META-ANALYSIS OF CONSUMERS' WILLINGNESS TO PAY FOR SUSTAINABLE FOOD PRODUCTS

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1. Introduction

Consumers are demanding products with high sustainable standards and have increasingly paid attention to the wider ethical issues and sustainable food products. This research helps to broaden the study of WTP for sustainable food products from a broad area, including different sustainable attributes simultaneously, by extracting data from the previous literature using a meta-analysis. The main objective of this study is twofold: firstly, to synthesize consumers' WTP studies regarding sustainable food products; and secondly, to measure the average WTP towards sustainable food products worldwide and their heterogeneity.

2. Data and Method

Meta-analysis was defined as “the statistical analysis of a large collection of analysis results from individual studies to integrate the findings”. The available studies relevant to consumers' preferences and WTP for sustainable food products (from 2000 to 2020) were identified from the electronic databases of Google Academic. We used the following keywords: “consumer preferences”, “willingness to pay”, “WTP”, “consumer behavior”, and “sustainable food products”. Included studies were based on “English”, mainly “choice experiment (CE) or contingent valuation method (CVM)”, “willingness to pay or price premium or preferences”. Finally, 80 papers were included. In this meta-analysis, standardized average WTP value in included studies was taken as effect size. For the monetary WTP, the transformation was as follows:

$$\text{WTP (\%)} = \frac{\text{WTP sustainable} - P_{\text{conventional}}}{P_{\text{conventional}}} \times 100\%$$

“ $P_{\text{conventional}}$ ” denoted the price of conventional food products. The Egger's test and funnel plot were conducted to measure the publication bias. Subgroup analysis and meta-regression were adopted to test the deeper heterogeneity of the data. Tau² estimated the size of the variance component between-study. The smaller the value was, the better the model fitted.

3. Results

3.1 Descriptive statistics

In the 80 included studies, 34 were from Europe, 21 were conducted in Asia, 21 were from North America and the remaining 4 were from Oceania. The maximum size was 4103, which was studied in 8 European countries. Whereas, the minimum size was only 60 studied in Ukraine. Regarding valuation methods, 31.3% of the studies were CE, with 2 papers using non-hypothetical CE and 33.8% were CVM. Only 8.8% of papers were using an auction experiment. 23.8% of the studies were other valuation methods. The lowest mean percentage WTP was 1.7% from sustainable wine in North America, while the highest one was 91.0%, studied in Iran for organic milk by Amirnejad and Tonakbar (2015).

3.2 Overall results

We checked for publication bias using Egger's test method (Table 1). The existence of publication bias in favor of studies with positive WTP for sustainable food products was confirmed by visual inspection of the funnel plot (Fig.1) and results of the Egger's tests (Table 1) ($p < 0.01$).

Table 1 Result of Egger's test ($N = 80$)

Std_Eff	Coef.	Std. Err.	t	p> t	Lower 95% CI	Upper 95% CI
slope	0.03	0.04	0.87	0.39	-0.04	0.11
Bias	13.12	2.64	4.96	0.00***	7.82	18.38

Note: *** Significance level: 0.01.

$p < 0.01$, denoting that there is a significant difference, which means significant existence of publication bias

Fig. 1 Funnel plot of study

Note: ES means effect size (standardized average WTP value in this research) and s.e. of ES denotes standard error of effect size. In the absence of publication selection bias, the plot looks like a symmetrical funnel. This funnel is not symmetrical, indicating the existence of publication bias.

3.3 Subgroup results

Table 2 showed that the overall WTP estimate was 29.5%. With regard to the results of the subgroups for socio-demographic characteristics (age, income) and the date of publication, it should be noted that only 2 articles had an average age of over 56. The results of age showed that the younger generation had a higher WTP value with 34.6%, while the 56 and older had the lowest WTP with 29.5%. Regarding the results of the subgroup for average annual household income, it demonstrated that those whose income was over \$60,001 had the highest WTP with 30.7%, while those whose income was between \$30,001 and 60,000 got the lowest WTP with 25.5%. With respect to the subgroup of date of publication, it showed that the WTP value of papers published before 2008 was lower (21.6%) than those after (31.0%). The I^2 values of all three subgroups were over 90.0%, which demonstrated the existence of high heterogeneity.

