

Institut für Lebensmittel- und Ressourcenökonomik

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**The role of production method and country-of-origin  
labelling in consumers' food choice:  
Empirical study based on meta-analyses and stated preference  
choice experiments**

Dissertation

zur Erlangung des Grades

Doktorin der Agrarwissenschaften (Dr. agr.)

der Landwirtschaftlichen Fakultät

der Rheinischen Friedrich-Wilhelms-Universität Bonn

von

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Bonn, 2019

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Tag der mündlichen Prüfung: 02.09.2019

Angefertigt mit Genehmigung der Landwirtschaftlichen Fakultät der Universität Bonn

## Abstract

Organic production and domestic origin of food serve for consumers as extrinsic cues for food safety and food quality dimensions. With consumers' growing interest in food quality and their increasing concern regarding food safety organic and domestic origin labeling has gained in relevance for businesses and policy makers as well as in research. Accordingly, numerous studies have investigated the effects of organic labeling (OL) and domestic origin labeling (DOL), arriving at heterogeneous results. This leads to the question whether there are any systematic patterns that can explain the difference in the magnitude and in some cases even the sign of willingness to pay (WTP) estimates for OL and DOL. The objective of this research is twofold. First, by conducting two meta-regression analyses (MRA) the thesis identifies the main determinants that drive consumers' WTP a premium for OL and DOL as derived from previous literature. Second, for Taiwan—a newly industrialized country—three empirical field studies are conducted investigating the role of trust and attitude as well as the impact of information on consumers' choice of products differentiated by OL and DOL. The studies use red sweet pepper as study object and make use of Discrete Choice Experiments (DCE) (chapters 3, 4 and 5), Best Worst Scaling (BWS) (chapter 5) as well as Propensity Score Matching (chapter 4).

After a brief introduction (chapter 1), two MRA analyses are conducted (chapter 2), one in which the results of 74 WTP estimates for OL and another in which the findings of 31 WTP estimates related to DOL are considered. The research finds evidence for the presence of publication bias in both MRAs. In addition, the results reveal systematic variation of WTP estimates across underlying study characteristics such as the location the survey was conducted as well as the elicitation methods used to derive WTP estimates.

Chapter 3 examines the relative importance of product and process information—country of origin, production methods, chemical residue testing (CRT) and price—for Taiwanese consumers' product choice based on a convenience sample of 290 valid responses. Results show that respondents focus mostly on country of origin labeling, followed by price. Furthermore, interaction between attributes matter and consumers' preference for attribute levels depend on socioeconomic characteristics.

Given the increasing relevance of organic imported products on the Taiwanese market the impact of an equality of organic standards information treatment on Taiwanese consumers' food preference and purchasing behavior is examined in chapter 4 based on a valid sample of 800 respondents. Results indicate that information on the equality of organic standards significantly increased the purchase likelihood for Taiwan-origin organic products, while the opposite effect is detected for Chinese organic products. In addition, an increase in the utility of the opt-out option in the information treatment group was revealed. Provision of information thus failed to assure consumers about the equality of organic standards.

Making use of data obtained from the same survey as in chapter 4 chapter 5 combines two elicitation techniques—DCE and BWS—to provide information about the role of consumers' attitude and trust in influencing food choice decisions. Results of linking the DCE with the BWS attitudinal dimensions reveals that consumers' attitude and trust significantly explain consumers' membership to a specific consumer segment and therefore, is of importance for understanding food purchase behavior.

The main results, limitations and conclusions are summarized in chapter 6. The research presented in this thesis adds to the literature twofold. From a content point of view the studies conducted in the framework of this thesis provide a better understanding of consumer food choice behavior, specifically with regard to OL and DOL. Some of the insights are obtained by the combination of methods that so far have not been applied jointly in the literature. Therefore, the thesis also adds to the literature from a methodological point of view.

## Zusammenfassung

Ökologischer Anbau und die inländische Herkunft von Lebensmitteln dienen Konsumenten als Anhaltspunkte für die Bewertung der Lebensmittelqualität und -sicherheit. Mit zunehmendem Interesse der Verbraucher für die Qualität von Lebensmitteln und der steigenden Sorge um die Lebensmittelsicherheit haben Bio-Label (BL) und Inländische Herkunftslabel (IHL) sowohl bei Unternehmen und politischen Entscheidungsträgern als auch in der Forschung an Relevanz gewonnen. Dementsprechend haben zahlreiche Studien die Zahlungsbereitschaft von Konsumenten für Produkte mit BL und IHL untersucht. Diese Studien kommen zu heterogenen Ergebnissen. Dies führt zu der Frage, ob systematische Muster existieren, welche die Größenordnung und das Vorzeichen der Zahlungsbereitschaft (ZB) für BL und IHL erklären können. Die vorliegende Dissertation verfolgt zwei Forschungsziele. Erstens werden auf Basis von zwei Meta-Regressionsanalysen (MRA) die Determinanten identifiziert, die die ZB der Konsumenten für BL und IHL bestimmen (Kapitel 2). Zweitens erfolgt für Taiwan – einem Schwellenland – auf Basis von drei empirischen Studien eine Analyse der Präferenzen von Konsumenten für Produkte mit BL und IHL unter Berücksichtigung der Rolle von Vertrauen, Einstellungen sowie des Einflusses von Informationen. Die Analysen erfolgen am Beispiel von Paprika, unter Anwendung von Discrete Choice Experimenten (DCE) (Kap. 3, 4 und 5), der Methode des Best Worst Scaling (BWS) (Kap. 5) als auch der Propensity Score Methode (Kap. 4).

Nach einer kurzen Einleitung (Kap. 1) werden zwei MRA Analysen durchgeführt (Kap. 2). In der ersten werden die Ergebnisse von 74 ZB-Schätzungen für BL, in der zweiten die Ergebnisse von 31 ZB-Schätzungen für IHL betrachtet. Beide Untersuchungen finden Belege für die Existenz eines „Publication-bias“. Darüber hinaus weisen die Ergebnisse auf eine systematische Variation der ZB in Abhängigkeit von den zugrundeliegenden Studienmerkmalen – wie beispielsweise dem Ort an dem die Studie durchgeführt wurde und die Erhebungsmethoden – hin.

Im dritten Kapitel wird die relative Bedeutung der Produkt- und Prozesseigenschaften - Produktionsmethode, Chemikalienrückstände und Preis – für die Produktwahl auf Basis einer Stichprobe von 290 Konsumenten untersucht. Die Ergebnisse zeigen, dass die Herkunft der Produkte die größte Bedeutung bei der Produktwahl hat, gefolgt vom Preis. Darüber hinaus zeigt die Analyse, dass Interaktionen zwischen Produktattributen von Bedeutung sind und die Präferenzen der Verbraucher für verschiedene Attribute und ihre Ausprägung von sozioökonomischen Merkmalen abhängen.

Angesichts der zunehmenden Relevanz von importierten Bio-Produkten auf dem taiwanesischen Markt wird in Kapitel 4 untersucht, welchen Einfluss Informationen über die Gleichwertigkeit der Bio-Standards unabhängig vom Herkunftsland auf die Präferenzen und das Kaufverhalten haben. Die auf einer Stichprobe von 800 taiwanesischen Konsumenten basierenden Ergebnisse zeigen, dass entsprechende Informationen die Kaufwahrscheinlichkeit für taiwanesishe Bio-Produkte signifikant erhöht, wohingegen das Gegenteil für chinesische Bio-Produkte gilt. Darüber hinaus steigt der Nutzen der Opt-Out-Option. Entsprechend lässt sich schlussfolgern, dass die Informationen nicht dazu geführt haben, die Verbraucher von der Gleichwertigkeit der Bio-Standards zu überzeugen.

