

四川省生态恢复项目环境效益非市场 价值评估

ESTIMATING NON-MARKET ENVIRONMENTAL BENEFITS OF THE ECOLOGICAL RESTORATION PROGRAM(ERP) IN SICHUAN PROVINCE, CHINA

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研究主题

The Issue

- 生态恢复项目的政策目标：改善生态环境
- Policy objectives of the Ecological Restoration Program (ECP)
- 生态改善将产生市场价值和非市场价值
- Environmental improvements have both market and non-market values
- 本研究的主要目的 - 评价生态恢复项目的非市场价值
- The objectives of this research – non-market valuation of the ECP

研究逻辑

logistics

- 生态经济模型
 - **Bio-economic modelling**
- 评价生态恢复带来的环境变化 – 生物物理模型
 - **Identify and estimate environmental changes under the ECP**
- 评价人们对于环境改善的支付意愿 – 选择模型
 - **Estimate people's willingness to pay for environmental improvements – choice modelling**

选择模型

The Choice Modelling Approach (CM)

- 对于实现假想环境目标支付意愿的问卷调查
 - **Hypothetical survey**
- 核心部分为选择题，每个选择题包括不同选项
 - **Several choice sets with a number of scenarios in each choice set**
- 每个选项包括环境物品的属性和支付费用
 - **The scenarios are defined by several environmental attributes and a payment attribute**
- 通过人们的取舍来判断每一种环境属性的货币价值
 - **Marginal value for each environmental attribute is derived through modelling people's tradeoffs**

问卷中选择题例子

Example of a Choice Set

	Option A: No new action (选项A: 保持现状)	ECP (实施生态恢复)	
		Option B (选项B)	Option C (选项C)
Payment to farmers each year(3 years) 每年向农民义务支付金额(为期3年)	¥0	¥500	¥300
Number of days with good to excellent air quality 年良好天气日数	250 days	290 days	275 days
Number of plant species on wastelands 造林地上植物种类增加量	200	600	500
sediment discharge into Yangtze river 每年流入长江泥沙量	100 million	97 million	98 million
Chance of improvement occurring 不确定性	Not applicable	50%	90%
I would choose (please tick one) 我将选择:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

选择模型情景设计

Scenario in the CM Survey

- 确定环境变化的地理范围：
 - **Geographical Boundary of Environmental Changes – the Yangtze River Basin**
- 通过焦点小组确定环境物品属性和支付方式
 - **Define the environmental attributes and payment vehicle through focus groups**
- 支付方式：3年内每年向造林农户进行义务支付
 - **Payment –annual compulsory payment to ECP farmers over a 3-year period**

环境物品属性

Environmental Attributes

- 优良天气日数，入长江泥沙，造林地上植物种类
- days with good to excellent air quality , sediment discharge, plant species



选择模型调查设计

The Choice Modelling

Survey

- 两个调查样本点：上海，成都
 - Two survey sites –Shanghai, Chengdu

- 不同社会经济特征和至案例点的地理距离
 - Differences in socio-demographics and distance to the Case-study site

四川省及长江流域地理位置

The Location of Sichuan Province in Yangtze River Basin, China



调查对象

Survey Respondents

- 调查对象: 城镇居民
 - **Survey respondents: urban households**
- 调查方式: 网上调查
 - **A web-based survey was conducted**
- 每个样本地调查750户, 其中, 500户是4属性问卷调查, 250户是5属性问卷调查
 - **About 750 households in each city: 500 households with 4 attributes questionnaires, 250 households with 5 attributes**

数据分析

Data Analysis

- 运用CL和 RPL模型进行模型估计
 - Conditional logit and random parameter logit models estimated
- 对两地分别比较CL和RPL结果
 - Separate choice models were estimated for the two sites and the results compared.
- 比较结果显示：无显著差异
 - No significant differences were found between the implicit price estimates derived from the conditional logit (CL) model and the random parameter logit (RPL) model for the environmental attributes.

环境物品属性单位价值和置信区间 Mean Annual Implicit Price and Confidence Interval (CL models)Unit: CNY /p.a. 元/年

Variable	Shanghai models		Chengdu models	
	4-attribute	5-attribute	4-attribute	5-attribute
<i>AIR QUALITY</i>	5.01	<u>1.38</u>	4.76	<u>-0.22</u>
	(3.23~6.86)	(-4.59~7.05)	(1.81~8.01)	(-19.18~27.53)
<i>WATER QUALITY</i>	-37.29	<u>24.35</u>	<u>16.75</u>	<u>92.92</u>
	(-64.32~-8.95)	(-52.57~106.11)	(-23.98~57.53)	(-142.48~753.28)
<i>SPECIES</i>	0.77	1.05	0.66	<u>0.07</u>
	(0.54~0.99)	(0.57~1.62)	(0.32~1.03)	(-2.12~1.97)
<i>UNCERTAINTY</i>	Na	558.96	Na	<u>436.47</u>
	Na	(222.05~972.39)	Na	(-165.86~3237.66)

Note: “_” denotes those IPs that are not significantly different from zero at the 95% level; CIs in parentheses; the mean IPs and CIs reported in this table are calculated using the Krinsky and Robb (1986) procedure.

