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Using Choice-Based Conjoint Analysis to Estimate Different Groups' Preferences for Water Environmental Changes

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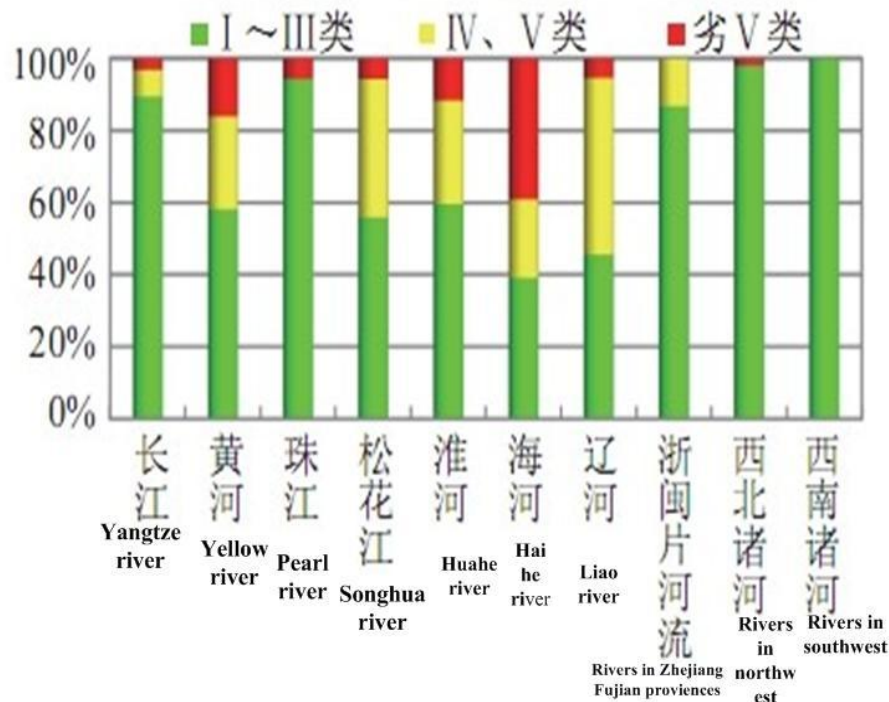
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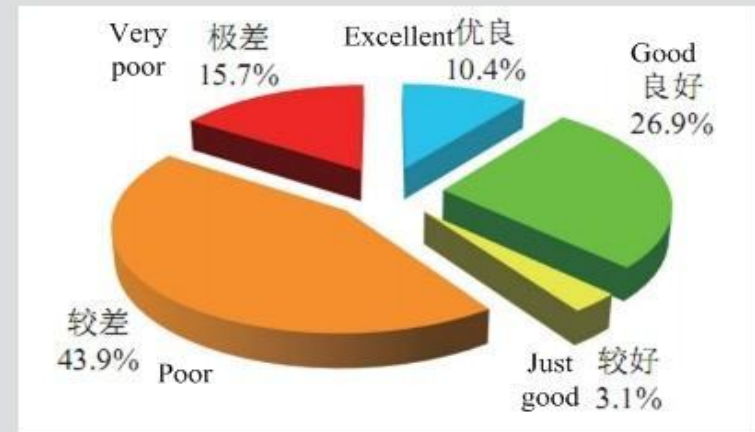
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1.The situation of watershed in China

Top ten river basin quality in China in year 2013



Water quality of ground water monitoring sites in China in year of 2013



The total number of ground water quality monitors are 4778, including 800 national monitoring sites.

- In year of 2013, Overall national surface water are suffering mild pollution, rivers flowing through some cities are seriously polluted, in China.
- The central government invested 1.6 billion CNY for protecting lakes in the year of 2013 to 2020. Chinese government paid more and more attention to the use of payment for ecosystem services for environmental governance.

2.Ecosystem Services Valuation Development in China

Now, environmental valuation methods including Direct market method, Contingent valuation method, Transfer Costanza's method are applied in China.



Direct market approach



Contingent valuation method



Travel cost method



Transfer costanza's method

Few scholars in China use conjoint analysis method to evaluate ecosystem services, but in watershed ecosystem services valuation no researchers use choice-based conjoint analysis in China.

2.Ecosystem Services Valuation Development in China

Direct market approach

Direct market approach is the technique used the longest, including the shadow value, market price, opportunity cost and so on.

