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 μ_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:

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

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

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

As before, the parameter β_i denotes public body i's active waste propensity. Instead, the parameter μ_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 μ_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):

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

The equilibrium payoff for the manager is:

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

As before, it is immediate to obtain

Proposition 5 *The off-Consip equilibrium price is an increasing function of both μ_i and β_i.*

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

$$\hat{\Omega}^c_{igt} = -p^c_{gt} + \nu_{igt},$$

where ν_{igt} is some idiosyncratic preference for Consip.

If instead the manager buys off Consip he maximizes

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

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

Proposition 6 *The probability that the PB switches to Consip is an increasing function of μ_i and a decreasing function of β_i.*

P roof. The probability of buying from Consip is

$$\Pr\left[\nu_{igt} \geq p^c_{gt} + \hat{\Omega}^n_{igt}\right].$$

By the envelope theorem, we see that $\hat{\Omega}^n_{igt}$ is increasing in β_i and decreasing in μ_i. ■

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

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).

Appendix 3: Strategic Timing

To test whether purchasing managers strategically alter the time of purchases, 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.[29]

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 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, η_m, η_y, and η_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 α_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.

[29] 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).

Appendix 4: Estimation Concerns and Robustness

The analysis raises two classes of concerns: measurement error in $\hat{w}_i$ and omitted variables correlated with μ_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. We now argue that both types of measurement error would lead us to underestimate α, 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 α, 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 α, 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 α. 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.[30] We then re-estimate (1) and (2)

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

using the complex good sample only where we expect to find stronger evidence that price differences are due to differences in active waste. Reassuringly, 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:

$$\ln p_{igt} = \beta C_{igt} + X_{igt}\gamma + \rho_g \ln Q_{igt} + \eta_g t + \theta_g + w_i + \varepsilon_{igt} \tag{9}$$

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, θ_g are goods fixed effects and w_i are PB fixed effects. We allow the 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 A2 report estimates of (9), 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:

$$\ln p_{igt} = \varphi A_{igt} + X_{igt}\gamma + \rho_g \ln Q_{igt} + \eta_g t + \theta_g + w_i + \varepsilon_{igt} \tag{10}$$

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 A2 report estimates of (10), without and with the vector of goods characteristics X_{igt}. The coefficient φ 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:

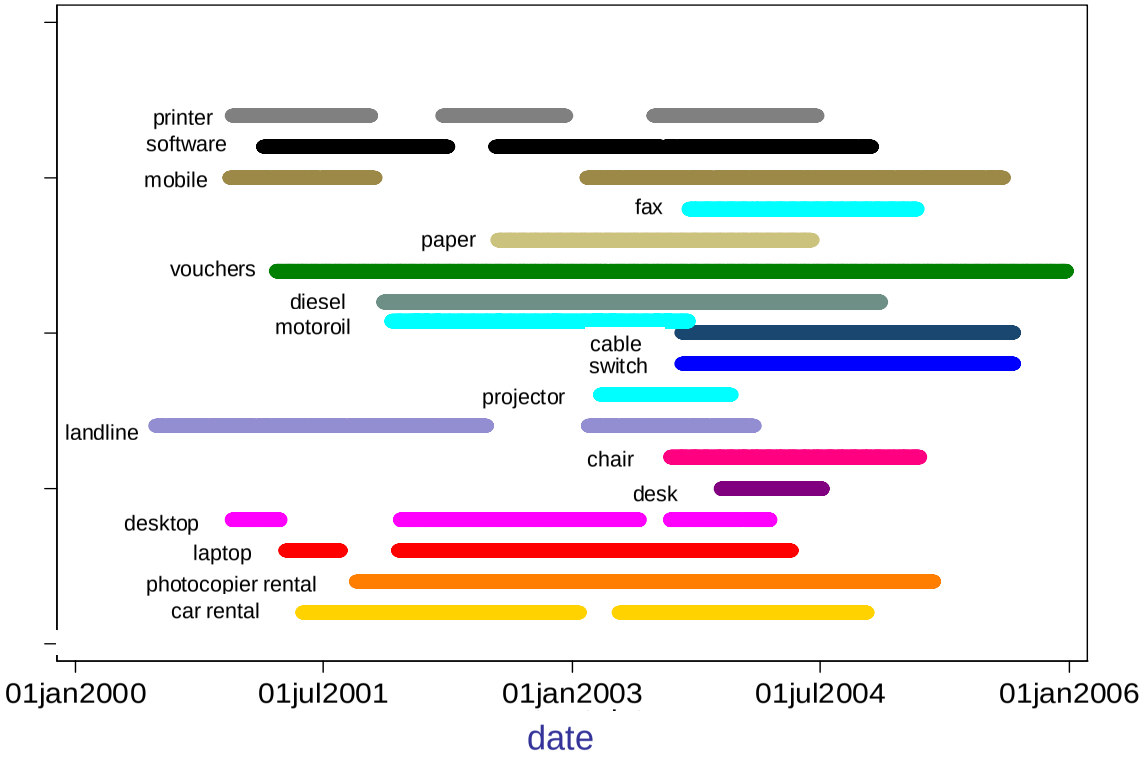
$$\ln p_{igt} = \delta C_{igt} + X_{igt}\gamma + \rho_g \ln Q_{igt} + \eta_g t + \theta_g + \varepsilon_{igt} \tag{11}$$