Auf Basis von Daten der Umfrage, die Grundlage des vierten Kapitels war, werden in Kapitel 5 zwei Erhebungstechniken – DCE und BWS – kombiniert, um Erkenntnisse in Hinblick auf den Einfluss von Einstellungen und Vertrauen von Konsumenten auf die Lebensmittelwahl zu gewinnen. Die Ergebnisse zeigen, dass die Einstellung und das Vertrauen der Konsumenten die Zugehörigkeit zu einer spezifischen Konsumentengruppe erklären und für das Verständnis des Kaufverhaltens von Lebensmitteln von Bedeutung sind.

In Kapitel 6 der Studie sind die wichtigsten Ergebnisse und Grenzen der Studie zusammengefasst. Darüber hinaus enthält dieses Kapitel ein kurzes Fazit. Die vorliegende Arbeit leistet einen Beitrag zur Literatur in zweifacher Hinsicht. Inhaltlich liefern die im Rahmen der Dissertation durchgeführten Studien Erkenntnisse zum besseren Verständnis des Verhaltens der Verbraucher bei der Auswahl von Lebensmitteln in Bezug auf BL und IHL. Einige der aufgezeigten Ergebnisse werden durch die Kombination von Methoden gewonnen, welche bislang in der Fachliteratur noch nicht zusammen angewandt wurden. Daher bereichert diese Arbeit die Literatur auch aus methodischer Perspektive.

## **Acknowledgements**

Reaching the dissertation submission stage has been a long journey, and I am deeply grateful to numerous people who have encouraged, supported and pushed me along the way. First and foremost, I thank my major supervisor Professor Dr. Monika Hartmann for her guidance, support, and intellectual openness throughout this unforgettable journey of challenge and fulfilment. Prof. Dr. Monika Hartmann has walked me through all the stages of the research design, constructing of each paper and offered considerable help in various aspects including problem solving and feedback on manuscripts. Her insightful advices on my manuscripts have set the highest criteria which I should pursue. I would also like to express very special thanks to my co-supervisor, Prof. Dr. Stefan Hirsch for his constructive suggestions and professional contributions to my manuscripts. In addition, I wanted to thank my colleagues and numerous friends who helped and accompanied me throughout my time at University of Bonn. Finally, my thanks go to my family for their unconditional support and patience throughout this process. I am immensely grateful to my parents, Shin-Chen Yeh and Feng-Mei Yeh Wen, for being my inspiration and for giving me the strength to overcome any kind of situation; to my life partner, Dominik, for supporting me; to my teenaged daughter, Jing-Si, for always giving me reasons to smile. Whenever I feel tired, thinking about them will make me energetic and cheerful again.

## Declaration of originality

This dissertation contains four research articles. In the following, a list of my contribution and the contributions of the co-authors to the four papers is provided. Articles presented in Chapter 3 and 4 have been officially published in the peer-reviewed journals and can be quoted as:

Chapter 3 contains one research paper:

YEH, C. H.; HARTMANN, M. (2016). Consumers' Preference for Sweet Peppers with Different Process Attributes: A Discrete Choice Experiment in Taiwan. *International Journal on Food System Dynamics*, 7(4), 293-310.

Chapter 4 contains one research paper and one Data-in-Brief article:

YEH, C.-H., HARTMANN, M., HIRSCH, S. (2018): Does Information on Equivalence of Standards Direct Choice? Evidence for Organic Labels from Different Countries-of-Origin. *Food Quality and Preference*, 65, 28-39.

YEH, C.-H., HARTMANN, M., HIRSCH, S. (2018): Taiwanese Consumer Survey Data for Investigating the Role of Information on Equivalence of Organic Standards in Directing Food Choice. *Data in Brief*, 18, 688-690.

The current version of Chapter 5 has been submitted to a peer reviewed journal for evaluation:

YEH, C.-H., HARTMANN, M., LANGEN, N. (2018): The Role of Trust in Explaining Food Choice: Combining Choice Experiment and Attribute Best Worst Scaling. Submitted to *Agricultural Economics*.

Apart from the peer-reviewed journal articles listed above, the following work contains one research paper placed in Chapter 2 presented in this dissertation:

YEH, C.-H., HIRSCH, S., HARTMANN, M. (2018): Willingness-to-Pay for Organic and Domestic Origin Labelling Using the Evaluation of Choice Experiments: Evidence from a Meta-Regression Analysis.

The research design and the empirical work of the present dissertation was developed and carried out by me with advice and feedback provided by Prof. Dr. Monika Hartmann, as well as at all steps of the research process. Prof. Dr. Stefan Hirsch provided intensive knowledge support regarding econometric modelling tactic and the guidance of manuscript development.

I declare that I prepared the present dissertation on my own. This dissertation has not been previously submitted for any other degree or professional qualification at any university or other institute of tertiary education.

## Acronyms and Abbreviations

%	Percent
AIC	Akaike Information Criterion
BIC	Bayesian Information Criterion
BWS	Best worst scaling
CAIC	Consistent Akaike Info Criterion
C.I.	Confidence level
Coef.	Coefficient
COO	Country of origin
CRT	Chemical residue testing
d.f.	Degree of freedom
DCE	Discrete choice experiment
Diff.	Difference
DOL	Domestic origin labelling
EqualOrganic	Equality of organic standards
EqualOrganic	Equality of organic standard
FAT-PET	Funnel asymmetry test and precision-effect test
Ha.	Hectares
HB	Hierarchical Bayesian estimation
i.i.d.	Independent and identically distributed
IIA	Independence of Irrelevant Alternatives
kg	Kilogram
LCA	Latent class analysis
LL	Log-likelihood
LM	Lagrange multiplier
Max.	Maximum
Min.	Minimum

MLE	Maximum likelihood estimation
MNL	Multinomial Logit
MRA	Meta regression analysis
N	Number of observations
n.a.	Not assessed
NT	New Taiwanese dollar
Obs.	Observations
OL	Organic labelling
$p$	Probability value
PCA	Principal component analysis
PEESE	Precision-effect estimate with the standard error test
Per. Cert.	Percent certainty
RLH	Root likelihood statistics
RUT	Random utility theory
S.D.	Standard deviation
S.E.	Standard error
Sig.	Significance
TW	Taiwan
USD	US dollar
WLS	Weighted least square
WTP	Willingness-to-Pay

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# Chapter 1: Introduction

## 1.1 Problem statement, motivation and research objectives

Over the last decades consumers' awareness and concern with respect to the quality and safety of food has increased, leading to a rise in the demand for differentiated agri-products on the food market (Zanoli, 2004; Doherty and Campbell, 2014). One reason for this development has been food safety incidents and potential food-borne risks in food production that have stimulated public concerns over the safety and quality of food products (Botonaki *et al.*, 2006; Bekele *et al.*, 2017; Lehtinen, 2017). Moreover, available literature has indicated that the shifting trends in consumer behaviour and demand patterns towards safer food and higher quality food (Botonaki *et al.*, 2006; Swinnen *et al.*, 2015; Grunert *et al.*, 2015) have been driven by reasons such as rising disposable income (Wilcock and Ball, 2014; Yip and Janssen, 2015; Liu and Niyongira, 2017), growing health consciousness (Jongwanich, 2009; Mohan *et al.*, 2013), access to information on food production and processing (Krystallis *et al.*, 2006), rapid socioeconomic development supported by modernization and industrialization of agri-food production (Jongwanich, 2009; Yip and Janssen, 2015), and the globalization in agri-food trading system (Thøgersen *et al.*, 2017). As a consequence, these developments have led to the establishment of food labelling associated with the implementation of food safety standards and quality control mechanisms.

