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Abstract

This paper aims to shed light on the impacts of imposing co-payment on public services, a strategy employed especially in the realm of healthcare. We analyze the effect of imposing a charge for the individual appropriation of common resources. In our design, withdrawing the maximum amount is the dominant strategy for every player, but the resulting equilibrium is socially inefficient. We find that the presence of a price which is small enough to leave intact the conflict between individual incentives and collective welfare, is not effective in reducing appropriation among players who have previously played without it. On one hand, the upward trend in the average extraction of common funds continues after the introduction of a price. On the other, the presence of a price does decrease withdrawals, in comparison with a baseline treatment without any charge, as long as it is imposed from the outset. Our results provide insights on the conditions for the effectiveness of co-payment in curbing the over-consumption of public resources, most notably in the realm of healthcare.

Keywords: Common-pool resources; co-payment; public services; consumer choice.

JEL Classification: C91, C92, H41, I11, I18

1. Introduction

In this paper we propose an experimental investigation of the effect of imposing a price for the subtraction of resources from a common fund. Our evidence sheds light on some relevant aspects related to the effectiveness of co-payments in curbing the over-consumption problem, most notably in healthcare services.

The conflict between individual and collective welfare in common pool extraction problems has received attention since the early works by Gordon (1954) and Ostrom et al. (1994), among others. We use the common pool resource paradigm as a metaphor for publicly available services, like healthcare whose excessive use by the individuals entitled to access it leads to a collectively inefficient outcome. In other words, individual appropriation is detrimental to social welfare. In this context, our main question is: does the introduction of a *small* co-payment reduce individual extraction levels, thereby increasing efficiency and social welfare? The limited magnitude of the price per unit extracted allows the detection of effects in a context where the basic trade-off between individual and collective incentives remains intact. Can the focus on the price and/or the sheer "pain of paying" help maintain a high level of common resources? On the opposite side, could a "crowding-out" effect arise, whereby potentially social-minded subjects feel legitimated by the price to extract *more* of a common resource?

The present policy context in Europe is characterized by the effort to reduce public deficits. User charges, often in form of "co-payments", have been introduced for services that were previously given for free, and exemptions to these charges have been reduced. These measures, frequently applied in the realm of healthcare, entail a direct effect of a transfer from users to the public administration, hence more revenues, but the goal is also to reduce the over-consumption of public resources. As we focus on this second aspect, we explore the appropriation of resources following the introduction of co-payments in comparison with *i)* a situation where the co-payment is not introduced and *ii)* a situation where co-payment has always existed, i.e. the resource was never available for free. The first comparison relates to many dilemmas currently faced by European policy-makers in contexts of socialized

healthcare. The second comparison serves multiple purposes. On one hand, we observe the effect of the introduction of co-payment as a novelty compared with a game always played under the same rules. On the other, it isolates the effect of the habit to consume the good for free. Our evidence also provides insights on whether co-payment would be more effective for new goods and services that were never publicly available free of charge.

2. Background

Co-payments in healthcare, which impose on patients a part of the cost of services, represent one of the main examples of charges for the use of public services. They are imposed on primary care visits, on specialized care and on the purchase of pharmaceuticals. In European countries there are wide variations in terms of amounts, calculation methods (percentages, fixed fees, etc.) and with regards to which healthcare services are subject to co-payments (Espin and Rovira, 2007). Even bigger differences arise when considering US and Canada systems (Mas et al., 2011).

The rationale of co-payment for public services is twofold. First, it *might* improve the financial situation of the payer. In the European context of socialized medicine, this argument makes co-payment look unfair, as it hinges on a transfer from those who need more care to the rest of the population. Furthermore, as patients may be unable to distinguish the actual benefits, they could reduce the use of effective and ineffective healthcare in similar proportion, as shown in the famous RAND experiment in the U.S. (Manning and Newhouse, 1987), and possibly lead to negative health impacts and higher long-term healthcare expenditure (Gemmill et al., 2008). The second purpose consists of tackling the excessive use of resources. Standard economic theory points out that rational and selfish people use free services up to the point that they provide individual benefits which compensate individual non-monetary costs (e.g. time). From the societal perspective, individual incentives lead to over-consumption, as social welfare would be maximized if resources were consumed up to the point that marginal benefits (usually assumed to be decreasing) equal the marginal costs of providing

them. Co-payments can contribute towards a better alignment of individual and social incentives, thereby ameliorating the over-consumption problem.