Table 2 Summary of the results from the subgroup analysis

Subgroup	WTP Estimate	Lower 95% CI	Upper 95% CI	Study Numbers	p-value	I^2	
18-30 years old	29.8%	25.0%	34.6%	7	0.015	99.7%	Subgroup of age (excluding outlier)
31-55 years old	34.6%	6.7%	62.5%	61	0.000	99.4%	
56 and older	29.5%	25.1%	33.8%	2			
< \$30,000	27.5%	15.9%	39.0%	25	0.301	90.6%	Subgroup of annual income
\$30,001-60,000	25.5%	16.8%	34.1%	18	0.000	99.2%	
> \$60,001	30.7%	20.6%	40.9%	6	0.047	98.1%	
year < 2008	21.6%	13.7%	29.6%	13	0.000	99.2%	Subgroup of date of publication
> 2008	31.0%	25.9%	36.0%	67	0.000	99.5%	
North America	25.5%	17.5%	33.5%	21	0.010	99.5%	Subgroup of region
Europe	31.9%	25.6%	38.2%	34	0.000	99.3%	
Asia	31.8%	20.6%	43.1%	21	0.020	99.7%	
Oceania	17.2%	4.9%	29.5%	4	0.006	98.0%	
drinks	25.3%	18.3%	32.2%	19	0.000	99.2%	Subgroup of food categories
seafood	16.6%	11.1%	22.1%	10	0.023	82.3%	
dairy	34.9%	14.5%	55.3%	8	0.001	99.2%	
fruit & vegetable	38.8%	26.6%	51.1%	20	0.062	99.6%	
meat	29.4%	19.8%	39.1%	15	0.000	99.3%	
EF	21.3%	16.5%	26.1%	25	0.030	98.9%	Subgroup of sustainable attributes
local	21.1%	12.2%	30.0%	11	0.000	98.2%	
organic	38.1%	28.2%	48.0%	29	0.028	99.6%	
fair-trade	30.5%	16.4%	44.6%	9	0.006	99.6%	
animal welfare	29.5%	25.2%	33.9%	6	0.104	98.9%	
CE	27.9%	20.7%	35.1%	27	0.001	99.5%	Subgroup of methods types
CVM	38.3%	28.4%	48.1%	25	0.009	99.7%	
non-hypothetical	26.7%	16.5%	37.0%	9	0.001	94.9%	
others	21.3%	14.7%	28.0%	19	0.000	98.9%	
Overall	29.5%	25.1%	33.8%	80	0.000	99.5%	Overall estimate

As for the results of the subgroup for region, almost half of the research (42.5%) was conducted in Europe. While it should be noted that only 4 studies were from Oceania so the evidence was not conclusive. The results of the region subgroup demonstrated that the lowest WTP was in Oceania (17.2%), followed by North America (25.5%) and Asia (31.8%), and the largest in Europe (31.9%). The Asian WTP estimate was very similar to Europe both higher than North America. With respect to food categories, the analysis showed that seafood with 16.6%, obtained the lowest WTP estimate and the highest one was for fruit & vegetable,

with 38.8%. The WTP estimates of drinks, meat, and dairy were 25.3%, 29.4%, and 34.9%, respectively. I^2 value (82.3%) of seafood was the lowest, indicating that the heterogeneity was less compared with other food categories. As for the result of sustainable attributes, the WTP estimates of EF (environmentally friendly) attribute and local attribute were similar, with 21.3% and 21.1%, respectively. The highest one was for the organic attribute with 38.1%, followed by fair-trade and animal welfare attributes with 30.5% and 29.5%. Regarding the subgroup analysis of method types, the result indicated that the WTP estimate of CVM was highest (38.3%), followed by CE (27.9%). Non-hypothetical methods (e.g., non-hypothetical choice experiment, auction experiment, and real buying data) got 26.7%. The category of others had the lowest estimate, with 21.3%. I^2 of CE and CVM were more than 99.5%, indicating relatively high heterogeneity in the data, while the heterogeneity of non-hypothetical methods and others were a little lower (94.9% and 98.9%).