Food choice behaviour is complex. The reasons why consumers choose particular food products are multitudinous and can be related to the production method (e.g. organically or conventionally produced), the origin of the product, (e.g. domestically or foreign origin), the nutritional value of the product (e.g. sugar or fat content) and/or the price (e.g. premium or discount price). Some of these characteristics are 'credence attributes' that consumers cannot evaluate before, during, or even after consumption (Darby and Karni, 1973). Consumers need signals (e.g. in the form of labels) to make informed purchase decisions when it comes to food products differentiated by credence attributes. In this regard, labelling has become an important tool on food markets that can improve consumers' understanding and awareness about the food products they consume (Liu

*et al.*, 2013; Hall and Osses, 2013; Verbeke, 2013). For food producers and processors, labels are a means to communicate directly with consumers about the product and process quality of their respective products (Caswell and Mojdzuska, 1996). However, for tailoring their production and communication towards the needs of consumers, it is important for producers and processors to know which attributes consumers take into account during their purchase decision processes—that is, which factors play the most important roles in consumers' perception and evaluation of a given product.

Organic and Country of Origin (COO) are the two credence attributes which are studied in this dissertation in virtue of their practical and theoretical relevance in the food sector. The 'organic' attribute refers to products that are produced and processed in accordance with organic production standards (Marques Vieira *et al.*, 2013; Stranieri and Banterle, 2015; Balcombe *et al.*, 2016). The COO label provides information about the product's origin (Schnettler *et al.*, 2009; Schjøll, 2017). Both labels have been shown to serve in addition as extrinsic cues for other types of information, such as food quality and safety (Lusk *et al.*, 2006; Lobb and Mazzocchi, 2007; Van Wezemael *et al.*, 2010; Fernqvist and Ekelund, 2014; Newman *et al.*, 2014; Thøgersen *et al.*, 2017).

There exist a large body of scientific literature investigating consumers' food preferences, focusing on the impact of organic and COO attributes and using different elicitation methods (Loureiro and López, 2000; Loureiro and Umberger, 2007; Gao and Schroeder, 2009; Pouta *et al.*, 2010; Lim *et al.*, 2013; De-Magistris and Gracia, 2014; Nguyen, 2015; Lagerkvist *et al.*, 2014; Ortega *et al.*, 2016). However, simply generalizing outcomes from a single primary discrete choice experiment (DCE) study is inadequate given that the focus of each study is specific in terms of the inclusion of different product attributes, selection of the product category, data surveying processes, and willingness-to-pay (WTP) elicitation format selected. Consequently, the results from various individual primary studies can be inconclusive and sometimes even contradict each other. This in turn may lead to the provision of ineffective or inefficient marketing recommendations for labelled food products.

In light of such methodological problems, the author conducts in this thesis a meta-regression analysis (MRA) to identify the determinants for systematic differences in consumers' WTP for organic and COO-labelled products throughout the existing literature, and to derive a proxy for the genuine WTP estimate for organic and domestic COO labelled agri-food (see Chapter 2). The approach taken will also allow for the examination of the presence of publication bias across reported WTP estimates for organic and COO labelled product.

Most of the previous DCE studies regarding organic and COO labelling have shown that consumers have a high preference and a high WTP for domestically produced food over imported food (Loureiro and Umberger 2003; Lim *et al.*, 2013; Fitzsimmons *et al.*, 2015). Previous studies have also found that consumers generally prefer organic products over conventional alternatives (Akaichi *et al.*, 2016; Peterson and Li, 2011; Risius and Hamm, 2017). Nevertheless, few findings exist so far on consumers' perceptions and understanding with respect to the concept of the equality of standards for organic labelling (EqualOrganic) originating from different countries. To fill this gap the author conducts DCE research associated with EqualOrganic information treatment (see chapter 4).

Furthermore, in spite of the fact that research employing choice experiments for investigating organic and COO labelling is vast, research gaps remain regarding a better understanding of the determinants of choices. In this thesis, the author combines insights on consumers' attitude and trust obtained from a best-worst scaling (BWS) experiment with the finding from a DCE thereby introducing an approach that allows for a better understanding of the factors influencing food choice.

Thus, the dissertation aims at contributing to a deeper understanding of consumers' food choice behaviour by providing detailed insights into consumers' valuation of product and process attributes, as well as into their attitudes towards and perceptions of the trustworthiness of labelled agri-foods. The main objectives of this dissertation can be summarized as follows:

1. Calculate consumers' WTP for organic and COO-labelled agri-food as derived in previous studies, and identify the determinants that explain variability in results.
2. Understand consumers' preferences and perceptions regarding different product and process attributes for different consumer segments in Taiwan with the example of red sweet pepper.
3. Gain insights into the impact of providing information on equal standard of organic products originating from different countries on consumers' product choice.
4. Obtain a more in depth understanding of the relevance of attitudinal factors and trust for the relevance of process characteristics in consumers' food choice.

## **1.2 Structure of the thesis and methods applied**

To pursue those objectives the dissertation consists of four independent though related empirical papers and makes use of a multitude of methods including of meta-regression analyses (MRA) (chapter 2) as well as the stated preference methods, Discrete Choice Experiment (DCE) (chapter 3 to 5) and Best Worst Scaling (BWS) (chapter 5). Those studies are presented in the four subsequent chapters.

Chapter 2 makes use of MRA<sup>1</sup> following the guidelines of Stanley et al. (2013) to identify systematic patterns in consumers' WTP for Organic Labels (OL) and Domestic Origin Labels (DOL) across stated preference DCE literature over the period 2007 to 2017. In both MRAs factors potentially driving the heterogeneity in study results such as study country, product type, and methodological characteristics of the study are taken into account. Thereby evidence for the main determinants that drive consumers' WTP for OL and DOL are presented. The analysis is

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<sup>1</sup>MRA has its roots in medical sciences (DerSimonian and Laird, 1986) and was first applied to an economic context in the '90s, with the contribution by Jarrell and Stanley (1990). It has also been drawing particular attention as a tool to assess systematic variation in WTP (Cicia and Colantuoni, 2010; Clark *et al.*, 2017; Grilli, 2017).

based on weighted least square (WLS) regression models with heteroscedasticity robust standard errors. Furthermore, the analysis tests for the presence of publication bias across reported WTP estimates for OL and DOL in the existing DCE applying the funnel asymmetry test and precision-effect test (FAT-PET) as well as the precision-effect estimate with the standard error (PEESE) test.

Chapters 3 through to 5 present empirical field work conducted by the author in Taiwan on consumers' preferences regarding production methods and the COO at the example of red sweet pepper using DCE and BWS. In the DCE choice scenario, participants are requested to choose among product alternatives that are distinct due to different combinations of attribute levels. In the BWS choice task, participants are asked to indicate the most important and least important items within a set of items.