In our design we observe whether co-payment can enhance efficiency, in a context where experimental subjects are informed about their own benefit from appropriating public resources and the cost this implies for the group they belong to. The size of co-payment is small, so that choices respond to the typical trade-off between individual and collective benefits. An example of a very small co-payment is found in the "euro-per-prescription" proposed by the government of the Spanish Autonomous Community of Catalonia.

In this context, the introduction of a "price" in order to take away common resources may modify behavior. As a positive price is obviously higher than zero, if the usage of resources is a "normal" good, the demand effect should be negative. The presence of a price may also create the "pain of paying", whereby the sheer act of paying diminishes the pleasure of consuming a good (Prelec and Loewenstein, 1998).

The crowding-out effect moves towards the opposite direction. As described in Frey and Oberholzer-Gee (1997), it arises whenever people are, in principle, willing to cooperate and take socially-oriented choices but, when confronted with a price, become more "selfish". The presence of a price may shift the focus away from collective costs and suggest that the individual can "legitimately" compare her own benefit with the amount she would have to spend to appropriate public resources (Gneezy and Rustichini, 2000). In this case, the individual appropriation of common resources would increase.

3. Experimental design, procedures and predictions

The experiment took place during the first week of July 2012 at the Laboratory of Experimental Economics (LEE) of the University Jaume I, located in Castellón, Spain. A total of 125 students participated, 35 in the "Baseline"(B) treatment, 30 in the "Copay"(C) treatment, and 60 subjects in what we will refer to as the "Baseline+Copay"(BC) treatment. Presentations and instructions given to the students

made no use of the word “co-payment”. All sessions were programmed in z-Tree (Fischbacher, 2007).

In order to avoid possible doomsday effects, subjects did *not* know *ex ante* the total number of rounds (30 in each session). At the beginning of each round, they were divided in groups of 5 subjects each. No subject was informed about the identity of her fellow group members. Subjects *did* know that, after each round, they would be randomly re-matched and that, at the end of the experiment, they would be paid according to the payoff achieved in a single round, randomly selected. The random selection of a single round as the basis for payment implies the removal of history effects, whereby a player would perceive herself as rich or poor depending on her results in previous rounds. Before the beginning of the experiment, their comprehension of the rules was checked with easy questions on deriving payoffs from possible combinations of choices among group members.

In treatment B, at the beginning of each round every group is assigned a common fund worth 100 euro. Each one of the 5 group members has the option of withdrawing an integer amount between 0 and 10 euro. Each euro withdrawn passes to her private fund and reduces the common fund by 2 euro. At the end of each round, what remains of the common fund is equally shared among the 5 members. Therefore, the payoff of a group member is calculated as the sum of her private fund and 20% of the amount left in the common fund. For example, if X_i is the amount extracted by player *i* from the common fund, player *i*’s payoff in any given round equals:

$$Payoff_i(B) = X_i + \frac{1}{5}\left(100 - 2\sum_{j=1}^{5} X_j\right) \qquad i, j = 1,\ldots,5$$

At the end of each round, each subject is informed just about her own payoffs, but not about the payoffs of the other members of her group.

In this context, the payoff-maximizing strategy for each player is to withdraw the maximum amount permitted, i.e. 10 euro, as each euro taken away from the common fund only reduces her share by 2/5, i.e. 0.4 euro. Assuming rationality and selfishness,

in the Nash equilibrium each group member withdraws 10 euro, so that nothing is left in the common fund and each subject gets a payoff of 10 euro in each round, including of course the one randomly selected for the final payment. Clearly, the Nash equilibrium is not Pareto efficient. In particular, if all members refrain from extracting resources from the common fund, they enjoy a payoff of 20 euro each, i.e. twice as much as that obtained in the Nash equilibrium.

In treatment C, for each euro withdrawn from the common pool, the subject has to pay 0.1 euro. All the co-payments enter the common fund and are redistributed among group members. Therefore, player *i*'s payoff is calculated as:

$$Payoff_i(C) = X_i - 0.1X_i + \frac{1}{5}\left(100 - 2\sum_{j=1}^{5} X_j + 0.1\sum_{j=1}^{5} X_j\right) \qquad i, j = 1,\ldots,5$$

It is easy to see that the payoff-maximizing strategy for each subject still consists in withdrawing 10 euro. The Nash equilibrium strategy profile is the same as in treatment B, while the payoff per subject is still 10 euro per round (recall that the revenues from co-payment are redistributed). In the case where no subject withdraws anything from the common fund, each subject gets a 20 euro payoff like in the baseline treatment.