where C_{igt} equals 1 if PB i buys good g from Consip at time t and 0 otherwise. 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.

Finally we note that while the findings in Column 6 are an interesting aside, they obviously do not impinge on the validity of our estimate of the coefficient α 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.

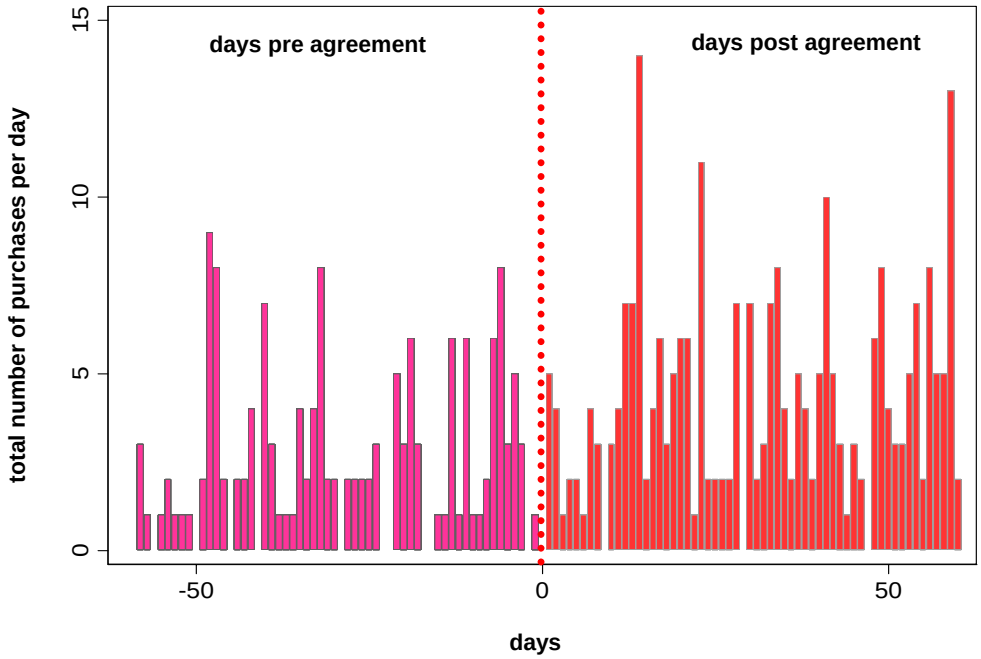
Figure A1: Timing of Consip Agreements, by Good



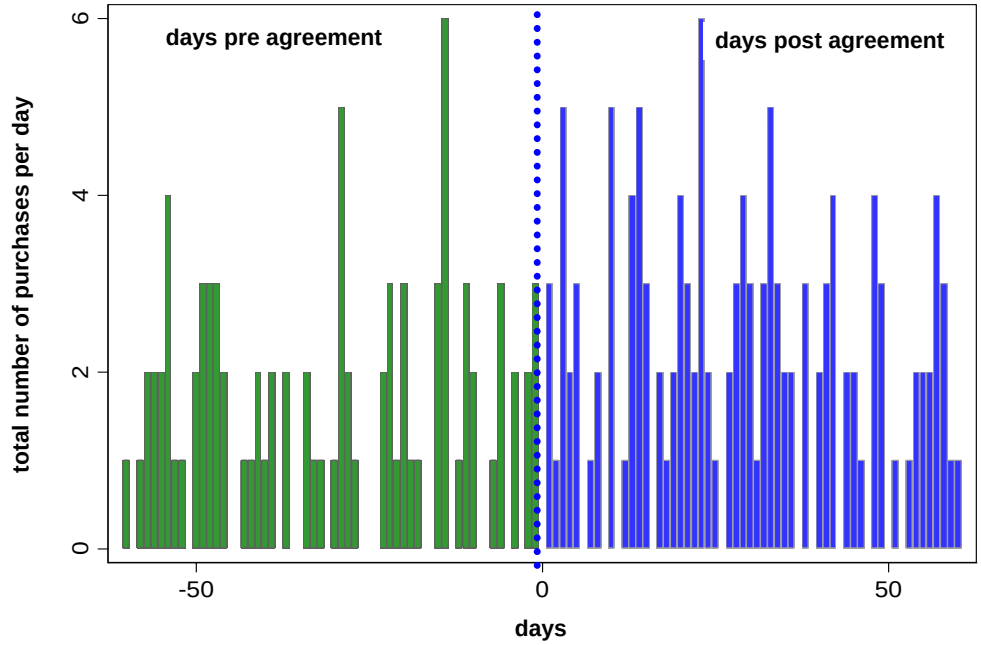
Note: For each good, the line is full on dates when an agreement is active, blank when there is no active