Chapter 3 provides the background and results of a study that serves as a pilot study for the subsequent investigations in chapters 4 and 5. It is based on a convenience sample and makes use of an internet-based questionnaire including a discrete choice experiment. This study investigates the relative importance of food label information (COO, production methods, chemical residue testing (CRT)) and price for Taiwanese consumers' in their purchase of sweet peppers. Besides main effects of attributes also interaction effects between attributes are considered. Data is analysed applying aggregate-level logit models as well as hierarchical Bayesian inferences of random effect logit models.

Chapter 4 examines whether an equality of organic standards (EqualOrganic) information treatment impacts Taiwanese consumers' food preference and purchasing behaviour. EqualOrganic implies that regardless of products' COO, organic certifications are based on the same production regulation and managerial processes. Data was collected by combining computer assisted personal interviews with traditional web survey techniques. In this study discrete choice experiments are combined with a propensity score matching approach to ensure the existence of

structural sample balance between EqualOrganic-treated and non-treated consumers. The DCE data is analysed using hierarchical Bayesian mixed logit models.

Chapter 5 makes use of the data obtained from the survey already introduced in chapter 4. The study combines two elicitation techniques – DCE and BWS – to provide information about the role of consumers' attitude and trust in influencing food choice decisions in the case of credence attributes. DCE data are examined using latent class analysis, while Bayesian mixed logit model is applied on the BWS data. Furthermore, to link the DCE with the attitudinal dimensions a multinomial logit model is used.

The final chapter of the thesis (Chapter 6) summarizes the most significant findings from the four empirical studies and presents some conclusions, including reflections on the merits, contributions and limitations of this dissertation, as well as its implications and suggestions for the direction of future research.

### **1.3 Contribution of the thesis**

The research presented in this thesis adds to the literature twofold. From a content point of view the studies conducted in the framework of this thesis provide a better understanding of consumer food choice behaviour, specifically with regard to organic and COO labels. Some of the insights are obtained by the combination of methods using distinctive experimental design with different focus dimensions that so far have not been applied jointly in the literature. Therefore, the thesis also adds to the literature from a methodological point of view. More specifically, the core contributions of the research presented in this dissertation are the following:

1. A quantitative literature review of the latest and most relevant empirical findings using meta regression analysis. This is the first study to simultaneously review the discrete choice experimental literature on consumers' willingness to pay for organic and domestic origin labelling in the food sector (see chapter 2, entitled '*Willingness-to-Pay for Organic and*

*Domestic Origin Labelling Using the Evaluation of Choice Experiments: Evidence from a Meta-Regression Analysis*’.)

2. An empirical assessment of the impact of information treatment on consumers’ choice. The innovative part of this study is that propensity score matching is applied to ensure structural sample balance between treated and non-treated consumers prior to analysing and comparing the DCE choice data using hierarchical Bayesian mixed logit models. (See chapter 4, entitled ‘Does Information on Equivalence of Standards Direct Choice? Evidence for Organic Labels from Different Countries-of-Origin’.)
3. An analysis of the relevance of attitudinal and trust factors for explaining consumers food choice. To the best knowledge of the authors this is the first study that combines results from DCE and BWS applying distinctive experimental design and to arrive at a better understanding of consumer choice. (see chapter 5: ‘The Role of Trust in Explaining Food Choice: Combining Choice Experiment and Attribute Best Worst Scaling’.)

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## **Chapter 2:**

# **Willingness-to-Pay for Organic and Domestic Origin Labelling Using the Evaluation of Choice Experiments: Evidence from a Meta-Regression Analysis**

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# Willingness-to-Pay Organic and Domestic Origin Labelling Using the Evaluation of Choice Experiments: Evidence from a Meta-Regression Analysis

## Abstract

With consumers' growing interest in food quality and their increasing concern regarding food safety organic and domestic origin labelling has gained in relevance in business, policy and research. Numerous studies have reported a wide range of consumers' willingness-to-pay (WTP) estimates for organic labelling (OL) as well as for domestic origin labelling (DOL) using stated preference discrete choice experiments (DCE). The present study uses meta-regression analysis (MRA) to investigate the determinants of this heterogeneity in reported WTP estimates. In a first MRA we synthesize the results of 74 WTP estimates for OL extracted from 37 DCE primary studies, while the second MRA focuses on the findings of 31 WTP estimates related to DOL obtained from 10 DCE studies published over the period from 2007 to 2017. We find evidence for the presence of publication bias in both MRAs. In addition, our results reveal systematic variation of WTP estimates across underlying study characteristics. More precisely, the location that the survey was conducted in is an important factor influencing the WTP value for organic labelling. In addition, the elicitation methods used to derive WTP estimates have a significant effect on the WTP for both organic and domestic origin labelling.

**Keywords:** *meta-regression analysis, willingness to pay, organic label, country-of-origin label*

## 2.1 Introduction

Organic production and domestic origin of food serve for consumers as extrinsic cues for food safety and food quality dimensions such as taste and healthiness of the food (Lobb and Mazzocchi, 2007; Bernabéu *et al.*, 2008; Ferngvist and Ekelund, 2014; Newman *et al.*, 2014; Xie *et al.*, 2016; Thøgersen *et al.*, 2017). Furthermore, organic production is associated by consumers with environmental protection and animal friendliness (Massey *et al.*, 2018). With consumers'

growing interest in food quality and their increasing concern regarding food safety organic and domestic origin labelling has gained in relevance for businesses and policy makers as well as in research.

Accordingly, numerous studies have investigated the effects of organic labelling (OL) and domestic origin labelling (DOL) and conclude that both attributes hold great importance in consumers' food purchase decisions (Loureiro and Umberger, 2007; Ehmke *et al.*, 2008; Schnettler *et al.*, 2008; Newman *et al.*, 2014). More specifically, a substantial stream of research investigated consumers' willingness-to-pay (WTP)<sup>2</sup> for OL and DOL most of which indicate that consumers are willing to pay more for products carrying those labels compared to products without such information.

Consumers' WTP a premium for OL have been found across different product categories, such as fruits and vegetables (Aprile *et al.*, 2012; De-Magistris and Gracia, 2014; Akaichi, 2016), animal products (Van Loo *et al.*, 2011; Ortega *et al.*, 2016; Risius and Hamm, 2017), non-alcoholic beverages (Langen, 2011; Van Loo *et al.*, 2015; Basu *et al.*, 2016) and alcoholic beverages (Barreiro-Hurle *et al.*, 2008) though the magnitude of the effects considerably varies. Furthermore, there are also contradictory results reported in the literature implying that studies do not always find support for a positive WTP (e.g. Chang *et al.*, 2013; Costanigro *et al.*, 2014; Lim and Hu, 2016) or even evidence for a negative WTP for organic labelled products relative to conventional products (Forbes-Brown *et al.*, 2016, Rousseau 2015; Yanguí *et al.*, 2014). The literature investigating consumers' preferences for DOL has demonstrated for a variety of countries and products (e.g. apples: Xie *et al.*, 2013; beef: Gao and Schroeder, 2009) that consumers have a positive WTP for domestic versus imported food. However, also regarding DOL the magnitude of the findings considerable differ. Factors such as the study country/region (Ehmke, 2006), the time the study was carried out (Ehmke, 2006), the product type (Thøgersen *et*

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<sup>2</sup> WTP is a welfare measure that captures the maximum amount of money an individual is willing to pay for the change in the quality of a product (or service), or the avoidance of undesirable product characteristics (Unterschultz *et al.*, 1997; Hanley *et al.*, 2001; Jedidi and Zhang, 2002; Freeman, 2003).