Contingent valuation method

Contingent valuation method was first applied in China in the mid-1990s, then gradually widely used.

Travel cost method

Travel cost method was first applied in China in 1996, then gradually widely used.

Transfer costanza's method

After Costanza's paper< The value of the world's ecosystem services and natural capital> was published on Nature, Chinese researcher Xie Gaodi evaluated average Chinese value of annual ecosystem services in 2003. Chinese ecologists use land use data to evaluate Chinese ecosystem services with the Chinese average value.

2.Difference between China and other Countries

1

HPM

- It is difficult to use HPM in China, because the data including real estate price and air quality is difficult to obtain.

2

Trasfer constanza' Method

- Other countries rarely use this method to assess.
- But Chinese scholars prefer to use this method because of its convenience.

3

- Few scholars do in-depth theoretical study about CVM and TCM in China.

3.The introduction of project



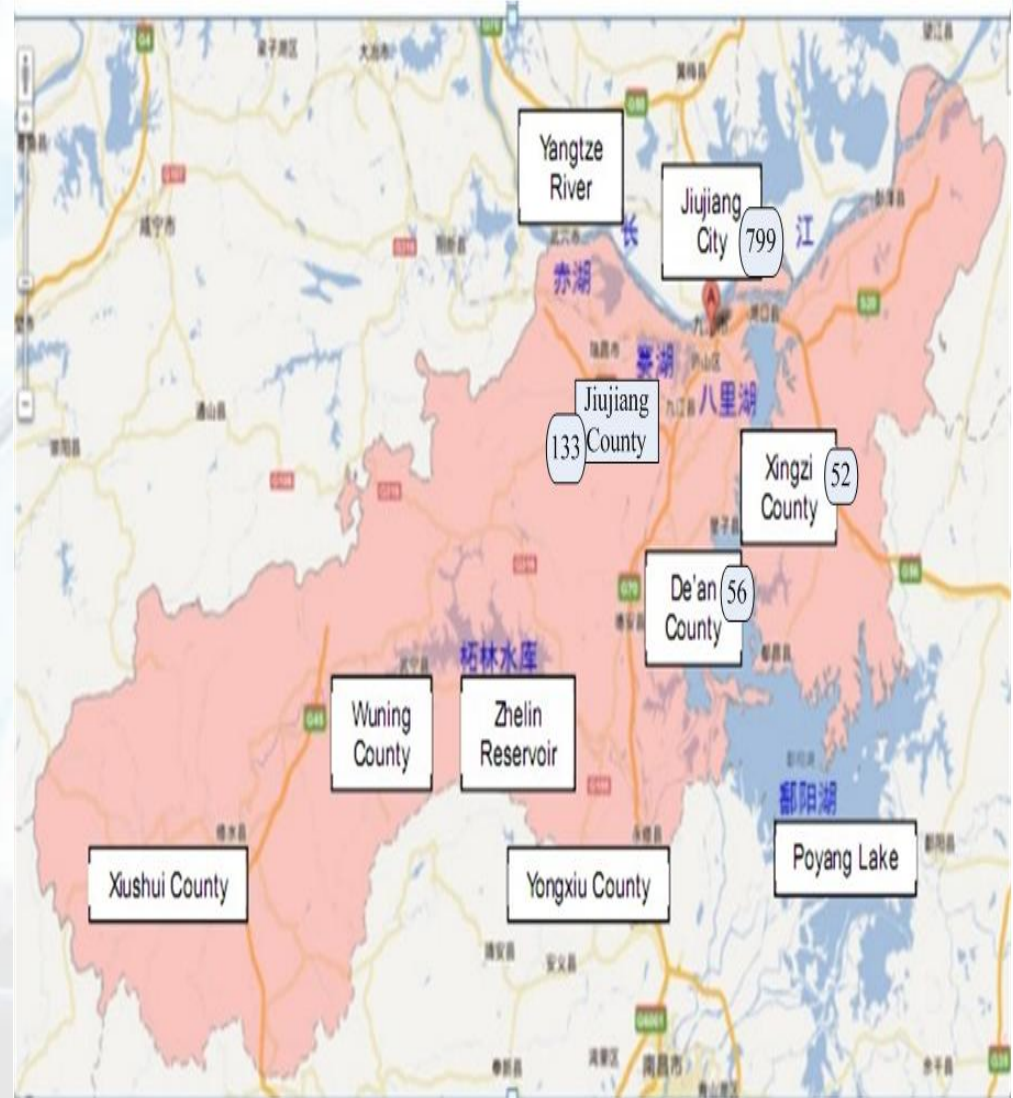
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- It was funded by ADB PPTA Jiangxi Zhelin Lake Water Resources integrated Utilization Project.
- The project will provide improved water supply to people in Jiujiang Municipality and in semi-urban downstream areas currently experiencing water scarcity and poor water quality.
- Substantial efforts on watershed protection will be to ensure sustainable supply of high quality water from upstream Xiu River and Zhelin Lake.