Finally, in the BC treatment, the first 15 rounds are played with the same rules as in the baseline. Before round 16, all subjects are informed that during the rest of the session they will have to pay 0.1 euro per each euro *withdrawn*, and that all those payments enter the common fund, precisely as in the C treatment.

4. Results

Figure 1 shows the evolution of average individual withdrawals in the three treatments. The line in the middle points out the division between the first 15 rounds and rounds 16-30, where copayment is introduced in the BC treatment.

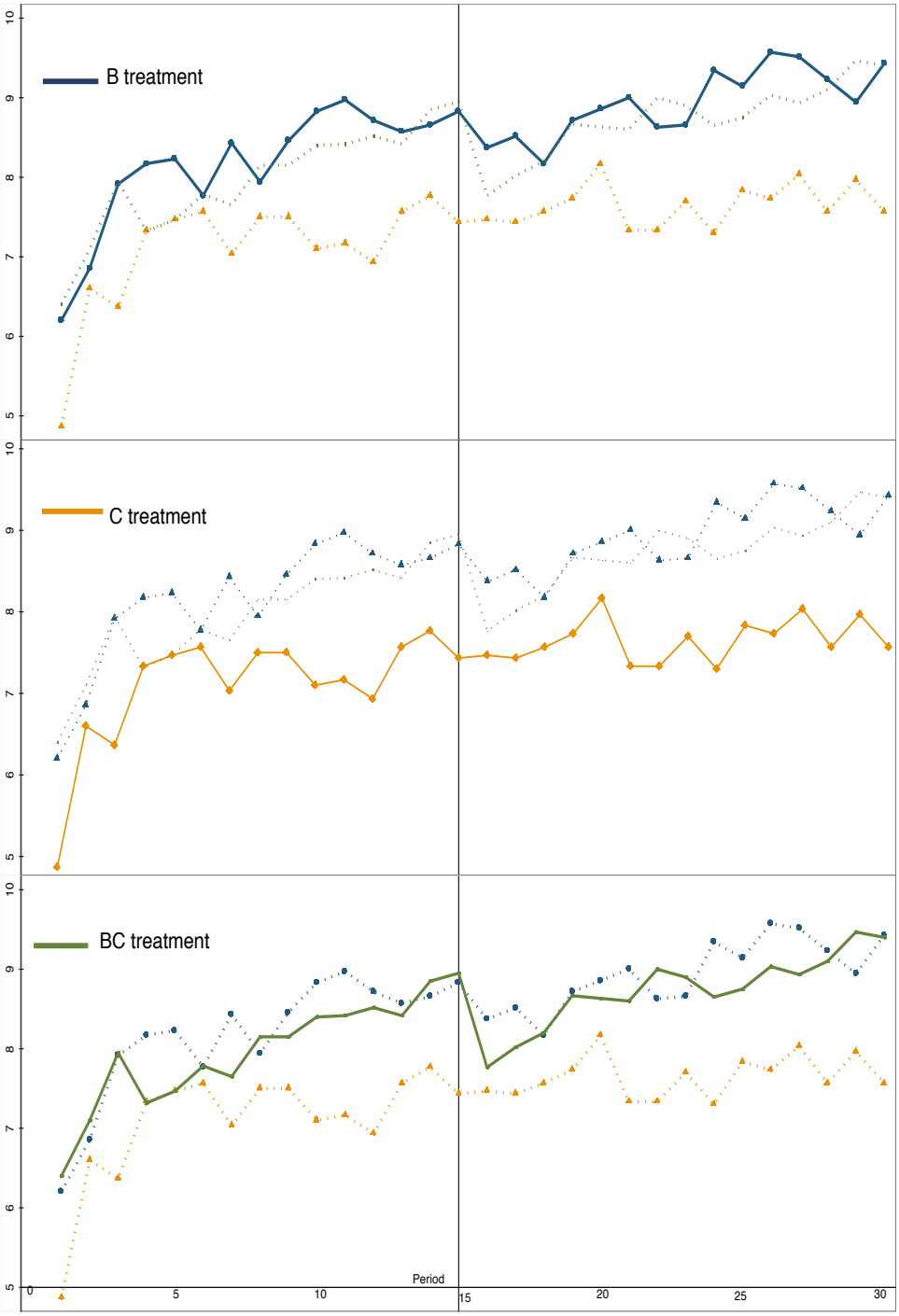

Figure 1: Evolution of average extraction, by treatment.

Considering that in this experiment the cooperative choice consists in refraining from withdrawing funds from the common pool, it is immediate to observe that the pattern during the first rounds mirrors the one typically observed in public good games

(Ledyard, 1995), where cooperation is relatively high in the first round and then decays progressively.