*al.*, 2017), the number of (credence) attributes considered (e.g. Ehmke, 2006; Newman *et al.*, 2014; Thøgersen *et al.*, 2017; Gao *et al.*, 2010), methodological differences (including sample size see e.g. Gao *et al.*, 2009; the elicitation method see Wendler *et al.*, 2009; Chang *et al.*, 2013; experimental design see Gao *et al.*, 2010; Lusk and Schroeder, 2004) are potential drivers for the heterogeneity in the OL and DOL WTP estimates. As the focus of one study is usually on one product in one country at a specific point in time making use of one specific method it is not possible to derive generalizable results from a single primary study. Identifying systematic differences in consumers' WTP for OL as well as for DOL based on a quantitative overview can help to understand consumers' preferences and valuation of respective labelling schemes, thereby assisting market actors and policy-makers to make informed decisions in the highly competitive food markets.

We therefore conduct meta-regression analyses (MRA)<sup>3</sup> following the guidelines of Stanley *et al.* (2013) to identify systematic patterns in consumers' WTP for OL and DOL across previous literature. In a first MRA we synthesize the results of 74 WTP estimates for OL extracted from 37 DCE primary studies, while the second MRA focuses on the findings of 31 WTP estimates related to DOL obtained from 10 DCE studies published over the period from 2007 to 2017. In both MRAs we take into account factors potentially driving the heterogeneity in study results such as study country, product type, and methodological characteristics of the study. Thereby we provide evidence for the main determinants that drive consumers' WTP a premium for OL and DOL.

Three previous MRA studies (Ehmke, 2006; Xia and Zeng, 2008; Yu *et al.*, 2016) exist investigating consumers' WTP<sup>4</sup> for organic and country-of-origin (COO) labelling independently. Xia and Zeng (2008) focus on consumers' WTP for organic labelling while Ehmke (2006) and Yu *et al.* (2016) investigate consumers' WTP for COO labelling. Our article differs from these

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<sup>3</sup> MRA has its roots in medical sciences (DerSimonian and Laird, 1986) and was first applied to an economic context in the '90s, with the contribution by Jarrell and Stanley (1990). It has also been drawing particular attention as a tool to assess systematic variation in WTP (Cicia and Colantuoni, 2010; Clark *et al.*, 2017; Grilli, 2017).

<sup>4</sup> These three MRA studies screened previous WTP works elicited from various methods (e.g. contingent valuation, DCE, experimental auction).

studies as follows: First, we provide a state-of-the-art review<sup>5</sup> of the DCE literature on consumer's WTP<sup>6</sup> for organic and domestic origin labelling together in the food sector during the timeframe 2007 to 2017 and derive proxies for the WTP for OL and DOL. Thus, in contrast to the previous three MRA we concentrate on literature that uses the DCE<sup>7</sup> method and assess the variation in WTPs for OL and DOL derived by this strand of literature. Regarding the OL literature, we focus on organic labelled products versus non-labelled product and thus, do not consider studies that investigate differences in consumers' WTP for a product with an organic label relative to one with another organic label or relative to other process standards such as Fair Trade. We decided for this restriction as measuring WTP for OL based on different reference categories does not allow for a direct comparison of the estimates. With respect to the COO labelling literature, our analysis in contrast to the ones by Ehmke (2006) and Yu *et al.* (2016) investigates consumers' WTP for domestic origin labelled food versus non-labelled food rather than for DOL versus foreign COO. This allows for a straightforward interpretation of the obtained estimates. Furthermore, it needs to be noted that though the study by Yu *et al.* (2016) is from a methodological point of view most closely related to our analysis their MRA is restricted to US beef products in relation to foreign beef. Second, different to the previous three MRA we examine whether the results on WTP for OL and DOL are affected by publication bias caused by the fact that authors and journal editors might favour significant results over insignificant ones (Stanley, 2005). Third, we identify to what extent the heterogeneity in WTP is driven by underlying study design characteristics such as the study country, product focus, or the DCE design used. In summary, we provide researchers and policy makers with a concise synthesis of the research related to DCE derived WTP estimates for OL and DOL, and derive recommendations for future WTP studies.

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<sup>5</sup> The MRAs conducted in this study is the most recent one. The meta data used in Ehmke (2006) covers the timeframe of 2001-2005, in Xia and Zeng (2008) are in the timeframe between 1990 and 2007, and in Yu *et al.* 2016 covers the timeframe of 1995-2013.

<sup>6</sup> Note that the WTP reported in the empirical studies originally does not relate to a (relative) percentage surcharge in the WTP of a product caused by the presence of a label but rather reflects the monetary WTP compared to a product alternative without the respective label.

<sup>7</sup> The method of discrete choice experiment is part of a wider family of the stated preference methods.

The paper proceeds as follows. In section 2.2 we introduce the method of selecting studies for our two MRAs and describe the main characteristics of those studies. Section 2.3 provides information on the MRA framework while the results of the analysis are presented in section 2.4. Finally, we conclude and summarize the main findings in section 2.5.

## **2.2 Selection of studies for MRA and descriptive statistics**

In section 2.2.1 we describe the selection process and decisions made regarding the studies included in the two MRAs. This is followed by a descriptive overview on the selected studies (section 2.2.2) and information on the dependent variable (section 2.2.3) as well as the explanatory variables (section 2.2.4).

### **2.2.1 Criteria for selecting primary studies**

An extensive literature search was conducted to identify all relevant published and unpublished empirical DCE studies (i.e. working papers, conference contributions or theses) written in English and focusing on WTP for OL and DOL over the period from January 2007 to December 2017. For this reason, we made use of the online search engines EmeraldInsight, SpringerLink, Web of Science, ScienceDirect, AgEcon search, AGRIS, BioOne, EconPapers, Wiley Online Library, and Google Scholar<sup>8</sup> entering the Boolean<sup>9</sup> search phrases shown in table 2.1. The initial search resulted in 1351 articles related to consumers' WTP for OL and 2186 studies linked to consumers' WTP for DOL. A subsequent title, abstract, and keywords screening<sup>10</sup> led to the selection of 329 papers for the former and 434 papers for the latter. We then excluded studies that

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<sup>8</sup> Including Google Scholar allowed us to access the grey literature, such as conference proceedings, working papers and research theses. By doing so we intend to minimize the presence of publication bias in our sample as the presence of such bias can skew the results of a meta regression (Stanley, 2005).

<sup>9</sup> Boolean search is a type of search technique that is based on all meaningful combinations of keywords to identify relevant literature.

<sup>10</sup> Studies were excluded if the specific terms such as choice experiment, willingness-to-pay (WTP), COO/organic are not covered in the abstract, keywords, or title.

did not directly report the information of the WTP measure<sup>11</sup> and a corresponding measure of its estimation accuracy e.g. standard error/ variance/ standard deviation/ 95% confidential interval. Moreover, the identified studies were screened to assess their relevance with respect to the predetermined inclusion criteria. For instance, we excluded studies that do not focus on food and final consumers, are not conducted based on the stated preference DCE method or do not use fixed price points<sup>12</sup> defined in the DCE framework. Furthermore, we only considered those papers that provide information on the OL and DOL in relation to the no-label<sup>13</sup> alternative. In addition, we focused on the WTP estimates conveyed for the aggregate sample without any intervention effect. Thus, WTP measures derived from latent class analysis (e.g. Langen, 2011), multiple sub-samples (Van Loo *et al.*, 2011), or from the treatment group in information treatment studies<sup>14</sup> (Risius and Hamm, 2017) were not included in the MRAs.<sup>15</sup> Finally, studies investigating concepts different from WTP such as “willingness to accept” or “willingness to donate” were not considered. Thus, on the basis of full text information a large number of potential studies had to be excluded from our MRA.

