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Geographic proximity, information and common-pool resources: an experimental approach with a large population

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Extended Abstract

The tragedy of the commons is one of the most documented economics phenomena about natural resources. Through this phenomenon, the selfish action of each individual conducts to a decrease of available resources and, at the end, to their extinction. The efficient common-pool resources management needs to understand the decision mechanisms and collective organization underlining the actions of economic agents. Experimental and behavioral economics can help us to improve this understanding and to explore some decision mechanisms and the decision environment (Ostrom, 2006). We suggest an experiment allowing to study individual decisions about common-pool resources in four ways: (1) does the geographical proximity of the resource play a role on the intensity of exploitation? (2) has the nature of the resource an effect on its exploitation? (3) does information about the threshold of the resource sustainability reduce the exploitation; and (4) do female and male behave in the same way?

The experiment is conducted in a specific context described by Lohéac et al. (2017). During the "European night of researchers" 2015, more than 2700 voluntary individuals participated in this experiment in 11 French towns. The participants are distributed into four treatments given the resource nature (fish or tree) and information (Table 1) and took two decisions: volume of resource extraction at local level (from 0 to 5), and volume of resource extraction at national level (from 0 to 5). The initial stock of resources (for fishes or tree) is 230 units at local level and 2300 units at national level.[1] The experiment introduces an incentive system

[1] - The experiment introduces time though generations of fishers or lumberjacks. We don't develop this part here.

based on right to participate to a lottery allowing to win purchase vouchers, depending on the number of resources extracted.

Table 1. Experimental design: four treatments

	Without information	**With information**
Lumberjacks / Trees	Reproduction rate: 5%	Reproduction rate: 5% Sustainability threshold: 1 tree by lumberjack
Fishers / Fishes	Reproduction rate: 15%	Reproduction rate: 15% Sustainability threshold: 3 fishes by fishers

2716 individuals (6+ years old) participated in the experiment. The average age is 28 years old and 55% of participants are women. 24% of participants are between 6 and 18 years old.

The first result is about extraction by resources and area of extraction (Figure 1). Whatever the information and resource, the extraction is significantly higher at the national level than at the local level (0.5 unit of resource), knowing that each participant takes decisions at both levels. We observe that information about the sustainable threshold has a significant effect, but only for threes. Estimations of extraction by treatment are presented in Table 2.

Figure 1. Average extraction by resource and information (treatments)

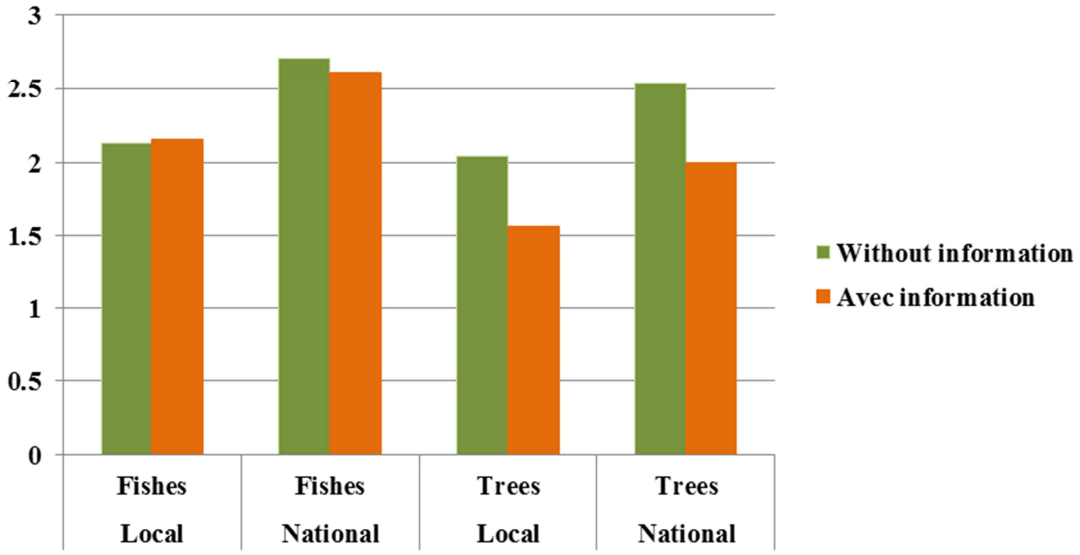


Table 2 shows that women extract significantly less resources than men (but the coefficient is higher at local level), and that age has a significant negative effect on resource extraction. The information about the sustainability threshold hasn't any effect for fish, but is significant for trees extraction. Information reduces trees extraction and the effect is higher at the national level. Note that a control for towns where the experiment takes place hasn't effects on the

coefficient, but some towns (especially from the East of France) have a significant negative effect for tree only (without changing coefficients for the variables of interest).

