Analysis

Costs and Perceptions Conditioning Willingness to Accept Payments for Ecosystem Services in a Brazilian Case[☆]

Ronaldo Seroa da Motta[a,][*], Ramon Arigoni Ortiz[b]

[a] State University of Rio de Janeiro, UERJ, Av. Borges de Medeiros 3709 ap. 401, Lagoa, Rio de Janeiro 22470-001, RJ, Brazil
[b] Rio de Janeiro Town Hall, Rua Leite Leal, 99 apto 16, Laranjeiras, Rio de Janeiro 22240-100, RJ, Brazil

ARTICLE INFO

ABSTRACT

This study analyzes the willingness of farmers to accept payments for ecosystem services in the Paraíba do Sul River basin applying a contingent valuation methodology. Ecosystem services would be those resulting from forest conservation and regeneration and sustainable and innovative production practices. The results suggest a regressive bias when some variables that capture the income effect positively affect participation in the program and acceptance of the payment offered. There is also evidence of adverse selection when acceptance of the amount offered is more sensitive to the service provision already being suited to the modes of production adopted. The results, on the other hand, indicate that farmers' decisions to join the program depend not only on their opportunity costs, but also on their perceptions about specific issues, such as their environmental knowledge or awareness, inertia to change production modes, fear of additional monitoring, and level of understanding of the program. These results are important to support the program's outreach strategies and the design of mechanisms for the selection of beneficiaries and pricing of payments.

1. Introduction

This study analyzes the willingness of farmers to accept payments for an ecosystem services program in the Paraíba do Sul river basin in Brazil. This basin crosses the states of São Paulo, Minas Gerais, and Rio de Janeiro, and covers an area of 56,500 km² that includes the Paraíba Paulista Valley and Fluminense regions and the Northwest Fluminense and a major part of the Mata Mineira Zone.

Since colonial times the basin has been an agricultural center. With the end of slavery and facing severe soil it experienced a decline in agriculture with the expansion of dairy cattle farming. At the beginning of the 20th century dynamic industrial activity begins and with the heavy industrialization process in São Paulo and installation in the basin, in 1946, of the Companhia Siderúrgica Nacional (CSN), the National Steel-Making Company, the region becomes essential to the economic integration of the states of Rio de Janeiro and São Paulo, transforming the basin into one of the key communication and development hubs for the region and for the country, thanks to the exceptional conditions that it offered –water supplies, sufficient electricity, a consumer market, and the easy distribution of goods. Along its course there is also a high urban density, dams for supplying water and generating hydroelectric power, mining sites, and substantial floodplain

agriculture (http://www.marcadagua.org.br).

With this long and intense human occupation, today the region preserves < 20% of its original Atlantic Rainforest biome. This biome is recognized as one of the five most important areas of biodiversity in the world. Despite Regulation no. 11428, passed in 2006, prohibiting any area of the Atlantic Rainforest being removed, the areas preserved still face many external threats, such as illegal hunting and logging, and accidental or natural fire.

In addition, there is forest fragmentation that, as well as the loss of biodiversity, affects the region's water cycle, impacting water quality and the recurrence of flooding and droughts. One of these more recent consequences occurred at the beginning of 2010 when a flood caused by raised waters damaged around 300 buildings in the city of São Luiz do Paraitinga, displacing and leaving around 90% of the city's population homeless and destroying a major part of the historic center.

Given the need to better conserve this remaining Atlantic Rainforest and mitigate hydrological effects in the basin, state and federal governments were engaged in developing a program of payments for ecosystem services (PES), which widens the current state initiatives and specifically directs these towards an area of the basin in three states located in four different municipalities, namely: São Luís do Paraitinga and Santa Natividade in the state of São Paulo, Varre-Sai in the state of

Rio de Janeiro, and Muriaé in the state of Minas Gerais.[1]

The PES program under analysis intends to encourage the adoption of a bundle of environmentally benign best practices that contribute to the mitigation of hydrological effects in the basin. Such aim could be achieved either by reducing degradation of current forestland or converting current grazing area with reforestation or commercial forest cultivation.

Since each activity bundle would result in different levels of activity effort from farmers and, mainly, generating distinct level of service provision, the PES program classified them as distinct services, namely:

Service 1 – Forest Conservation: activities to reduce forest and land degradation, such as controlling fire, pests, invasion, hunting, palm heart harvesting, and other sources of degradation and risks.

Service 2 – Forest Regeneration: activities to convert degraded grazing land without any income alternative through the planting of native trees.

Service 3 – Productive Conversion: activities to convert current grazing land into rotational management and/or mixing agriculture and grazing with forest cultivation.

Farmers could accept to participate in one or more of these services. Those taking part will receive a six-monthly payment per hectare for a period of three years.

Payment for ecosystem services (PES) has proved to be a widely-used instrument for encouraging conservation and forest regeneration in the world and in Brazil (Latacz-Lohmann & Hodge, 2003; UNEP, 2008; FAO, 2011 and Guedes & Seehusen, 2011).