This screening process resulted in an original set of 38 OL studies with 75 observations and 10 DOL studies with 31 observations. We then explored the existence of outliers, because those estimates can distort MRA. To identify outlying WTP estimates, we followed the BACON

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<sup>11</sup> The WTP value derived from DCE choice model is calculated by taking the utility of attribute level divided by the negative utility of the price (Lim and Hu, 2016; Akaichi *et al.*, 2016).

<sup>12</sup> WTP measures derived from the DCE framework involving the random price points (Costanigro *et al.*, 2014) in the price attribute were excluded.

<sup>13</sup> For studies on consumers' WTP for organic labelling, an estimate reflecting consumers' WTP for organic compared to a conventional alternative (non-organic level) has to be reported in monetary units and no interaction effects are considered. For studies on consumers' WTP for COO labelling, we only include WTP estimates related to the main effect of the domestic COO attribute level versus the “none” level (no-COO indication) without interaction effects considered.

<sup>14</sup> We only included the reported WTP measures derived from the control group, but excluded the WTP measures derived from the treatment group.

<sup>15</sup> Those studies provide extremely heterogeneous WTP measures for the same product while at the same time it is impossible to control e.g. for segments in the MRA.

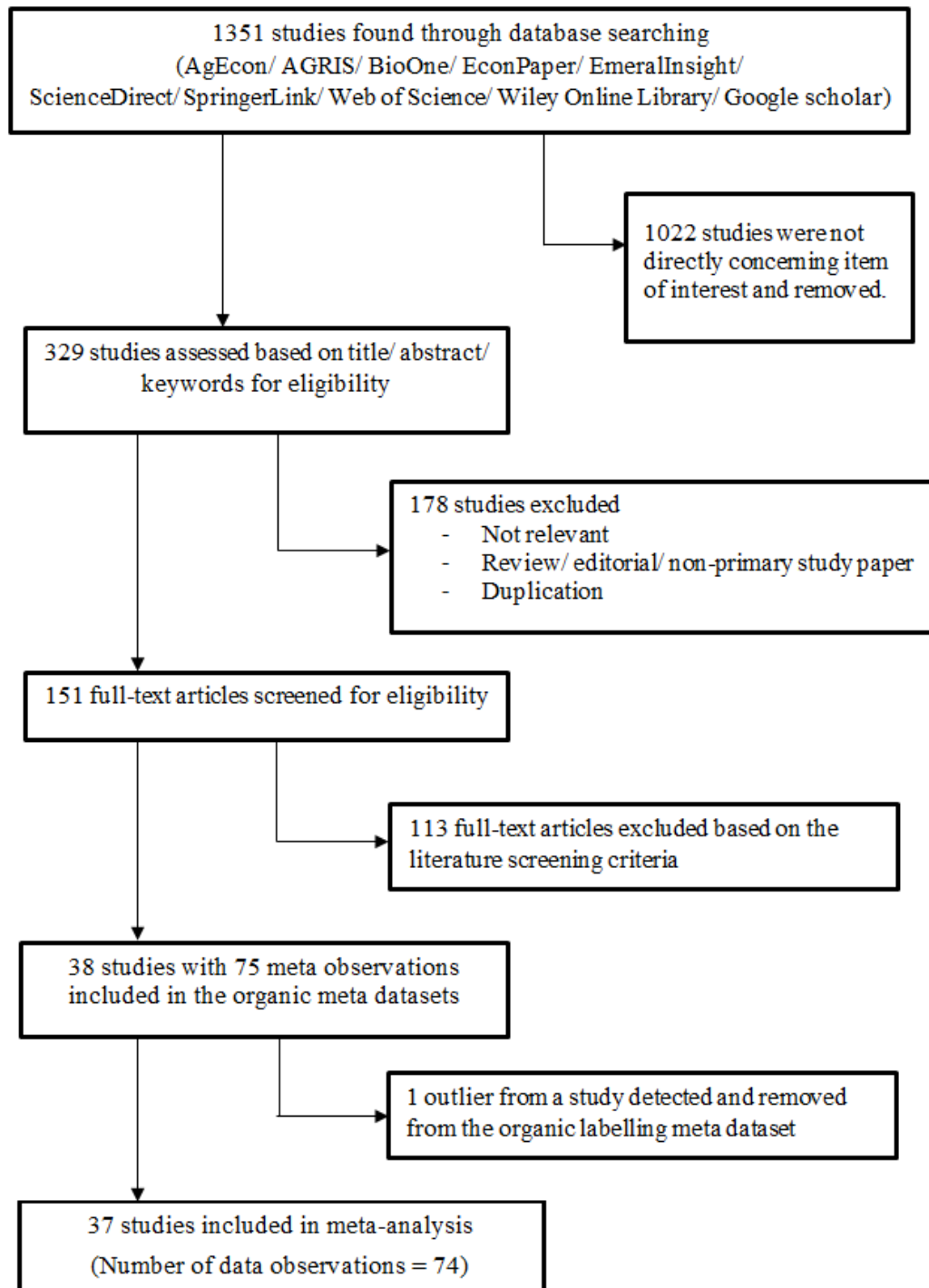
regression approach used in Billor *et al.* (2000)<sup>16</sup>. One observation reported in a master thesis (Charity, 2016) on OL for honey products had to be removed from the MRA datasets based on this screening. This led to a final set of 37 studies that provide 74 WTP estimates regarding OL, and 10 studies that provide 31 WTP estimates for DOL. Among the remaining 47 studies, there are 36 peer-review journal articles (29 for OL and 7 for DOL), 9 working papers (7 for OL and 2 for DOL) and two dissertations (1 for OL and 1 for DOL).

An overview of the systematic literature search process that followed the PRISMA guideline (Liberati *et al.*, 2009) can be found in figure 2.1 (for organic WTP literature) and figure 2.2 (for domestic COO WTP literature), including the number of studies excluded at each stage. A list of the studies and their main characteristics are summarized in tables 2.2 and 2.3.