Figure A2: Timing of Purchases

Panel A: PBs that do not buy from Consip

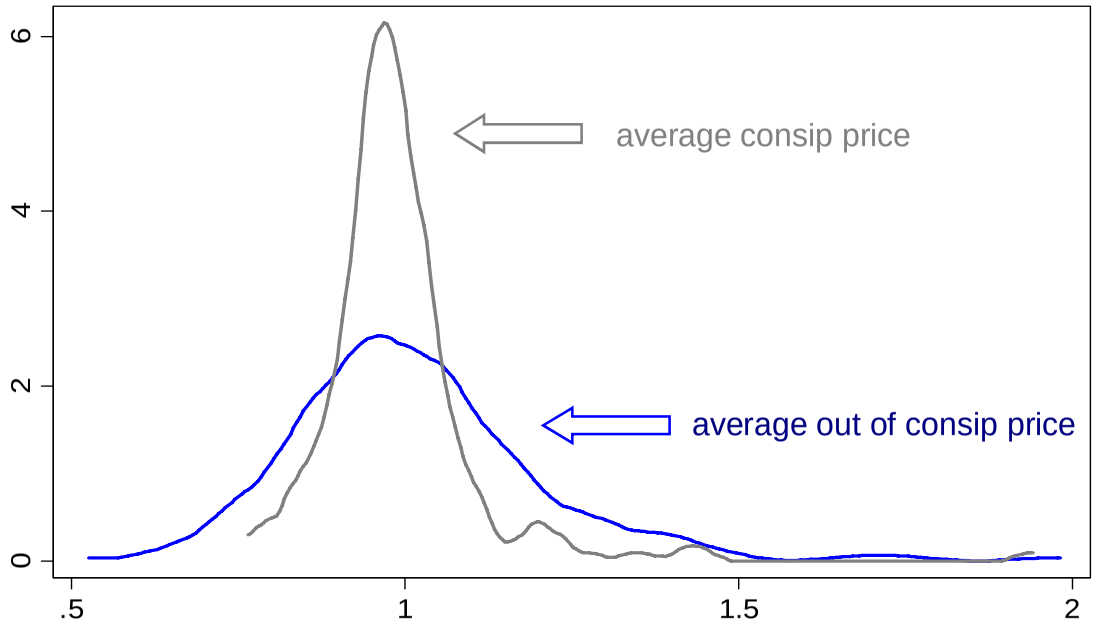


Panel B: PBs that do buy from Consip



Note: The figure illustrates the number of purchases of all goods on the 60 days before the start of a consip agrement 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 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)
continuous measures								
number of days before agreement	.016				.001			
	(.017)				(.011)			
number of days after agreement			-.0002				.015	
			(.023)				(.015)	
splines								
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 Colums (5)-(8) is restricted to PBs that do buy from Consip when it is feasible to

Table A2: Price Savings and the Quality Margin

Dependent Variable is Log(Price)
Linear Model- Robust Standard Errors in Parenthesis

	(1)	(2)	(3)	(4)	(5)	(6)
sample:	*PBs that buy from Consip*		*PBs that do not buy from Consip*		*All PBs, while agreement is on*	
Agreement Purchase (=1 yes)	-.199***	-.276***			-.171***	-.125***
	(.040)	(.038)			(.027)	(.028)
Agreement Active (=1 if yes)			.017	-.013		
			(.030)	(.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 Colums (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 Colums (5) and (6) includes all PBs but is restricted to days when an agreement is active for that good.