Combining Stated and Revealed Preferences for valuing Organic Chicken Meat

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INTRODUCTION

Background

- Identifying consumers' preferences and willingness to pay (WTP) for environmental attributes is an important element of environmental economics.
- WTP measures are usually estimated using either stated preferences (SP) or revealed preferences (RP) techniques. This study applies a joint SP and RP estimation (RPSP). The reasons are as follow:
- **SP** can elicit preferences for attributes or combination of attributes that do not exist yet in the market
  - However, estimates suffer from **hypothetical bias** and other types of biases
- **RP** rely on actual market transaction, as they are based on real choices,
  - However, they suffer from **collinearity**, **heteroskedasticity** and **endogeneity**
- **RPSP** approach addresses the shortcomings of both methods.
  - Joining the RP and SP data offers more observations that enable more robust WTP estimates.

Objectives

- Estimate consumer preferences for environmental attributes related to organic chicken meat.
- Test and correct the issues associated with joint estimations, above all scale differences between RP and SP data.
- Test and correct over-estimations of SP.


STATED DATA

The SP data was collected using a **choice experiment (CE). It was used to:**

- Elicit the preference for specific environmental attributes typically associated with organic that might not exist in a single product on the market.
  - such as `animal welfare' and `environmentally friendly' and combinations between them.
- Elicit a rich set of socio-economic variables and behavioural attitudes of consumers towards organic products, the environment and towards a healthy lifestyle that would have been very difficult to obtain in revealed data.
- Serve as an input of variables to help the analysis in three different ways:
  1. for validity checks
  2. for behavioural insights related to organic consumption
  3. as interaction terms in the regressions in order to help with heterogeneity and to relax the assumption of independently and identically distributed variables (IID).

JOINT DATA

Why join RP and SP data?

- Using just the stated preference dataset would yield a relatively low number of observations that might leave doubt about the validity of results.
- The revealed preference (RP) data helps to ground the choices made in the experiment in actual choices made by consumers in supermarkets.
- The RP data (Kantar World-panel) used for the construction of the dataset for the RP estimations offers a number of individuals that is 50 times larger than the ones used in the choice experiment leading to a significantly larger number of observations in total.
- Even though both samples were constructed to be representative for the UK consumer population this confers not only more certainly with respect to representativeness but also with respect to the robustness of the results.

	Stated Preference (SP)	Revealed Preference (RP)	Combined Method
Data Source	Survey	Market Data	**Survey and Scanner**
Market	Hypothetical	Real	**Real**
Potential Limitations	Hypothetical Bias	Multicollinearity; Heteroscedasticity	**Difficult to match scale parameter of attributes between SP and RP**
Advantages	More reliable results at attribute level	More reliable aggregate results	**More explanatory power, whilst mitigate limitations of ST and RP**

METHOD

- **SP and RP models**: conditional logit
- **Joint RPSP model**: heteroscedastic conditional logit (CLHet).
- Both c-logit and CLHet models included interaction terms (consumer characteristics and behaviours x attributes - addressing the IID assumption.
- Joint estimations have their advantages, but also issues such as:
  - inter-alternative error structures, unobserved heterogeneity effects, state-dependence and scale difference.
- CLHet with interaction terms applied to different SP and RP samples offers a viable way to offset these issues simultaneously.
  - To our knowledge this is the first study to apply CLHet with interaction terms to address the assumption of homogenous preferences and other problems associated with joint estimations.
- Empirical Model:

$$P_{ij} = \frac{exp\{\mu_i[\alpha Z_{ij} + \beta(Z_{ij} * X_i)]\}}{\sum_{k=1}^{J} exp\{\mu_i[\alpha Z_{ik} + \beta(Z_{ik} * X_i)]\}}$$

Where: *P* is the choice probability that an individual *i* with characteristics *X* would choose alternative *j* with attribute *Z*, across the *J* alternatives; μ is the scale factor

RESULTS

- Consumers are willing to pay a significant premium for animal welfare, environmentally friendliness, and are negatively impacted by "chemical usage".
- "Quality" is the attribute with highest WTP value.
- "Organic" is associated with high variation, mostly driven by different age groups. The attribute is not significant when consumers have the option to choose alternatives with low chemical usage and environmental friendly (usually assumed to be embedded in the "organic" label.
- After accounting for heterogeneity and scale effect, the preferences of the two datasets are similar and can be meaningful combined.
- Parameter restriction was only accepted in the CLHet model, and failed in the c-logit model.
- The use of interaction terms in joint estimation studies promises to be a fruitful avenue for future research.

WTP Results - with interaction terms (£)

Attributes	(1) SP	(2) RP	(3) RPSP	(4) RPSP (CLHet)
Volume		-2.61 (0.16)	-2.90 (0.18)	-2.62 (0.16)
Organic	-0.10 (0.75)[i]	2.09 (1.79)	1.43 (0.27)	0.14 (0.63)[i]
AnimalWelfare	1.31 (0.48)	1.45 (0.93)	1.91 (0.19)	1.35 (0.41)
Quality	2.60 (0.53)	2.66 (0.48)	1.35 (0.16)	2.58 (0.35)
Chemicals	-1.14 (0.87)		0.89 (0.30)	-1.06 (0.76)
EnvFriendly	1.05 (0.38)		0.53 (0.16)	1.03 (0.36)
Healthy		-0.79 (2.99)[i]	-0.95 (3.29)[i]	-0.80 (2.99)[i]
Offer		-0.27 (0.08)	-0.31 (0.09)	-0.27 (0.08)

WTP Results - with interaction terms (£)

Volume		-1.37 (0.13)	-1.55 (0.14)	-1.36 (0.13)
Organic	3.96 (1.91)	1.80 (6.49)	3.66 (0.97)	4.31 (1.83)
AnimalWelfare	1.21 (0.48)	1.73 (0.94)	1.87 (0.22)	1.36 (0.40)
Quality	1.68 (0.69)	0.70 (1.39)	0.81 (0.33)	1.41 (0.61)
LessChemicals	-0.86 (0.79)		0.83 (0.32)	-0.88 (0.75)
EnvFriendly	0.75 (0.35)		0.44 (0.17)	0.77 (0.35)
Healthy		-0.68 (2.96)[i]	-0.83 (3.34)[i]	-0.67 (2.93)[i]
Offer		-0.40 (0.09)	-0.46 (0.10)	-0.39 (0.08)

Standard deviations in parentheses
i: Statistically insignificant
2016 values

CONCLUSIONS

- Common problems risen from pooling SP and RP data can be mitigated with the application of a heteroscedastic conditional logit model, and the inclusion of interaction terms.
- Scale differences between RP and SP data can have a significant impact on joint WTP estimates. Ignoring the issue, the data used in the study would not accept the parameter restrictions, and would bias estimations.
- IID assumption does not significantly change results.
- WTP estimates from the SP (choice experiment with hypothetical bias) are very consistent with RP ones.