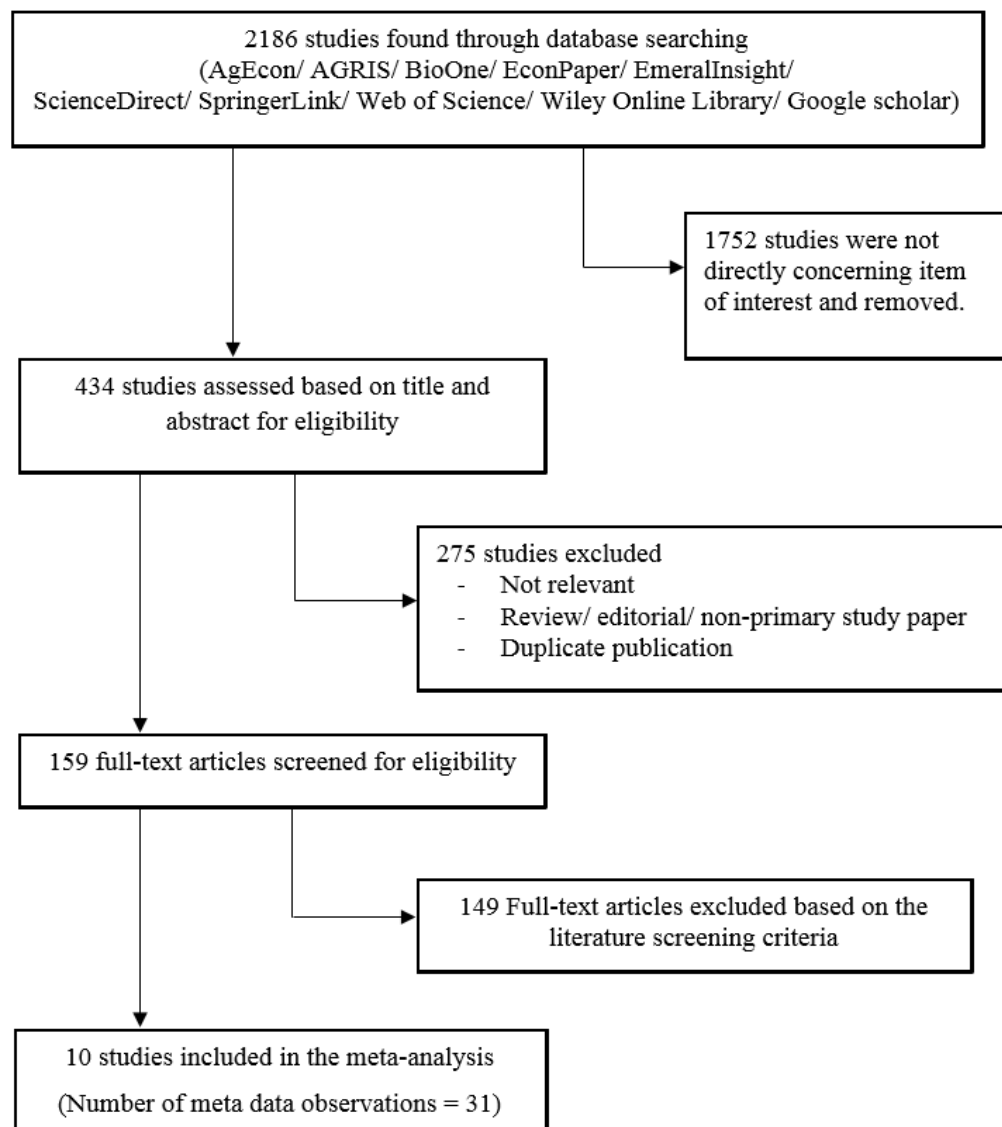
**Table 2.1** Search terms for the identification of relevant literature

	<b>Organic labelling literature</b>	<b>Domestic COO labelling literature</b>
	(willingness to pay OR WTP) AND	(willingness to pay OR WTP) AND
	food* AND label* AND (consumer*	food* AND label* AND (consumer* OR
<b>Boolean</b>	OR household*) AND (organic food	household*) AND (country-of-origin OR
<b>search</b>	OR organic milk OR organic beverage	COO) AND (choice-experiment OR
	OR organic product) AND (choice-	choice-based conjoint)
	experiment OR choice-based conjoint)	

<sup>16</sup> The BACON algorithm method was implemented to determine the 90 percentiles of the chi-squared distribution set as a threshold to separate outliers from non-outliers in a STATA routine (Weber, 2010).



**Figure 2.1** Systematic literature search and study selection diagram of DCE based WTP estimates for organic labelling



**Figure 2.2** Systematic literature search and study selection diagram of DCE based WTP estimates for domestic origin labelling

### 2.2.2 Research designs and characteristics of the selected WTP DCE works

Table 2.2 and 2.3 present a list of the 47 DCE empirical studies with 105 WTP estimates and their underlying main characteristics. A total of 16 studies (34.0%) reported more than one WTP estimate as the study either considered more than one food category (Balcombe *et al.*, 2016; Forbes-brown *et al.*, 2016; Ortega *et al.*, 2015; Hasselbach and Roosen, 2015; Zheng, 2014), focused on more than one country (Agnoli *et al.*, 2016; Akaichi *et al.*, 2016; Xie *et al.*, 2013), or applied more than one modelling approach to derive WTP values (Wendler *et al.*, 2012). Tables

2.2 and 2.3 also reveal that the relative WTP measures for OL and DOL are, in most cases, positively indicating that consumers are willing to pay a price premium for OL and DOL. However, the tables also point to considerable variation in the relative WTP estimates, ranging from a discount of 14% consumers have to receive up to a premium of 183% they would be willing to pay and to buy OL products instead of conventional ones. In the case of the DOL investigations all relative WTP estimates are positive and indicate that the percentage premium consumers are willing to pay varies between 9% and 197%. Table 2.4 shows that on average the relative WTP estimate is 35% for OL and 72% for DOL.

Tables 2.5 to 2.10 summarize the distribution of the studies and their findings with respect to the region the study was carried out (table 2.5), the product group considered (table 2.6), the elicitation model applied (table 2.7), the survey method used (table 2.8) as well as the number of attributes (table 2.9) and price levels (table 2.10) considered in the analysis.

The 47 DCE studies considered in the two MRA provide WTP estimates for 17 countries on four continents (Europe, the Americas, Asia and Oceania). While none of the studies was carried out in Africa or South America table 2.5 reveals that the vast majority of results are obtained from surveys conducted in Europe (OL studies 58.1%; DOL studies 38.7%) and North America (OL studies 33.8%; DOL studies 51.6%). Noteworthy, is the relative low average relative WTP values for OL obtained from the studies carried out in North America. Table 2.6 provides information regarding the product groups considered in the analysis showing that 48.6% of the identified WTP estimates for OL and 67.7% of the one for DOL refer to animal-based products (meat, fish, eggs or dairy). Thus, the share of WTP estimates for animal- versus plant-based products is about the same in the case of OL while regarding the WTP for DOL we find a much lower share of results for plant-based products (32.3% versus 51.5%). According to table 2.6 there is a slight indication that the relative premium consumers are willing to pay is higher for meat products (OL 45%; DOL 80%) compared to dairy (OL 8%; DOL 38%) and plant-based products (OL 6% to 33%; DOL 46% to 71%). Table 2.7 investigates the relevance of different elicitation models applied in estimating DCE WTP measures and most WTP values are estimated using mixed logit models and thus models that consider heterogeneity among

consumers (OL 79.9%; DOL 74.2%) while multinomial logit models are especially of little relevance in the analysis focusing on OL (4.1%) and conditional logit models in the one relating to DOL (3.2%). As table 2.8 reveals web-based surveys are predominant in our samples for the two MRA. Their share is especially high for our DOL sample (71.0% for DOL compared to 59.5% for OL). Finally, the findings of tables 2.9 and 2.10 provide information on the number of attributes and the number of price levels of the price variable defined in the DCE. The tables reveal that the large majority of OL WTP estimates are based on a DCE design with four or more attributes (79.7%, table 2.9). Furthermore, four or more price levels are included in the DCE design of most OL investigations (82.8%, table 2.10). The respective shares are somewhat lower for the DOL sample (67.7% see table 2.9 and 67.8% see table 2.10, respectively). Based on the information in tables 2.7, 2.8, 2.9, and 2.10 the descriptive analysis allows no first conclusion regarding the influence of the elicitation model, the survey mode, the number of attributes or price levels in the DCE design on the size of the effect, in our case the relative WTP estimate.

