

Factors influencing payment levels in Payments for Ecosystem Services: evidence from a meta-analysis of water schemes in Latin America

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Relevant conference themes:

2. Natural resources, ecosystem services and environmental quality

2.1. Economics, incentives and institutions for ecosystems and biodiversity

2.3. Ecosystem services: debating, valuing, preserving and providing

Or possibly to the Special Session:

7.18. Interrogating Payments for Ecosystem Services on Intrinsic Motivations for Conservation]

Summary: (150 words)

Payments for Ecosystem Services (PES) schemes are receiving great attention, while practical examples continue to be implemented across the world. We carry out a meta-analysis of the PES literature, searching to identify what factors determine payment levels and looking separately at buyers and sellers. A collection of 310 distinct payment transactions obtained from 40 PES schemes in ten Latin American countries was modelled using mixed linear models. Models are at an early stage of development, and hence results should be taken with care. However, it is already possible to suggest some interesting insights. E.g., for both buyers and sellers, payments levels are higher when multiple services are the object of transaction, and when sellers engage in more than one type of action. The presence of intermediaries affects buyers' payments but not sellers' receipts. Further research will involve developing 'extended' models with a larger set of covariates and discussing results in the context of current debates on PES conceptualization.

Keywords: buyers, linear mixed models, markets, sellers.

Extended abstract: (600 – 1200 words)

1. Introduction

Payments for Ecosystem Services (PES) schemes have received and continue to receive great attention in the scientific and policy spheres, while practical examples continue to be implemented across the world. PES schemes are advocated in situations in which an environmental externality can be re-dressed through the creation of ad-hoc markets based on the Coasean postulate by which the social optimum might be attained via bargaining. Martin-Ortega et al. (2013), in a systematic review of payments for water ecosystem services schemes in Latin America, provided evidence on how PES practice (as reported by the literature) differed from PES ‘theory’ in aspects that are critical to the principles by which PES are expected to perform better than other conservation and natural resources management instruments. Theoretically, payments should be based on a mutual willingness between participants, and should be based on the seller’s opportunity costs and the buyer’s willingness to pay. However, very few of the studies reviewed by Martin-Ortega et al. (2013) seem to address these issues, and, although in some schemes buyers and sellers influence the payment levels, in the vast majority of transactions these are set in top-down decisions. Moreover, sellers’ average receipts were found to be 60% larger than buyers’ average payments, suggesting that subsidies from a third party may be playing a significant role in price setting. These facts would provide some support to recent assertions that not all PES are the outcomes of a market-based dynamic ((Ioris, (2010); Muradian *et al.* (2010); Schomers and Matzdorf, (2013); and Gomez-Baggethun, (2014)).

In this context, gathering evidence on what are the factors that determine payments in PES schemes in practice and how those diverge from theoretical expectations seems a critical issue that has not yet been addressed comprehensively. In this study, we carry out a meta-analysis of published studies reporting on water PES schemes in Latin America to statistically assess the factors that have an influence payment levels. We look separately at payments received by service sellers and at payments made by service buyers.

2. Materials and methods

A collection of 310 observations (distinct payment transactions) was obtained using information from 40 PES schemes in ten Latin American countries, dating from 1984 and published up to 2012. Studies were selected from the peer-reviewed and the ‘grey’ literature. We model two dependent variables: buyers’ payments and sellers’ receipts, expressed in USD (updated to 2012) per hectare per year.

Our dataset has a nested structure, where one programme might be composed of several schemes including various transactions (our dependent variables are at this transaction level). To deal with this structure, we use a two-level model, with one level for country (programmes are country specific) and a second level for scheme. Additionally to the nested random structure for scheme within country and the random effect for country, and because our data set is skewed towards the number of transactions taking place in Costa Rica (were the largest national PES programme takes place), we use mixed models including country as a fixed effect, as it has previously been suggested that one should not fit multilevel models to data consisting of fewer than 10 clusters (Snijders and Boskers, 1999).

