

# Public-Private Governance for Climate Change Adaptation: An Experimental Investigation

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This is an experimental analyses that compares different alternatives to provide investment for climate change adaptation. More precisely, we test whether public-private governances are more effective than a private regime (no government intervention) in terms of final investment and efficiency. To the best of our knowledge this is the first experimental contribution that test effectiveness of public-private governances in applying adaptation investment<sup>1</sup>.

The issue of climate change is becoming more and more relevant, especially in sectors as forestry and agriculture where final outcomes largely depend on external environmental conditions. Indeed, with climate change, private land owners like farmers or foresters are more and more confronted to its effects in terms of land degradation and monetary costs<sup>2</sup>; besides, climate change impact on the field conservation entails consequences for the collectivity. A thorough description of climate change effects on the forest ecosystem is provided in the report to the European Commission "Impacts of Climate Change on European Forests and Options for Adaptation" (EFI, BOKU, INRA, IAFS 2007 - thereafter EBII 2007). The analyses initially presents climate change scenarios, thereafter it studies direct and indirect impacts of climate change on the field capability to generate revenues for the private owners and social services for the collectivity. For instance, a higher frequency of wind storm implies negative effects on the forest management activity (harvesting and transport of timber) as well as on the availability of forest services for the population (the recreation forest expected by walkers, naturalists or inhabitants).

In such a context, the alternative strategy to "*laissez faire*" is adaptation<sup>3</sup>. Adaptation investment allows public and private stakeholders to face with the consequences of climate change. The objective function changes according to whether the government participates or not in the investment strategy. If only the private agent is involved, social effects are not considered. On the other hand, the public intervention in the investment strategy can be costly for the society, notably in terms of financing costs<sup>4</sup>. In this paper we study the relevance of public - private interactions (Public Private Partnership, henceforth PPP). Specifically, we first develop a theoretical model, then we test the empirical relevance of our predictions through an experiment in the laboratory.

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<sup>1</sup>However there are some laboratory experiments that focus on quite different aspects of public-private-partnership and procurement contracting (Hoppe et al. 2011, Cox et al. 1996).

<sup>2</sup>Moreover, especially the forestry sector is really important in terms of climate change impacts: "Forestry can make a very significant contribution to a low-cost global mitigation portfolio that provides synergies with adaptation and sustainable development." (Nabuurs et al. 2007).

<sup>3</sup>According to IPCC (2007) adaptation is defined as *adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities*.

<sup>4</sup>Distortive social consequences of collecting resources from the population to finance the investment.

In the model we have a costly adaptation investment ( $I$ ), whose implementation requires efforts ( $e$ ) from the private agent. The higher the effort, the lower the size of private and social losses (the higher the benefit) in case of climate change events. The decision making process is made of two steps: first, the choice concerns the level of initial investment (investment phase), then the agent sets the optimal effort (management phase).

We solve the model considering three different scenarios: private, benefit-sharing and cost-sharing. In a private regime, the agent chooses the investment levels and is in charge of the management phase. In case of a benefit-sharing regime, the government sets a transfer aiming at fostering the agent's benefit from the investment, while the owner manages the investment and the management phases. Finally, in case of a cost-sharing regime, investment costs are shared between the two actors. In all scenarios, expenses of the public sector are weighted with a shadow cost of public funds ( $\lambda$ ). We derive two main conclusions:

- Cost-sharing is more effective than benefit-sharing to enhance the private investment; besides, a PPP is preferred the higher the social surplus and the lower the shadow cost of public funds.
- Once the investment is made, the management activity is not affected by the initial investment.

Starting from these theoretical predictions, we develop an experimental design made of five treatments:

1. Private (Benchmark Scenario) - the private agent chooses first the level of investment ( $I^{pr}$ ), then the optimal effort ( $e^{pr}$ );
2. Benefit-Sharing with  $\lambda = 0$  - the government decides the optimal marginal transfer ( $T$ ), then the private agent sequentially chooses the levels of investment ( $I^{bs}$ ) and effort ( $e^{pr}$ );
3. Cost-Sharing with  $\lambda = 0$  - the government decides the optimal cost-sharing parameter ( $\alpha$ ), then the private agent sequentially chooses the levels of investment ( $I^{cs}$ ) and effort ( $e^{cs}$ );
4. Benefit-Sharing with  $\lambda = 1$  - it is equal to treatment 3, but government costs are higher because of  $\lambda$  (shadow cost of public funds);
5. Cost-Sharing with  $\lambda = 1$  - it is equal to treatment 4, but government costs are higher because of  $\lambda$  (shadow cost of public funds).

The behavioral assumptions we test in the experiment are the following:

- $I^{cs} > I^{bs} > I^{pr}$  when  $\lambda = 0$ , while  $I^{cs} > I^{bs} = I^{pr}$  when  $\lambda = 1$ .
- $e^{cs} = e^{bs} = e^{pr}$ , independently from  $\lambda$ .

## References

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