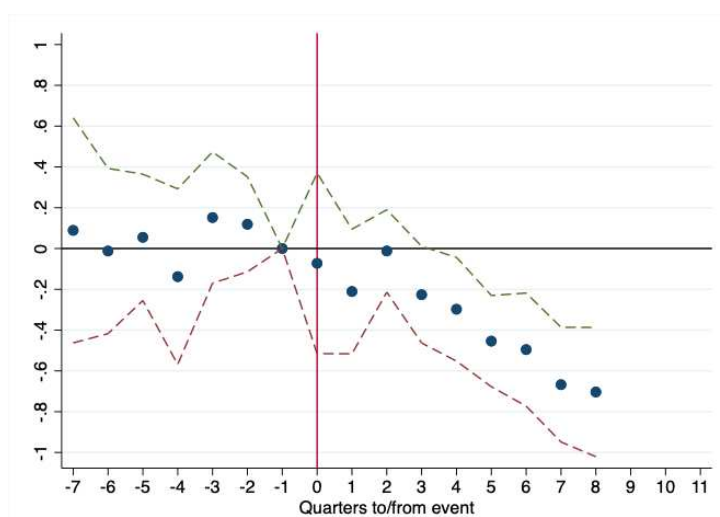


*Notes.* The figure shows the number of public bodies and the total number of purchases around the end of a Consip deal, distinguishing between: all sample, PBs that do not buy from Consip, and PBs that do buy from Consip.

## C Event-Study Analysis for Technologically Complex Goods

From the event study around Consip's entry into the market, we can see that there are no pre-trends. If obsolescence was an issue, then we should have seen a downward trend in prices even in the period before Consip's entry. The following figure replicates the event study for technologically complex goods, namely laptops, projectors, fax machines, and printers, for which obsolescence might be more salient in principle. Once again, we find that there are no pre-trends.

Figure C.3: Event-Study Analysis for Technologically Complex Goods – Entry



*Notes.* The figure displays estimated change in log prices at different lags and leads since the time of first Consip's entry (denoted by a vertical line). All coefficients are expressed relative to the effect in the year before entry; 95 percent confidence intervals are reported. See text for details.

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