3.The introduction of my study

- Under the project Zhelin Lake will become a major drinking water source for the downstream areas of Jiujiang Municipality ,and the upstream counties will provide the precious clean water at some costs.
- A sample of 1040 urban households in the downstream of Zhelin Lake, a drinking water source for Jiujiang Municipality, were interviewed for their willingness to pay for changes in the water environment of the Zhelin Lake.



3.The introduction of my study

❖ Research Framework

Survey

- Different number of questionnaires, depending on the number of beneficiaries.

Data

- The understanding of water source and household water
- CBC
- Basic information

Analysis

- According to the social and economic attributes of different groups
- STATA software
- Clogit Model

Results

- Different group' preference
- Factors for Marginal WTP

4. Questionnaire Design

Ecosystem services
identification, environmental
awareness,
water use

**Awareness of
of water
source and
household
water**

CBC

Scenario
selection table

Age, Gender,
Education,
Income, Chronic
or not, Hukou

**Social and
economic
information**

**Investigator
assessment
of
respondent**

Whether respondents
answered seriously

4.Questionnaire choices Design

- Improved watershed services are composed of attributes and levels-----Water quality, Water quality, Stable or not, Price(Prices are determined by pre-survey)
- Payment bid including 0CNY,10CNY,20CNY.
- Orthogonal arrays(SPSS--- Orthogonal Design)—12 scenarios .
- Remove irrational choice sets, 4 scenarios are selected in the survey.

Attributes	Levels Degrees	value
Quality	class I	1
	class II	2
Quantity	Stable	1
	Unstable	2
Payment bid	Low	1
	Moderate	2
	high	3

4.Questionnaire choices Design

Services scenarios

Attributes	Scenario A	Scenario B	Scenario C	Scenario D
Quality	Increased to class I water	Maintaining class II water	Increased to class I water	Maintaining class II water
Quantity	Stable	Unstable	Stable	Unstable
payment (CNY per month per household)	20	10	10	0

5.The results-descriptive statistical analysis

Variable	Attributes	Percentage
Gender	Male	51
	Female	49
Age	Youth(≤ 44)	61
	Middle-aged(45-59)	26.3
	Elder(≥ 60)	12.7
Education	Middle school or Below	39.9
	Senior high school	30.7
	Junior college	13.1
	Undergraduate	13.9
	Postgraduate	2.4
Monthly family income	≤ 3000	15.8
	3001-8000	59.4
	> 8000	24.8

5.The results-Recognition of ecosystem services

The respondents' recognition of watershed ecosystem services.

The highest degree of recognition as "fresh water" accounted for 55%, followed by "fishing, tourism increase income" and "power" of 30.2%.

The important watershed ecosystem services such as “ maintain biological diversity," "gas regulation", "flood control" ,identification of them is really low.

Ecosystem services related with respondents' living ,the higher degree of recognition.

5.The results-Set selection



Scenarios	Frequency	Effective percentage	Cumulative percentage
Scenario A	399	38.4	38.4
Scenario B	321	30.9	69.3
Scenario C	134	12.9	82.2
Scenario D	185	17.8	100.0
Total	1039	100.0	

38% respondents selected scenario A(Class I , stable,20).For the same amount 10CNY,the support rate of scenario B (Class II , stable,10)is higher than that of scenario C(Class I , unstable,10), which reflect that under the same paid amount, respondents prefer to choose stable water rather than choose quality improvement. Scenario D(Class II ,unstable,0)support rate is higher than scenario C support rate. It reflect that some respondents do not want to spend 10 CNY to improve water quality.