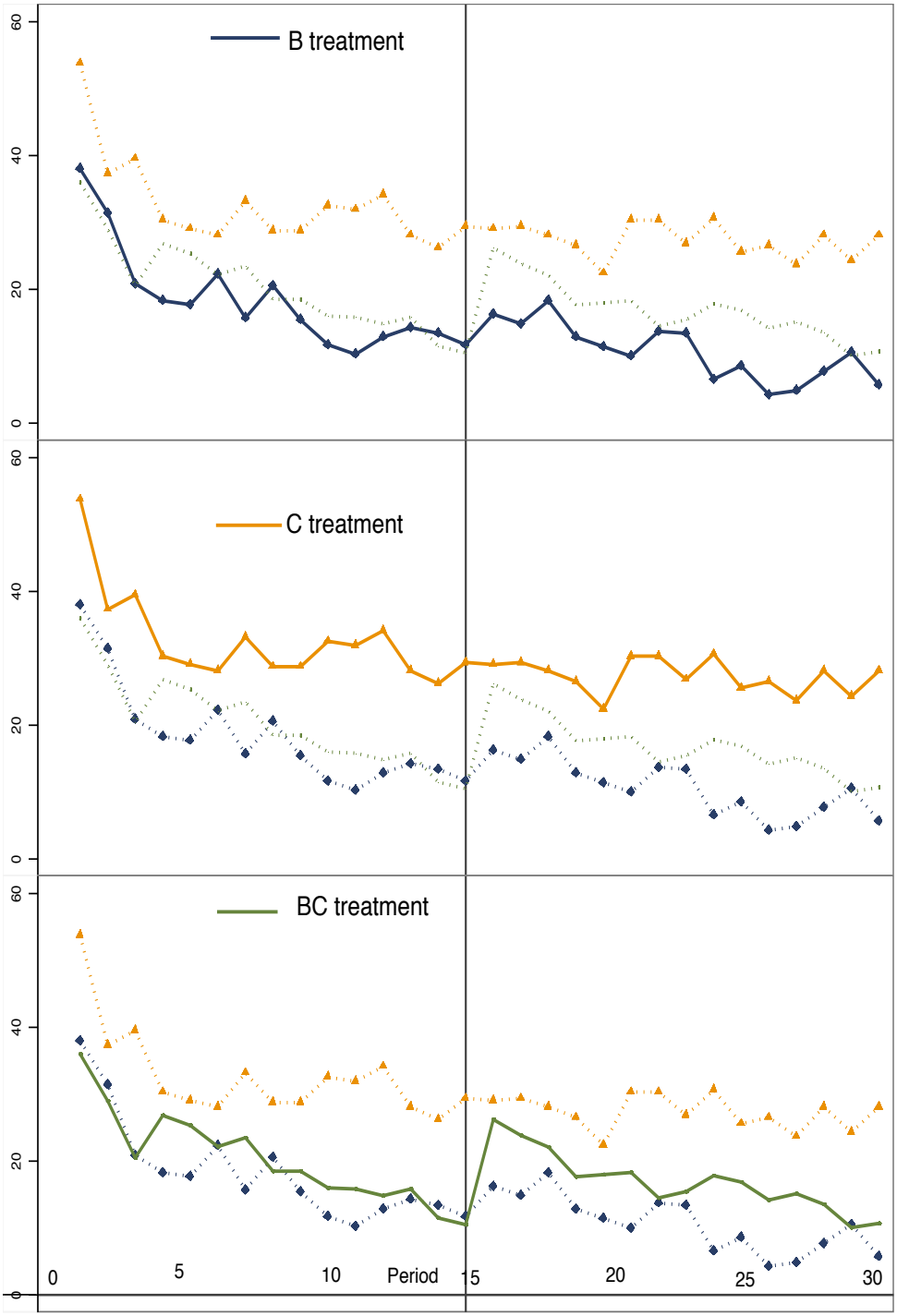

Figure 2: Evolution of the common fund after extraction, by treatment.

In fact, if we look at Figure 2, we observe that the corresponding evolution of the common fund is decreasing in the corresponding rounds.

The standard explanation for this pattern is based on the fact that some players are conditionally cooperative, so that they start imitating free-riders once they observe their behavior (see e.g. Keser and van Winden, 2000). Observe, however, how this pattern changes after period 15 for treatment C, where the trend is not positive anymore. We will further confirm this point. This evidence is summarized in our first result:

Result 1: *In all three treatments, withdrawal levels exhibit an increasing trend during the first 15 rounds.*

Figure 3 shows the distributions of the extraction levels by treatment.