环境物品属性单位价值和置信区间

Mean Annual Implicit Price and Confidence Interval (RPL models) Unit: CNY /p.a. 元/年

Variable	Shanghai models		Chengdu models	
	4-attribute	5-attribute	4-attribute	5-attribute
<i>AIR QUALITY</i>	<u>5.48</u>	<u>1.60*</u>	<u>4.75*</u>	<u>8.52*</u>
	<u>(3.35~7.39)</u>	<u>(-4.84~7.43)</u>	<u>(1.71~7.96)</u>	<u>(-11.83~32.32)</u>
<i>WATER QUALITY</i>	<u>-50.08</u>	<u>23.55*</u>	<u>18.65</u>	<u>107.7*</u>
	<u>(-73.94~-26.54)</u>	<u>(-51.24~101.90)</u>	<u>(-21.53~68.16)</u>	<u>(-120.94~634.27)</u>
<i>SPECIES</i>	<u>0.79*</u>	<u>1.05*</u>	<u>0.65</u>	<u>0.07*</u>
	<u>(0.54~1.03)</u>	<u>(0.57~1.71)</u>	<u>(0.25~1.04)</u>	<u>(-2.01~1.75)</u>
<i>UNCERTAINTY</i>	Na	<u>569.22</u>	Na	<u>757.75</u>
	Na	<u>(205.26~1029.80)</u>	Na	<u>(-221.71~3702.98)</u>

Note: “_” denotes those IPs that are not significantly different from zero at the 95% level; CIs in parentheses; * the mean IPs and CIs are calculated using the unconditional parameter estimates, other mean IPs and CIs reported in this table are calculated using the Krinsky and Robb (1986) procedure.

CL 模型与RPL 模型单位价值比较检验

A Comparison of Implicit Prices: CL and RPL

	Shanghai Prob	Chengdu Prob
	$(IP_{CL} - IP_{RPL} > 0)$	$(IP_{CL} - IP_{RPL} > 0)$
<i>AIR QUALITY</i>	0.6376	0.5008
<i>WATER QUALITY</i>	0.2439	0.5140
<i>SPECIES</i>	0.5558	0.4943

生态恢复工程环境改善的支付意愿

Willingness to Pay (WTP) for the Environmental Improvements under ERP

- 没有实施生态恢复工程, 截止2030年
 - Without ERP at 2030
 - 年优良天气数: 250天
 - days with good to excellent air quality p.a.
- 250
 - 造林地上植物种类: 200
 - Veg. Cover – 200
 - 年入长江泥沙量: 1亿吨
 - Sediment discharge p.a.
- 0.1billion tons
- 实施生态恢复工程, 截止2030年
 - With ERP at 2030
 - 年优良天气数: 290天
 - days with good to excellent air quality p.a.
- 290
 - 造林地上植物种类: 600
 - Veg. Cover – 600
 - 年入长江泥沙量: 0.97亿吨
 - Sediment discharge p.a.
- 0.097 billion tons

户均支付意愿和置信区间

Household WTP and Confidence Intervals

Unit: yuan

	Shanghai 上海	Chengdu 成都
Household WTP p.a. 年支付意愿	959.59 (847.26 ~ 1074.85)	1051.37 (898.69 ~ 1221.10)
PV of 10-year WTP (3%) 现值	2795.75 (2468.47 ~ 3131.54)	3063.13 (2618.31 ~ 3557.64)
PV of 10-year WTP (10%) 现值	2625.01 (2317.71 ~ 2940.29)	2876.05 (2458.4 ~ 3340.36)
PV of 10-year WTP (20%) 现值	2425.64 (2141.69 ~ 2716.98)	2657.62 (2271.69 ~ 3086.67)

选择模型结论 (1)

Findings from the CM Survey (1)

- 生态恢复项目将产生显著的环境非市场价值
 - **Significant non-market environmental value of the ERP**
- 上海和成都居民对生态恢复项目环境改善均有支付意愿
 - **Shanghai and Chengdu respondents are WTP for the environmental improvements under the ERP**
- 环境问题跨越了地理界限
 - **Environmental issues transcend local boundary**

选择模型结论 (2)

Findings from the CM Survey

(2)

- 两地居民对生物多样性和空气质量都非常关注
 - Shanghai and Chengdu provided general consensus regarding the value of air quality and biodiversity conservation
- 上海居民更关注水质改善，成都居民对长江水质不关注
 - More concern about water quality in Shanghai. In contrast, respondents in Chengdu are indifferent about it
- 上海户均支付意愿为户均年收入的1.3%，成都为户均年收入的2.1%
 - WTP about 1.3 per cent and 2.1 per cent of households annual household income in Shanghai and Chengdu
- 不确定性因素对居民支付意愿有明显影响
 - risk and uncertainty do have impact on people's choices

Thank You