Farmer participation in PES programs is thus conditioned by the opportunity cost (direct and indirect) of the financial commitment made by suppliers to offer these services. There is, however, extensive literature that evaluates these experiments and points out that farmer participation in PES is not only subject to the opportunity cost (direct and indirect) for them There are also adverse selection problems when participation tends to attract landholders who are already advanced in the implementation of these services. Furthermore, regressive biases are recorded when higher earning landholders, or those with large properties, and greater ability to mitigate risks, are more inclined to join the program and/or are less demanding with regards to payment amount (Alipizar, Blackman, & Pfaff, 2007, Wunder, Engel, & Pagiola, 2008, Stefanie, Pagiola, & Wunder, 2008, Gomez-Baggethun, Groot, Lomasa, & Montesa, 2010, Martin-Ortega, Ojea, & Roux, 2013 and Grammatikopouloua, Ihoa, & Pouta, 2013).

In addition to opportunity cost, it is observed that the degree of uncertainty regarding the program implementation, inertia in changing production modes, and knowledge of the environmental impact of the services also affect how farmers price joining these programs. (Grosjean & Kontoleon, 2009; Cranford & Mourato, 2011 and Vijesh et al., 2013).

In the Brazilian case, Zanella, Schleyer, and Speelman (2014), by carrying out an *ex-post* evaluation of the first PES program in Brazil for water conservation practices, note that participation is correlated with family labor intensity and access to information.

The same conditions appear in studies that analyzed program proposals, identifying the degree of importance of these factors *ex-ante* and the values that would attract the participation of farmers, with the aim of contributing to the program's design and which could improve its performance (Amigues, Boulatoff, Desaigues, Gauthier, & Keith, 2002, Cooper, 2003, Ferraro, 2008, Buckley, Hynes, van Rensburg, & Doherty, 2009, Vatn, 2010; Cranford & Mourato, 2011and Leimona et al., 2015).

Stated preference techniques are usually applied in these cases of *ex-*

ante evaluation. These techniques undertake surveys involving a sample of potential participants of a PES program in a certain region in which the program is presented, describing the activities to be remunerated and questioning the interviewees about the factors that would affect their participation and the amount that the interviewee would be prepared to accept to join the program.

This study will thus identify, with a contingent valuation survey, the economic and perception factors of agricultural landholders in the region, which affect participation in the PES program and, particularly, the acceptance of the payment levels. Our contribution consists of the first *ex-ante* evaluation of a PES program in Brazil, particularly with the offer of three different service level provisions from distinct bundle of environmentally benign best management practices, in which perception variables are included.

The next section presents the specification of the adopted model and identification strategy. Next the survey is described and results follow. Last section concludes.

2. The Model

Stated preference methods can be presented in two large groups: the contingent valuation method (CVM), in which the person interviewed is offered an amount to pay or accept a certain good or service provision level; or the choice experiment (CE) in which interviewee reacts to pay offers for attributes of the good or service. It is more difficult for the interviewee to understand CE questions, despite it being the most widely indicated technique when the attributes are relevant and understandable (Hoyos, 2010, and Hanley, Mourato, & Wright, 2001). However, in this study we investigate the willingness to accept payments to each service provision and not attributes of them, therefore, CVM is adopted.[2]

A contingent valuation survey is applied in a close-ended format. First interviewees are asked if they would be willing to join the program. If they would then they are asked if they would accept or not a certain payment to delivery of each service. The analysis starts identifying the factors that influence farmers in deciding to accept or not to take part in the program and then the ones influencing acceptance of a payment.

Formally, in this case, we take the rural landholder's expected utility function as u (j, y; s), where j = 0 if the landholder maintains his/her existing activities in an area of the land and j equals to 1 when he/she accepts the service for the payment (PAY) offered to change these activities. The y term is the landholder's income (rural and non-rural) and s is the vector of features that affect the decision to join the program.

The landholder's expected utility in taking part in PES in exchange for payment is given by $u_0 = u(1, y + PAY, s)$ and that for those who do not take part is given by $u_1 = u(0, y; s)$. If u (j, y; s) is composed of an observable component, v (j, y; s), and another non-observable one, ε_j, so that u (j, y; s) = v,(j, y; s) + ε_j. The landholder will decide to join if

$$v(1, y + PAY; s) + \varepsilon_0 > v(0, y; s) + \varepsilon_1 \qquad (1)$$

or

$$v(1, y + PAY; s) - v(0, y; s) > \varepsilon_1 - \varepsilon_0 \qquad (2)$$

Assuming a distribution for the error term ε_j, the difference $\varepsilon_1 - \varepsilon_0$ would be distributed, for example, in Logit and Probit models. In other words, the likelihood of the landholder accepting to take part in the PES for the proposed payment would be when Δv equals the difference in utility in Eq. (2) (Hanemann, 1984 and Maddala, 1983).

The validity tests for the results will be based on analysis of the

[2] A CE approach to PES can be seen, for example, in Ruto and Garrod (2009) and Broch and Vedel (2012) that investigate farmers´ stated preferences for attributes of afforestation contracts. That is, how much payment can be traded with contract terms.