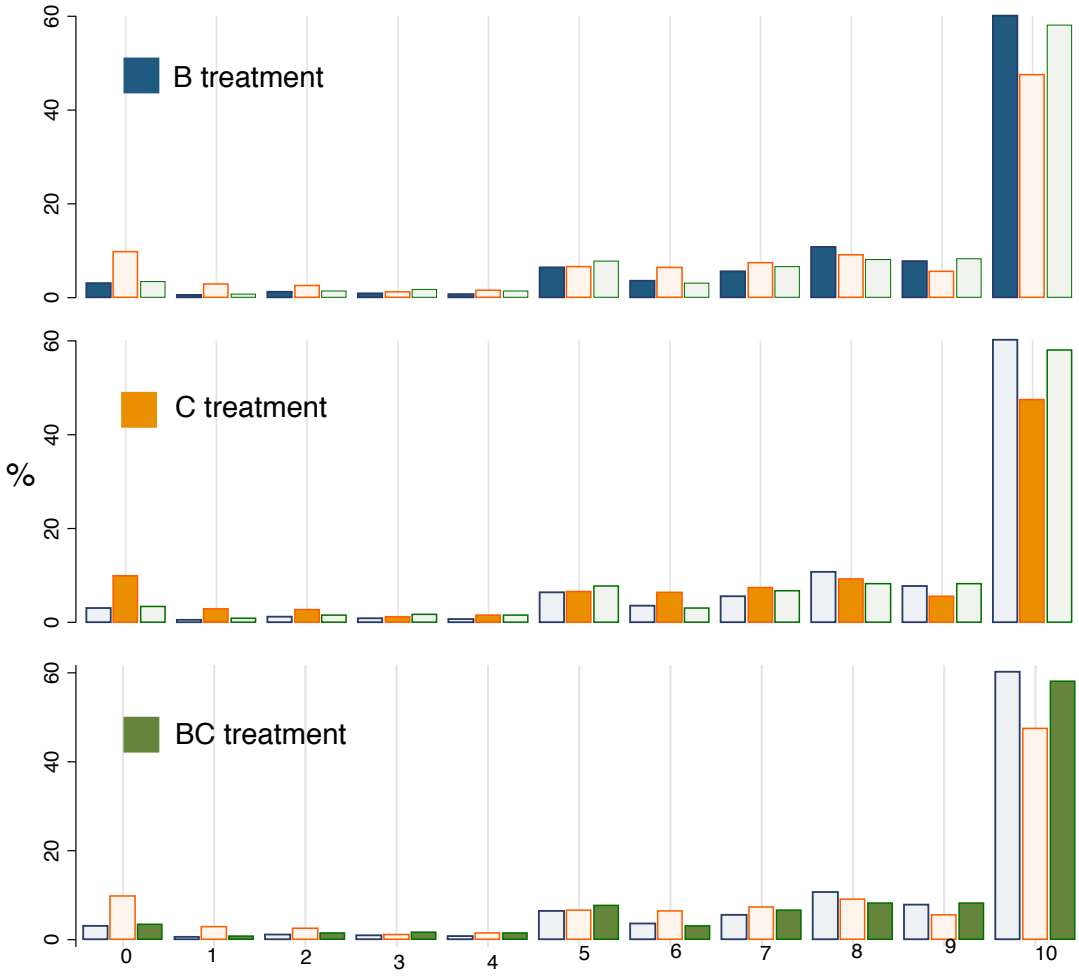

Figure 3: Distribution of the extraction levels, by treatment

A non-parametric Spearman test, applied to the first 15 periods of the session, shows that the increase in extraction levels over time is significant at 1% level in all three treatments. See Table 2 below.

Table 2: Spearman's rho, non-parametric test

Treatments	B treatment		C treatment		BC treatment	
Period	∈ [1, 15]	∈ [16, 30]	∈ [1, 15]	∈ [16, 30]	∈ [1, 15]	∈ [16, 30]
Observations	525	525	450	450	900	900
Spearman's rho	0.1755	0.1659	0.1104	0.0121	0.2062	0.1467
Prob > |t|	0.0001***	0.0001***	0.0192**	0.7974	0.000***	0.000***

Note: asterisks used for significance at 10% (*), 5% (**) and 1% (***) levels.

An already expected pattern of our data is that no statistically significant differences can be observed between treatments B and BC along the first 15 rounds, where the rules are the same.