5.The results-Model Analysis

RUM,random utility model

The total sample Clogit model estimation results

variable	No cross-term model	Cross-term model
∇q	-5.2054*** (-3.94)	-5.3041*** (-3.96)
∇S	-4.3317*** (-3.36)	-4.3699*** (-3.35)
Bid	0.5425*** (3.99)	0.5353*** (3.87)
I. ∇q		0.0000573*** (2.15)
I. ∇S		0.0000443* (1.47)

- ∇q Stands for quality change from Class I to Class II, ∇S stands for water quantity change from stable to unstable. Bid Stands for payment for different scenarios. I. ∇q stands for income and water quality cross-term. I. ∇S Stands for income and water quantity and income cross-term.
- Those four variables through by significant test, and they are important influence factors.

Marginal willingness to pay of different groups

Group	Model	Quantity	Quality	Total	Group	Model	Quantity	Quality	Total
All Samples	A	9.59	7.98	17.57	Local hukou	A	9.68	8.10	17.78
	B	9.61	7.93	17.54		B	9.70	8.04	17.74
Low-income group	A	9.84	8.56	18.4	Environmental	A	9.15	7.15	16.30
	B	10.02	9.04	19.06		B	9.16	7.37	16.53
High-income group	A	8.80	--	--	Non-enviromental	A	10.68	8.96	19.64
Male	A	9.57	8.32	17.89		B	11.07	9.29	20.36
	B	9.73	8.25	17.98	Chronic	A	9.61	8.01	17.62
Female	A	9.65	7.56	17.21		B	9.72	7.78	17.5
	B	9.54	7.82	17.36	Non-chronic	A	9.58	7.97	17.55
Low education	A	10.58	--	--		B	9.59	8.13	17.72
	B	11.06	7.68	18.74	Higher education	A	8.60	--	--
Secondary education	A	9.80	7.93	17.73		B	8.63	--	--
	B	9.77	7.81	17.58	Non-decision group	B	9.53	8.52	18.05
Unstable job	A	9.72	7.90	17.62	Decision group	A	9.61	8.01	17.62
	B	9.73	8.09	17.82		B	9.62	8.11	17.73
Middle aged group	A	9.97	8.35	18.32	Older group	A	9.53	9.32	18.85
	B	9.98	8.41	18.39		B	9.02	8.83	17.85
Youth group	A	9.30	--	--	With elder and children family members	A	9.57	8.11	17.68
	B	9.61	--	--		B	9.58	8.05	17.62

5.The results- marginal WTP

income

Overall, the higher income, the higher willingness to pay, but the willingness to pay among income group is showing volatility. Marginal WTP for quantity of low-income group is higher than that of higher-income group.

Environmental awareness

WTP of non-environmental group is higher than that of environmental group. This is not corresponding with expectations. This may be related to self interest environmental awareness and altruistic environmental awareness.

Hukou

The marginal WTP of local Hukou group is higher than that of base group, which reflect that local Hukou households family have higher payment compared with non-local Hukou households. Non-local Hukou households have a stopover someplace ,have more obvious free- rider mentality.

Stable job

There are no obvious difference between stable job group and unstable job group.

5.The results- marginal WTP

Decision making

The WTP of non-decision makers in a family is higher than decision maker group. This is corresponding with expectation. Chinese people have the habit of saving, members who make decision in a family may be seriously consider each spending money.

Chronic patients

A household with chronic patients' WTP is higher than non chronic patients family. Household with chronic patients' prefer a healthy lifestyle, pay more attention on quantity drinking water and food.

Age

The WTP of middle aged group is higher than youth group and older group. Middle-aged bear more family and society responsibly, has strong economic strength, with more emphasis on the quality of the living environment.

Gender

Male has high WTP compared to female.

6. Discussion

Awareness

Clogit modeling results showed that downstream households were more sensitive to the water quality improvement rather than stability of water supply.
Enhance residents' environmental awareness and understanding of ecosystem services.

CBC used in china

Choice-based Conjoint (CBC) analysis was used for the first time in China to estimate urban households' willingness to pay (WTP) for the environment change. It indicated that CBC could better estimate the marginal WTP.

Future study

i) hukou, ii) whether or not from a family with old members or kids, iii) whether or not from a family with chronic patients, iv) decision making in a family are significant factors to willingness to pay, which should be considered in the future study.



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