Exploring the potential of local market in remunerating water ecosystem services in Cambodia: an application for endogenous attribute non-attendance modelling.

Tina Rambonilaza,

IRSTEA, France   Tina.Rambonilaza@irstea.fr

Malyne Neang,

ECOLAND, Cambodia nmalyne@rua.edu.kh

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Introduction

Exportation drive agriculture toward an intensive model increasing pollutions and ES degradation (agricultural products, soil and water, agro-biodiversity "human source of protein").

Literatures suggest that organic label may be the way to get the poor farmers out of poverty and resolve the environmental problem by support the sustainable traditional practice.

Consumer-PES schemes are also pragmatic approach to remunerate low-income farmers to maintain ecological benefit "Synergy of agriculture and ecosystem function" for developing country because of small proportion of public fund. => Challenge "Make the poor pay for price premium".

The motivation of consumers to pay for certified products has been studies in several studies but the potential of local consumers for ES has not yet been examined.

Our study deal both identification of ES and investigation of WTP from urban consumer

Agrarian System Analysis and Diagnosis was used to identify ES provided by rice cropping system.

TSL is the largest freshwater lake of Mekong river bassin and the floodplain is suitable for rice production but high risk of flood => water control for intensified rice and organic rice. The lake and its floodplain provide large habitat for bird and fish.

Ecosystem Services	Expected benefit for consumer	Intensive system dominated by short-term rice	System dominated by traditional medium-term and long-term rice	System dominated by organic rice	System dominated by floating rice
Protection against flood of agricultural landscape by the conservation of flooded forest	Food security	-	-	++	+++
Provisioning of water quality (for agricultural uses)	Reduced health risks from pesticides residues in rice products	-	++	+++	+++
Habitat for agro-biodiversity fauna, flora and amphibians of rice fields	Reduced health risks from pesticides residues in snacks	-	++	+++	+++
Conservation of traditional rice variety	Cultural heritage value	--	+++	++	+++

Note: -:Moderate Negative impact; --:High negative impact ; ++:Moderate positive impact; +++: High positive impact.

Trade-off

- To maintain water quality, habitat and agro-biodiversity preservation => **Rainy season rice including floating rice and organic rice cropping system**

- To maintain Local natural and diversification of rice varieties => **Rainy season including floating rice.**

300 of individuals was interviewed in 2013, only 295 are acceptable after data cleaning

Type of markets targeted	Distance from Independence monument	Population targeted	Type of Food sold
Traditional Markets (Psar)		41%	
Olympic	2 km	Upper and middle class	All kind goods and food but no organic
O'Russey	1.5 km		
Dorm Kor	2.8 km	Middle and lower class	
Stung Mean Chey	4 km		
Super Markets		10%	
Lucky Sihanouk Blv	0.7 km	Upper and middle class	All kind of goods especially imported goods
Lucky Soriya	1.5 km		
Luctky Sovanna	3.7 km	Middle and lower class	
Organic Shops		49%	
Happy Farm	0.7 km	Upper and middle class	Mainly organic and local food
Natural Garden	0.8 km		
CEDAC at street 63	0.9 km		
CEDAC at street 360	2 km	Upper, middle and lower class	
CEDAC at Kampuchea Krom boulevard	3.8 km		

The second part of questionnaires is about the perception of consumers related the impact of agricultural practices on environment which guide them to understand the ES. The CE is at the fourth part of the questionnaires.

Rice Type	Production method	Targeted ecosystem service (ES)	Price/kg
1. Fragrant rice	1. Certified Organic	1. Biodiversity and water quality of the river	1 (3000)
2. Normal rice	2. Certified Chemical free	2. Indirect Flooded forest conservation	2 (4500)
	3. Chemical free but non certified	3. Natural Variety	3 (6000)
	4. Chemical use	4. No specific ES	4 (7500)

Using fractional generation procedure "Ngene" software to produce the scenarios

Produce 36 choices sets that divided into 3 blocks and each respondent was with 6 choices sets:

They were asked to choose between 2 alternative scenarios or their current consumption habit (status-quo)

Scenario 1	Scenario 2	I don't change my consumption.
Fragrant rice	Normal Rice	Which rice?............
Rice certified grown without chemical use	Rice grown with chemical use	Why?
Protection against flood of agricultural landscape by the conservation of flooded forest	Preservation of local rice variety	
Riels 4,500	Riels 6,000	
☐	☐	☐

Result of survey population

Socio-economic status:

- Average age: 31 years old
- Head of household: 36%
- Highschool level: 44%
- Khmer: 90% /western (and others) :10%

Habit of consumption:

- Organic consumers: 67%

=> for healthy food: 95%, local products: 66%, Taste: 53%, increase farmers income: 50%, and **environmental conservation: 48%**.