This result is somehow surprising, as we could expect some impact from changing the rules of the game, especially considering what follows in result 3. This evidence, instead, shows that the introduction of the co-payment does not help curbing the inefficient appropriation of funds by group members or, at best, has a very short-lived effect.

A Kolmogorov-Smirnov non-parametric test (see Table 1) tells us about the differences among distributions (null hypothesis that the samples are drawn from the same distribution). In particular,

Result 2: *No significant differences are observed in withdrawal levels across treatments B and BC.*

Table 1: Kolmogorov-Smirnov test for differences in distributions among treatments

Treatments	D	p-value
BC vs B	0.0414	0.191
BC vs C	0.1322	0.000***
B vs C	0.1637	0.000***

Note: asterisks used for significance at 10% (*), 5% (**) and 1% (***) levels.

This may be linked to the "re-start effect" usually observed in public good games (Ledyard, 1995).

Moreover, in treatment C we observe a higher frequency of zero extraction. This fact may explain the flatter slope of the plot corresponding to this treatment.

In order to study in detail the per period behavior of agents in the three treatments, we propose an econometric analysis that allows us to compare three types of society: one in which copay does not exist (treatment B); one in which copay was always in place (treatment C); and, finally, a society in which copay has been implemented suddenly after a certain period. Table 3 shows an Ordinary Least Square group of models with Panel Data, one for the first 15 periods (aggregating treatments B and BC) and 3 models for the last 15 periods, each one aiming at studying the statistical treatment differences of the per period individual extraction. Hence, the dependent variable in each model is the individual extraction, including dummy variables for each treatment as explanatory variables.

For the first 15 periods observe that treatment C is significantly different to the other two. We obtain, for the last 15 periods, that the individual extraction in treatment B is 1.34 units higher than in treatment C. Also, individual extraction in treatment BC is 1.23 units higher than in treatment C. Moreover, individual extraction in treatment BC is 0.11 units lower than in the Baseline. All these differences are statistically significant.

The following result further corroborates the robustness of the evidence of lower extraction in treatment C compared to the other treatments:

Result 3: *Withdrawal levels are lower in treatment C than in the other two treatments in the last 15 periods.*

Table 3: O.L.S. with dependent variable: y= individual extraction

Treatment	**(1) Period<15**	**(2) Period>15**	**(3) Period>15**	**(4) Period>15**
B + BC treatments	1.2715			
	(8.66)***			
B treatment		1.3422	0.1086	
		(9.53)***	(0.83)	
C treatment			-1.2336	1.3422
			(-8.88)***	(9.53)***
BC treatment		1.2336		-0.1086
		(8.88)***		(-0.83)
R^2 within	0.0411	0.0570	0.0570	0.0570
R^2between	0.0142	0.0007	0.0007	0.0007
R^2 overall	0.0186	0.0400	0.0400	0.0400
Wald chi2(2)	74.94	108.99	108.99	108.99
N=	1875	1875	1875	1875

Z-score in parentheses

Note: asterisks used for significance at 10%(*), 5%(**) and 1%(***) levels.

This result is quite striking, as we could expect that if subjects "learn to defect", they should do so in all three treatments, hence differences across them would tend to vanish. On the contrary, they widen following clearly distinct paths highlighted in the following result.

Result 4: *In treatments B and BC withdrawal levels exhibit an increasing trend also during the last 15 periods of the session. The level of extraction does not increase significantly in treatment C as compared to the other two treatments.*

A closer observation at the evolution of extractions levels presented in Figure 1 shows that when a co-payment exists from the beginning (treatment C), average extraction increases substantially in the first periods (namely from 4.867 units in period 1 to 7.333 units in period 4) and then oscillates around 7.5 units, with a minimum of 6.933 units in round 12 and a peak of 8.167 units in round 20. There is no evidence of an upwards trend of extraction in this treatment.

In the other two treatments, B and BC, the increase is by no means limited to the first rounds and, in particular, goes on in the second part of the session (rounds 16-30). This difference is especially remarkable when comparing both treatments C and BC, where the rules are the same from round 16 onwards.

5. Discussion

There is a lively debate on the pros and cons of introducing user charges for public services, especially in relation to healthcare, which had traditionally been given for free and financed by general taxation and social security contributions in most European countries.

The most appealing argument in favor of co-payment is based on the need to reduce over-consumption. In our experiment, we explore how subjects behave when they can easily perceive that *i)* their own payoffs increase in their appropriation of public resources and *ii)* societal costs are higher than their individual benefits from this appropriation.