3. Results

Table 1 presents the preliminary model results for buyers and sellers. A first comparative result is that the model for buyers was easier to obtain and more consistent in the different model specification tested, while it was much harder to obtain a good fit for the sellers' model. Also, the buyers' model includes 60% more observations. Still, relevant variables have been proven to have a significant effect on payment levels for both buyers and sellers.

*Table 1. Models for factors determining buyers' payments and sellers' receipts in water PES in Latin America (2012USD/hectare/year)**

Variable	Description	BUYERS		SELLERS	
		Coef. (Std.error)	$P > t$	Coef. (Std.error)	$P > t$
Various services	Scheme involves one service only (0) or more (1)	1190.352 (58.544)	0.000	89.864 (18.586)	0.000
In-stream services	Scheme involves in-stream water service (1) or other type (0)	-1184.930 (56.698)	0.000	-91.365 (20.975)	0.000
Various Actions	Seller carries out one type of action (0) or various (1)	1053.278 (71.633)	0.000	37.287 (6.180)	0.000
Action Reforestation	Action includes reforestation (1) or not (0)	-	-	-131.599 (16.43)	0.000
Intermediary	There is an intermediary (1) or not (0)	1066.399 (86.680)	0.000	1.320 (3.891)	0.734
Contract scope	Surface under contract for sellers	-	-	0.002 (0.001)	0.000
Start year	Year of the start of the PES programme	12.535 (3.688)	0.01	7.654 (1.691)	0.000
Top-down price set up	Payments levels are set up by higher level instance (e.g. government) (1) rather than by negotiation from buyers and sellers (0)	-1033.221 (80.905)	0.000	3.231 (5.572)	0.562
Country per capita income	Updated per capita purchasing power	-0.005 (0.0054)	0.319	0.013 (0.001)	0.000
Country	Costa Rica (1), other (0)	111.209	0.003	97.358 (23.361)	0.000
Constant		-26152.190	0.000	-15386.09	0.000
N		148		88	
Log likelihood		-642.057		-329.940	
Wald chi2		3266.01		647.85	

*Large coefficients are due to great difference in scales for the different variables. Work in progress includes independent variables standardization.

4. Discussion and preliminary conclusions

Models results presented here are at an early stage of development, and hence should be taken with care. However, it is already possible to suggest some interesting insights. For both buyers and sellers, payment levels are influenced by the number and type of services. Transactions involving more than one service involve higher payment levels, while in both cases in-stream water services (e.g., for transportation, hydropower or fish production) involve lower payments than extractive water supply (e.g. irrigation and human consumption) or damage mitigation (e.g., to counter flooding, sedimentation, or saltwater intrusion).

Payments are higher both for buyers and sellers when sellers undertake several actions, as might be expected. Sellers receive lower payments for reforestation actions than for other kind of actions such as forest conservation, forest management and changes in agricultural practices and agro-forestry activities. Larger areas under contract involve higher per hectare payments for sellers, suggesting incentives for sellers to expand the scope of the scheme.

Contrary to our expectations, service buyers tend to pay higher payments when an intermediary is present, while this effect is non-significant in the case of sellers, questioning our suggestion that subsidies from the intermediary might be explaining the difference on average payments between buyers and sellers. Top-down price setting process (rather than party negotiation) involve lower payments from buyers (and are not significant for sellers), suggesting that payments might be below buyers' willingness to pay for the services.

No per capita income effect is detected for buyers, but it is for sellers, for whom is found, as expected, that richer countries involve higher payments. In both cases, more recent PES schemes involve higher payments for both sellers and buyers.

The analysis presented here has focused on comparing a number of 'core' variables expected to have an influence on both buyers and seller's payments and has shown convergence and divergence across them. Further research will involve the development of 'extended' models with a larger set of covariates in search of the full set of variables influencing buyer's payments and seller's receipts.

References

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