Evaluation of the farmers' willingness to accept and the industry sector's willingness to pay for transferring Agricultural water to industrial users during drought period - The application of Contingent Valuation Method

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Abstract

In this study, we compare the Agricultural sector willingness to accept, the industry sector willingness to pay and the society willingness to accept by Contingent Valuation Method (CVM), to realize the inner value of Agriculture water by the Agricultural sector, the industry sector and the entire society. The farmers' willingness to accept (WTA) for transferring Agricultural water to industrial users during drought or no drought seasons was evaluated. A questionnaire of sampling survey was arranged in Taiwan, and the CVM was employed to determine the compensation of transferring irrigation water for alternative uses. Under the idle-field situation, the value of Agricultural water in the first crop is 69331.79N.T. D. per hectare. In the second crop, it is 63122.39N.T.D. Per hectare. Chiueh & Huang (2015) also use the Contingent Valuation Method (CVM) to evaluate the amount of money industrial sectors are willing to pay under climatic change to avoid the risk of water shortage in Taiwan. We target the larger industrial areas and science parks as the objects of investigation. Interviews about the amount of willingness to pay (WTP) for transferring agricultural water are conducted in factories in the above mentioned areas, which include the Hsinchu Industrial Park, Chung-Li Industrial Park, Taichung Industrial Park, Lin-Yuan Industrial Park, Hsinchu Science Park, Central Taiwan Science Park, and Tainan Science Park. The results of this study show that the WTP for agricultural water transfer of the abovementioned industrial/science parks are $28NT/ton during drought periods. As for the Agricultural water conjunct with the multifunctionality function of the paddy. Chiueh(2012) uses the benefit and value assessment method, in conjunction with a Contingent Valuation Method (CVM) and Analytic Network Procedures (ANP), through the use of questionnaires, to assess the preference structure and relative weight scales that are assigned to the multifunctionality function and production output benefits that are derived from paddy fields. The monetary benefits constitute the gross domestic product (GDP), for rice production. In this study we adapted the 3,400 L water foot print of 1 Kg rice production, which calculate by Chapagain & Hoekstra(2004), transfer the monetary benefits shows in the follow: 1) Benefits from production are NT$6.72 per ton water used by rice (NT$1 about US$0.03385) (US$0.2274), 2) Benefits to food safety and reliance are NT$10.24 (US$0.3466), per ton water used by rice, 3) Benefits to cultural heritage and community development are NT$13.51 (US$0.0457), per ton water used by rice, 4) Benefits to recreation and landscape are NT$4.02 (US$0.1361), per ton water used by rice, and 5) Benefits to environmental conservation are NT$7.27 (US$0.2460), per ton water used by rice. By compare the Agricultural sector willingness to accept, the industry sector willingness to pay and the society willingness to accept, this study could provide a basis for the proposition of a reasonable water transferring system, such that the transaction cost could be lowered, the interests of all water users could be promoted, and the efficiency of water utilization could be increased.

The Empirical Results (farmers)

Rice Growth Period	Different stage	Model	WTP/ WTA	
idle-field	1 st idling of the field	probit	6803.881	WTA(NT$/ Hectare/ Stage)
		logit	6933.179	WTA(NT$/ Hectare/ Stage)
	2 st idling of the field	probit	6150.141	WTA(NT$/ Hectare/ Stage)
		logit	6312.239	WTA(NT$/ Hectare/ Stage)
	1 year investment	probit	11593.902	WTP(NT$/ Hectare/ Year)
		logit	9605.569	WTP(NT$/ Hectare/ Year)
Field just cultivating	1 st idling of the field	probit	11704.375	WTA(NT$/ Hectare/ Stage
		logit	11611.778	WTA(NT$/ Hectare/ Stage
	2 st idling of the field	probit	12747.842	WTA(NT$/ Hectare/ Stage
		logit	12106.168	WTA(NT$/ Hectare/ Stage
Rotation irrigation	1 st Rotation	probit	6244.581	WTA(NT$/ Hectare/ Stage
		logit	6043.535	WTA(NT$/ Hectare/ Stage
	2 st Rotation	probit	1759.697	WTA(NT$/ Hectare/ Stage
		logit	1006.769	WTA(NT$/ Hectare/ Stage
Flowering heading	Rotation	probit	14268.153	WTA(NT$/ Hectare/ Stage
		logit	11686.331	WTA(NT$/ Hectare/ Stage

The Empirical Results (17 Taiwan Irrigation Associations)

Irrigation Association	Idle-field (not included Farmer's Compensation)	Idle-field (Compensation Irrigation Association and Farmer)	Idle-field when field just cultivating (not included Farmer 's Compensation)	Idle-field when field just cultivating (Compensation Irrigation Association and Farmer)	Rotation irrigation (not included Farmer's Compensation)	Rotation irrigation (Compensation Irrigation Association and Farmer)	Water shortage during flowering heading (not included Farmer 'sCompensation)	Water shortage during flowering heading (Compensation Irrigation Association and Farmer)
A	4.23	8.33	3.67	8.33	3.00	7.33	1.83	19.00
B	6.50	11.33	7.83	12.67	9.83	18.50	9.17	16.33
C	5.18	8.75	5.63	9.50	6.50	10.75	7.75	12.25
D	1.23	3.67	1.23	5.00	2.73	7.67	3.40	9.67
E	7.11	10.00	9.33	11.56	9.56	11.56	9.67	12.00
F	7.37	10.00	9.39	11.51	9.60	11.69	9.70	12.27
G	25.60	34.30	26.30	37.00	25.70	37.00	27.50	40.20
H	10.00	16.90	11.10	20.40	11.50	21.70	11.80	23.40
I	3.53	7.14	5.20	8.86	5.91	10.00	6.77	11.29
J	2.70	4.50	3.20	6.50	3.20	6.70	3.30	7.00
K	4.50	12.78	8.22	12.56	10.67	14.44	13.33	18.78
L	5.33	23.89	6.22	27.78	5.67	27.56	6.11	27.78
M	8.33	12.33	7.67	7.00	10.33	7.67	7.67	7.00
N	2.44	6.22	6.22	4.22	10.56	3.89	10.22	4.33
Average	6.72	12.15	7.94	13.06	8.91	14.03	9.16	15.81

The price(value) of irrigation water