Our evidence shows that the introduction of a price for each unit extracted from a common fund does not reduce withdrawals, when subjects have freely accessed the fund in the past. In fact, we observe that withdrawals follow an upward trend even after the introduction of co-payment, with the single exception of the round immediately after the regime change. In fact, extraction levels never differ significantly during the whole experiment with respect to the baseline treatment without co-payment, and they converge to almost identical values in the last round.

While we do not observe any negative demand effect, there is also no sign of a "crowding-out" of potential cooperation due to the presence of a price. Results in the BC treatment show that, as the size of co-payment is small enough to keep intact the trade-off between individual and collective incentives, cooperation decays following a similar path as in the Baseline and, in general, with a trend akin to what is observed in most voluntary contribution mechanisms and public good experiments.

Extraction levels are lower in the C treatment where co-payment exists from the outset, so that the rules are the same as in rounds 16-30 of the BC treatment. While we may expect convergence when the rules become identical in the two treatments, differences in withdrawals actually *increase* in rounds 16-30. While in BC, as well as in the B, the average extraction grows to reach more than 90% of the common fund in the final rounds, in treatment C it increases in the first rounds and then oscillates around 75%.

We can conclude that even a small co-payment, which leaves intact the individual incentive to appropriate common funds, can curb over-consumption *provided that it exists from the outset*. In this case, we do find a negative demand effect for private appropriation of common funds, despite the fact that payoff maximization would still drive towards the complete depletion of common resources, as the price in this case does discourage appropriation among some subjects.

Seeing the same issue from another point of view, the habit of playing *without* a price undermines the potential effectiveness of introducing a co-payment.

These observations and the current upwards trend in the imposition of user charges leads to a potential research question on the impact of future policy considerations to remove co-payments, for instance when and if sustained growth allows to ease budgetary pressures. A new "CB" treatment would show whether restoring free access would lead to more, or less, selfish appropriation in comparison both to contexts where charges are preserved and to those where they were never introduced.

6. Conclusions

Our experimental design isolates the effect of co-payment in a context where subjects have complete information regarding the rules of the game and a trade-off exists between individual and collective incentives, where the former would lead towards full extraction of common funds.

We find that the introduction after 15 rounds of a small unitary price does not reduce the amount that group members withdraw from common resources, neither in comparison with the treatment where this price is never introduced nor with respect to the periods in which extraction was costless. Hence, our evidence indicates that imposing co-payments on previously free services does not foster "social cooperation", in the sense of limiting selfish over-consumption.

On the other hand, the same price does lead to lower extraction levels when it exists from the beginning of the session. Remarkably, extraction levels in the Copay treatment remain constant after the first few rounds until round 30, the last of the session. On the contrary, extraction increases steadily in the other two treatments, most notably in the last rounds of treatment BC where the price is introduced after round 15.

Field experiments by Cárdenas and Ostrom (2004) have inspired a plethora of studies showing that a decision maker's past experience from the real world determines behavior in common pool extraction settings. Our findings show that experience from the early periods of the experiment can also affect behavior in subsequent periods. Specifically, exposure to a totally free access regime, renders the use of co-payment ineffective ads a means of reducing over-exploitation. On the contrary, a copayment achieves the desired objectives if not presided by free access regime. As said above, it appears that free extraction spoils the future effectiveness of a co-payment in reducing over-consumption.

Some caveats are in order. First, we do not address the possibility that individual benefits are smaller than the co-payment imposed. Of course, in this case there is no trade-off: refraining from using public resources is individually optimal.

Our design does not address the risk of *under-consumption*. Some people, especially the poor, may refrain from using healthcare resources despite the fact that their benefits would more than compensate social costs of providing healthcare services. In this case not only would equity be hampered, but in the long run public expenditures could actually increase, for instance through higher costs of hospital services due to worsening health conditions in the population.

Other aspects that may limit the external validity of our findings relate directly to our design. For instance, for sake of simplicity, we have chosen a linear payoff function, despite the fact that societal costs of over-consumption may well be increasing rather than constant and marginal benefits could be decreasing. However, we think that our simple design is adequate for the analysis of behavior in a situation where users understand the key aspects of the trade-off between individual and collective interests.

The investigation on the effects of introducing a price to services previously offered free of charge is clearly relevant for policy-making. Our findings indicate that relying on the focal effect of price and on the pain of paying *per se*, even if the quantity is low, does not appear justified. Over-consumption could be significantly reduced if indeed many people are actually using services for really minor problems or with a substantial co-payment amount, entailing the risks described above in relation to efficiency and, especially, equity.

On the other hand, our experimental data highlight the effectiveness of imposing a price to reduce excessive use of services that have *never* been provided for free. It appears that, in those cases, the presence of a co-payment does provide a meaningful indication to refrain from the full appropriation of a common resource.