3.4 Meta-regression results

Table 3 Results of the Meta-Regression (excluding outlier)

	Coef.	Std. Err.	P> t	Monte Carlo permutation test	
				Unadjusted p-value	Adjusted p-value
female	0.467**	0.226	0.044**	0.045	0.048**
university	-0.100	0.212	0.652	0.662	0.744
year < 2008	-0.002	0.145	0.991	0.991	0.998
< \$30,000	-0.082	0.160	0.617	0.701	0.756
\$30,001-60,000	0.008	0.129	0.954	0.954	0.988
hypothetical	-0.029	0.092	0.757	0.768	0.798
dairy	0.183*	0.108	0.095*	0.095	0.098*
drinks	-0.618**	0.062	0.012**	0.012	0.014**
fruit & vegetable	0.222**	0.088	0.014**	0.016	0.018**
meat	0.128	0.093	0.171	0.244	0.262
North America	0.614**	0.326	0.034**	0.034	0.038**
Asia	0.571**	0.257	0.022**	0.032	0.042**
Europe	0.644**	0.259	0.044**	0.044	0.048**
EF	-0.314**	0.122	0.017**	0.025	0.034**
local	-0.312*	0.156	0.058*	0.058	0.076*
organic	-0.137	0.135	0.322	0.322	0.412
animal welfare	-0.150	0.150	0.329	0.436	0.488
_cons	0.221	0.366	0.570		
Number of obs	80				
Tau ²	0.008				
I^2	96.26%				
Adj R ²	81.73%				
Prob > F	0.042**				

Note: *** Significance level: 0.01; ** Significance level: 0.05; * Significance level: 0.1.

Table 3 indicated that the percentage of female, region, sustainable attributes, and food categories were the sources of high heterogeneity and they significantly influenced variations in WTP estimates across studies. First, the percentage of females ($p = 0.048 < 0.05$) highlighted a significant difference, showing that it was the source of heterogeneity. Second, regarding food categories, the results demonstrated that for drinks products ($\beta = -0.618$), WTP estimates were significantly lower than dairy and fruit & vegetable products. This was in line with the result of the subgroup analysis above. Third, the p-values of North America, Asia, and Europe showed significant differences among studies and confirming this subgroup as a source of heterogeneity. Finally, the environmentally friendly attribute ($\beta = -0.314$) and local attribute ($\beta = -0.312$) reported statistically significant lower WTP values, which was also similar to the result of the subgroup analysis above. However, results indicated non-significant differences among studies for organic and animal welfare attributes.

4. Discussion and conclusion

Results show that the WTP value of the studies adopting hypothetical approaches is higher than non-hypothetical methods. The WTP estimate from the CVM is higher than that from the CE. Interestingly, Asian WTP estimates, in percentage terms, are higher than those obtained in North America and similar to those from Europe. The subgroup analysis indicates that the fruit & vegetable category has the highest WTP estimate while the seafood received the lowest one. According to the results, the organic attribute is preferred than the local one. Thus, retailers can use, and are using, this argument to first place and highlight organic items in hotlines on the shelves, specifically the fruit & vegetables category. Organic labels should

be emphasized in front of other sustainable attributes to attract consumers. This outcome is highly important since it verifies the position of the organic attribute compared to the local food descriptor. The result shows that the WTP estimate for local food is the smallest. As a result, it is necessary to increase consumers' knowledge about local food products and consider how to differentiate them in the market. Policymakers at the local level could give more support to local producers for the potential adoption of organic farming practices which can add value by jointly producing organic and local food products.

Reference:

Amirnejad, H., & Tonakbar, P. (2015). *The Willingness to Pay for Organic Milk by Consumers in Tehran*. 17, 1685–1694.