Table 2. Estimation (linear regression) of resource extraction by treatment

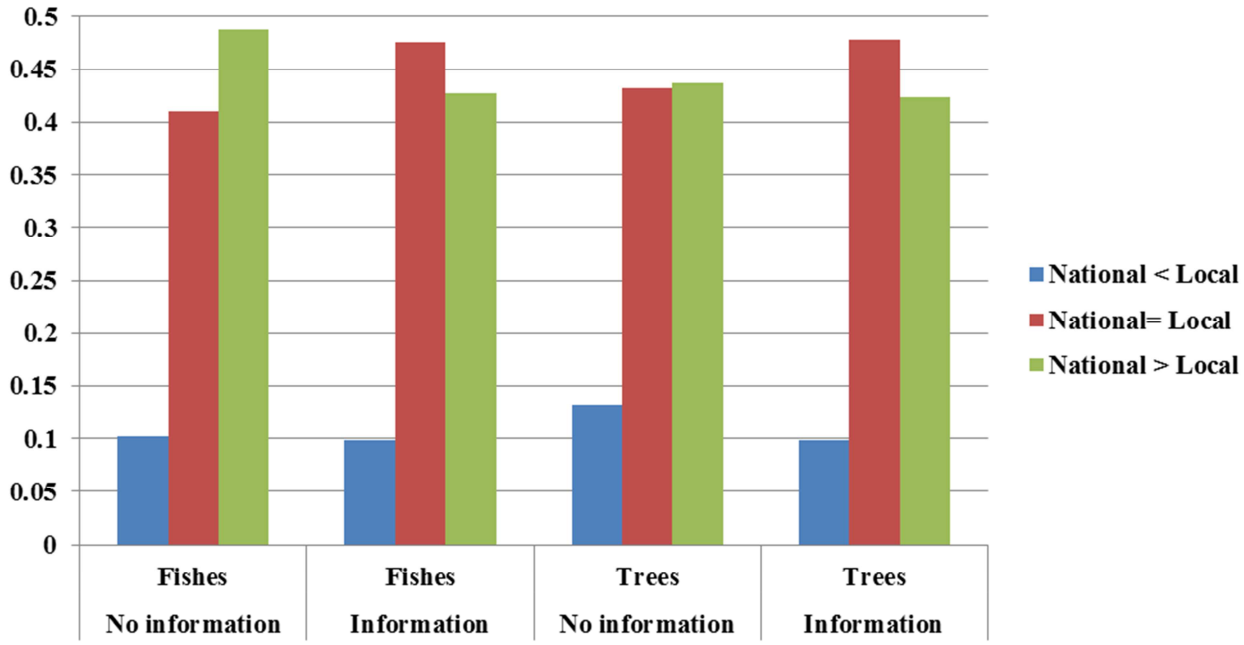
	Fish - Local			Fish - National			Tree - Local			Tree - National		
	Coef.		**S.E.**	**Coef.**		**S.E.**	**Coef.**		**S.E.**	**Coef.**		**S.E.**
Information	0.02		(0.06)	-0.08		(0.06)	-0.47	***	(0.06)	-0.49	***	(0.07)
Female	-0.37	***	(0.06)	-0.27	***	(0.06)	-0.28	***	(0.06)	-0.20	***	(0.07)
Age	-0.01	***	(0.00)	-0.01	***	(0.00)	-0.01	***	(0.00)	-0.02	***	(0.00)
Constant	2.49	***	(0.09)	3.15	***	(0.09)	2.59	***	(0.10)	3.25	***	(0.11)
Towns dummies	Yes			Yes			Yes			Yes		
Obs.	1366			1366			1350			1350		

Coef.=coefficient; S.E.=standard error

Level of significance: *=10%, **=5%, ***=1%.

At the individual level, we are interested in the consistency between the two decisions of resource extraction, at the local and national levels. On the whole experiment, 44.6% extract the same amount of resource in each area, 44.5% extract more at the national level, and 10.9% extract more at the local level. Figure 3 presents, by treatment, the proportion of participants extracting the same amount and less or more at the national level than at the local level. Between 10% and 13% reduce their extraction at the local level, and between 40% and 50% extract the same amount or extract more at the national level.

Figure 3. National-local gap by treatments, proportion of participants



The analysis of the national-local individual gap is conducted through a Probit estimation of knowing gap rather than no gap (Table 3). First of all, we test the consistency of estimation with the level of local extraction. When local extraction increases, the probability to know a negative gap rather than no gap increases, and this is the reverse for the probability to know a positive gap rather than no gap. The only significant common effect is the negative impact of

age. We can interpret this effect as when age increases, participants have a higher probability to not know any difference between their local and national extractions. Trees treatments and information treatments have a significant negative effect on the probability to know a positive gap, but interaction variable doesn't play a role. Thus, being part of the "fish without information" treatment increases the probability to extract more at the national level than at the local level.

Table 3. Estimation (Probit) on national-local gap

	Negative gap v/s equality			**Positive gap v/s equality**		
	M.E.		**S.E.**	**M.E.**		**S.E.**
Local extraction	0.06	***	(0.01)	-0.11	***	(0.01)
Trees	0.04		(0.02)	-0.06	**	(0.02)
Information	-0.04		(0.03)	-0.06	**	(0.03)
Trees*Information	0.01		(0.04)	-0.01		(0.04)
Female	0.02		(0.02)	0.03		(0.02)
Age	-0.01	***	(0.00)	-0.01	***	(0.00)
Towns dummies	Yes			Yes		
Obs.	1506			2421		

M.E.=marginal effect; S.E.=standard error
Level of significance: *=10%, **=5%, ***=1%.

To conclude, our results show that people extract more when the area is larger and with less proximity. Information on sustainable thresholds only reduces the extraction of threes, we can't conclude if it is linked to the resource (less known by humans) or to its reproduction rate. Last, women extract less resources than men whatever is the resources and the area.

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