Further research is needed to ensure the robustness of these findings, for instance, by varying the payoff parameters or the group size. Another research development worth undertaking consists in analyzing the interplay of co-payment with other factors such as income inequality and the launch of campaigns to make people aware of the social costs of funding healthcare services. As mentioned above, experiments may also shed light on behavioural impacts of policy options to remove existing co-payments.

We believe that experiments can complement both theoretical advances and the collection of empirical evidence in relation to the funding of public services affecting citizens´ welfare. The possibility to isolate relevant aspects in the lab can help developing sound policy-making towards the sustainable provision of high-quality services. In this perspective, our evidence casts doubts on the effectiveness of the introduction of co-payment on existing, free-of-charge public services for cost-

containment purposes, while setting prices on new services could instead succeed as a means to limit over-consumption.

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Appendix

Instructions[2] (translated from Spanish)

Welcome to this experiment, thanks a lot for your participation.

From this moment, please turn off your mobile and you shall not communicate in any way with the other participants during the session. Please read these instructions carefully and raise your hand if you have any doubts. Your questions will be answered privately by one of the organizers of this experiment.

Depending on your decisions and the decisions of the other participants, you may earn an amount of money that will be privately paid to you in cash at the end of the session.

In each round, each participant will be assigned to a group of 5 members of the room. None of the members will know the identity of the other members of the group. The group formation process will be carried out randomly and independently at the beginning of each round.

This session will consist of a series of rounds. These instructions are valid throughout all rounds. In case something changes during the session, you will be given specific instructions.

Decision-making

- At the beginning of each round, the group is given a common fund worth 100 euro.
- Each group member can withdraw from the common fund an integer between 0 and 10, to take in into his/her private fund. Each euro that is transferred to a private fund reduces the common fund in 2 euro.
- [Only for *co-payment*] For each unit you withdraw from the common fund, you have to pay 0.1 p. (a tenth of a euro). For example, if you withdraw 5 euro from

[2] These are the instructions for the Baseline. The instructions for treatment BC are exactly the same as in the Baseline for the first 15 periods. After round 15, an announcement is given that, from the following round, the subject has to pay 0.1 per unit and the amount collected enters the common fund.

the common fund, you have to pay 0.5 euro. This quantity is subtracted from your private fund and it goes to the common fund, which will be shared among the five members of the group.

- This decision is taken at each round simultaneously by each member of the group.

- Therefore, at the end of each round the quantity in the common fund will equal 100 minus the double of all the amounts withdrawn by group members plus one fifth of the amounts extracted by the five members of the group.

  Defining as X_1, X_2, X_3, X_4, X_5 the amounts withdrawn by the five members of the group, the common fund will be:

  $$\text{Common Fund} = 100 - 2X_1 - 2X_2 - 2X_3 - 2X_4 - 2X_5 + 0.1 \cdot [X_1 + X_2 + X_3 + X_4 + X_5]$$

- At the end of each round, the quantity left in the common fund will be shared equally among the five members of the group.

- Your outcome in the round will be equal to the sum of your private fund and a fifth of the quantity left in the common fund. For example, if you are member "1" your payoff will be:

  $$X_1 - 0.1 \cdot X_1 + 1/5\,[100 - 2X_1 - 2X_2 - 2X_3 - 2X_4 - 2X_5 + 0.1(X_1+X_2+X_3+X_4+X_5)]$$

- At the end of each round, the experimentalist will inform you about your payoff, indicating how much of it comes from your private fund, and how much from the common fund.

Payoffs

At the end of the session a random selection will pick the round that will determine your payoff in the experiment. The amount will be privately paid in cash at the end of the session.

The instructions for the Baseline are the same except the parts making reference to the 0.1 euro that is paid and its impact on the common fund. The instructions for the

Baseline+Copay are the same as in the Baseline. After round 15 an announcement is given that, from the following round, the subject has to pay 0.1 per unit and the amount collected enters the common fund.

QUESTIONS

1. If you withdraw €7 from the common fund, how much is the reduction in the common fund?

2. For each unit you withdraw from the common fund, how much does each group member lose assuming that the rest of the members do not withdraw? How much do you gain, considering the impact on your share of the common fund and on your private fund?

3. If each member withdraws €0 from the common fund, how much does each group member get at the end of the round?

4. If each member withdraws €5 from the common fund, how much does each group member get at the end of the round?

5. If each member withdraws €10 from the common fund, how much does each group member get at the end of the round?

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