Econometric estimation and results

	Model 1		Model 2	
Choice	Coefficient	z-score	Coefficient	z-score
Opt-out	9.89***	14.24	10.30***	14.51
Opt-out *Organic consumer			-0.65**	-2.01
Price	-0.001***	-14.37	-0.001***	-13.90
Taste attribute				
Fragrant rice	0.15*	1.74	0.15*	1.67
Labelling attribute				
Certified organically produced rice	2.29***	14.46	2.29***	14.53
Certified chemical free produced rice	2.07***	11.64	2.08***	11.74
Non certified chemical free produced rice	1.27***	7.78	1.27***	7.82
Ecosystem service attribute				
Preservation of water quality and biodiversity	1.36***	10.19	1.36***	10.19
Preservation of flooded forest	1.60***	10.00	1.59***	9.95
Conservation of local variety	1.28***	6.45	1.24***	6.35
Attribute non-attendance				
Predicted probability of non-attendance for price attribute	0.60***	13.46	0.61***	13.93
Predicted probability of non-attendance for labelling attribute	0.04	0.72	0.04	0.66
Predicted probability of non-attendance for ecosystem service attribute	0.17***	2.81	0.17***	2.89
Log-likelihood		-1291.77		-1289.76
AIC		2607.55		2605.52
BIC		2686.48		2691.03
Number of observations		5310		5310
Number of individuals		295		295

Note: *: significant at 10%; ** : significant at 5%; ***: significant at 1%

No different preference between different kinds of safe food

No different preference between ES

61% of respondents ignore the price attribute => increasing in price has not impact on consumer preferences.

4% of respondents ignore the labelle

Still 17% of respondents ignore ES

Class 1: 24%; Class 2: 59%; Class 3: 17%

	Class 1		Class 2		Class 3	
	Coefficient	z-score	Coefficient	z-score	Coefficient	z-score
Opt-out option	21.99***	5.18	8.96***	9.58	5.22*	1.66
Opt-out option*Organic consumer	-4.03***	-5.43	0.37	-1.00	2.88***	3.71
Price	-0.001***	-5.45	-0.0001***	-3.85	-0.001***	-5.15
Fragrant rice	0.43	1.45	0.07	0.62	0.53	1.13
Certified organically produced rice	4.40***	4.13	2.16***	11.53	1.14	1.63
Certified chemical free produced rice	3.86***	3.87	1.94***	8.74	0.20	0.26
Non-certified chemical free produced rice	3.14***	3.09	1.21***	6.51	0.30	0.34
Preservation of water quality and biodiversity	1.21***	2.88	1.24***	7.32	2.10***	2.63
Preservation of flooded forest	1.60***	3.28	1.49***	6.01	0.87	1.26
Conservation of local variety	1.20***	2.36	1.01***	3.70	2.52***	3.27
Log-likelihood	-1262.57					
AIC	2589.14					
Probability of class membership	0.24		0.59		0.17	
Number of observations	5310					
Number of individuals	285					

Note: *: significant at 10%; ** : significant at 5%; ***: significant at 1%

We can divide into 3 homogenous groups of preference.

All classes are non-attenders to price but the class 2 is low attenders = they have not considered the price to make decision

The class 3 is the only one who are not sensitive with label

All class are sensitive with ES

Willingness to Pay (WTP)

The class 3 ignore the price to make their decision, so they are excluded from WTP estimation

Attribute name	Eaalogit		Latent class/Class 1		Latent class/Class3	
	Mean value	Standard-deviation	Mean value	Standard deviation	Mean value	Standard deviation
Fragrant rice	-	-	-	-	-	-
Certified organically produced rice	3587	1343	6929	7412	-	-
Certified chemical free produced rice	3261	1303	6066	7061	-	-
Non certified chemical free produced rice	1988	1168	4939	6347	-	-
Preservation of water quality and biodiversity	2138	923	1899	3028	1623	2599
Preservation of flooded forest	2488	1191	2519	3574	-	-
Conservation of local variety	1950	1388	1881	3636	1945	2563

Respondents didn't show the different preference between different kinds of safe food but they don't put the same price

ES " Preservation of flooded forest and water quality and biodiversity" win the consumer supports

Choice-Experiment give more comparable choices than the real shopping experiences to consumers to make their choices.

The study suggests that consumers are willing to pay more for all kind of safe products. They also express their interest to preserve the environment that benefits other citizens, which opposites to majors studies' findings, which conclude that organic consumers value only their self-interest.

The consumers express their additional value for preservation of biodiversity and river water quality ecosystem services related to rice cultivation practices => there is willingness to pay higher price premium to promote these public goods "ecosystem services".

In the context of Cambodia, organic production is promoted by NGOs and international institution to alleviate rural poverty but farmers still face to label lost caused by flash flood.

This study open new perspectives:

- Make rice cultivation systems that preserve the quality of river, habitats and agrobiodiversity to get benefit from price premium
- Define the market-based environmental policy instruments in specific case of rice cultivation
    - define the new/innovative certification
    - Optimize price premium
    - Foster consumers confidence (health and nutritional benefit as well as social benefit)

Thanks for your attention