**Table 2.2** Overview of consumers' WTP DCE studies regarding organic labelling

Author(s) and year of publication	Country	Survey year	Survey mode <sup>a</sup>	Sample size	Product analysed	Analytic model used <sup>b</sup>	Number of WTP obs. reported	Number of attribute included	Number of pricing level included	Additional attributes included in the DCE	Relative WTP <sup>c</sup>
Akaichi <i>et al.</i> (2016)	Scotland	2013	Pen & Pencil	100	Banana	MXL	1	4	4	Fairtrade, carbon footprint, price	0.39
Akaichi <i>et al.</i> (2016)	France	2013	Pen & Pencil	95	Banana	MXL	1	4	4	Fairtrade, carbon footprint, price	0.63
Akaichi <i>et al.</i> (2016)	Netherland	2013	Pen & Pencil	52	Banana	MXL	1	4	4	Fairtrade, carbon footprint, price	0.44
Aprile <i>et al.</i> (2012)	Italy	2010	Pen & Pencil	200	Olive oil	MXL	1	5	4	GI labels, types of olive oil, price	0.74
Balcombe <i>et al.</i> (2016)	UK	2015	Web survey	490	Chicken breasts	MXL	1	6	4	Origins, product quality, farm assurance, price	0.40
Balcombe <i>et al.</i> (2016)	UK	2015	Web survey	490	Pepperoni pizza	MXL	1	6	4	Origins, product quality, farm assurance, price	0.42
Balcombe <i>et al.</i> (2016)	UK	2015	Web survey	495	Turkey Mince	MXL	1	6	4	Origins, product quality, farm assurance, price	0.40
Balcombe <i>et al.</i> (2016)	UK	2015	Web survey	495	Pork sausages	MXL	1	6	4	Origins, product quality, farm assurance, price	0.42
Balcombe <i>et al.</i> (2016)	UK	2015	Web survey	492	Pork leg	MXL	1	6	4	Origins, product quality, farm assurance, price	0.32
Balcombe <i>et al.</i> (2016)	UK	2015	Web survey	492	Bacon	MXL	1	6	4	Origins, product quality, farm assurance, price	0.34
Balcombe <i>et al.</i> (2016)	UK	2015	Web survey	492	Lamb leg	MXL	1	6	4	Origins, product quality, farm assurance, price	0.16
Balcombe <i>et al.</i> (2016)	UK	2015	Web survey	492	Chicken curry	MXL	1	6	4	Origins, product quality, farm assurance, price	0.44

Balcombe <i>et al.</i> (2016)	UK	2015	Web survey	492	Beef burger	MXL	1	6	4	Origins, product quality, farm assurance, price	0.22
Balcombe <i>et al.</i> (2016)	UK	2015	Web survey	492	Chicken pie	MXL	1	6	4	Origins, product quality, farm assurance, price	0.33
Balcombe <i>et al.</i> (2016)	UK	2015	Web survey	490	Gammon steaks	MXL	1	6	4	Origins, product quality, farm assurance, price	0.27
Balcombe <i>et al.</i> (2016)	UK	2015	Web survey	490	Beef lasagne	MXL	1	6	4	Origins, product quality, farm assurance, price	0.54
Barreiro-Hurlé <i>et al.</i> (2008)	Spain	2006	Pen & Pencil	296	Wine	MXL	1	5	4	Grape type, origin, aging, price	0.18
Basu <i>et al.</i> (2016)	Germany	2016	Pen & Pencil	149	Coffee	MNL	1	3	5	Origin, price	0.96
Baum and Weigelt (2017)	Germany	2013	CAPI	124	Tomatoes	MXL	1	5	5	Origin, retail format, ethical standards, price	0.57
Bazzani <i>et al.</i> (2015)	Italy	2014	Pen & Pencil	80	Apple sauce	MXL	1	3	4	Origin, price	0.47
Caputo <i>et al.</i> (2011)	Italy	2010	Pen & Pencil	400	Olive oil	MXL	2	4	4	GI labels, type of olive oil, price	0.63
Carlucci <i>et al.</i> (2017)	Italy	2015	Web survey	800	Oyster	MXL	1	6	4	Varieties of oysters, origin, size, preparation format, price	1.83
Chang <i>et al.</i> (2013)	USA	2010	Pen & Pencil	103	Beef	MXL	2	6	4	Brand, leanness, cuts, grass-fed, price	0.08
Chang <i>et al.</i> (2013)	USA	2011	Pen & Pencil	212	Rib eye steak	CLM	2	6	4	Brand, colour, juiciness, leanness, price	0.20
de-Magistris and Gracia (2014)	Spain	2011	Pen & Pencil	171	Almonds	MXL	1	3	4	Food miles, price	0.30
Forbes-Brown <i>et al.</i> (2016)	Canada	2012	Web survey	453	Milk	MXL	2	4	4	Brand, price	-0.12
Forbes-Brown <i>et al.</i> (2016)	Canada	2012	Web survey	453	Ice cream	MXL	2	4	4	Brand, price	-0.08
Hasselbach and	Germany	2012	Pen &	720	Milk	MXL	1	4	3	Origin, brand, price	0.84

Roosen (2015)			Pencil									
Hasselbach and Roosen (2015)	Germany	2012	Pen & Pencil	720	Beer	MXL	1	4	3	Origin, brand, price	0.10	
Hasselbach and Roosen (2015)	Germany	2012	Pen & Pencil	720	Bread	MXL	1	4	3	Origin, brand, price	0.08	
Heng <i>et al.</i> (2013)	USA	2012	Web survey	924	Eggs	MXL	1	7	3	Colour of shell, use cage, outdoor access, induced moulting, stocking density, price	0.04	
Heng <i>et al.</i> (2016)	USA	2012	Web survey	589	Eggs	MXL	1	7	3	Colour of shell, packaging materials, animal welfare, additive label, origin, price	0.15	
Hoke <i>et al.</i> (2017)	USA	2013	Web survey	548	Berries	MXL	1	4	6	Location, berry variety, price	0.04	
Hu <i>et al.</i> (2009)	USA	2007	Pen & pencil	202	Blueberry jam	MNL	1	4	4	Sugar free, origin, price	0.20	
Hu <i>et al.</i> (2011)	USA	2008	Web survey	1884	Blackberry jam	CLM	2	7	5	Brand, state proud logo, nutritional claims, price	0.07	
Lagerkvist <i>et al.</i> (2014)	Sweden	2012	Web survey	440	Beef	MXL	1	13	6	Origin, traceability information, animal welfare, feed type, health impact of consumption, price	0.14	
Lim and Hu (2016)	Canada	2013	Web survey	1082	Beef	MXL	1	5	4	Origin, feed types, BSE screening, price	0.01	
Mørkbak <i>et al.</i> (2014)	Denmark	2011	Pen & pencil	106	Apples	MXL	1	5	4	Origin, colour, taste and texture, price	0.49	
Onozaka and McFadden (2011)	USA	2008	Web survey	1052	Apples	MXL	2	5	6	Origin, fairtrade, carbon footprint, price	0.05	
Ortega <i>et al.</i> (2016)	China	2013	Pen & pencil	257	Beef	MXL	1	5	5	Origin, food safety information, animal welfare, price	0.85	

Ortega <i>et al.</i> (2015)	China	2013	Pen & pencil	784	Pork	MXL	1	5	5	Distribution channel, food safety information, animal welfare, price	0.88
Ortega <i>et al.</i> (2015)	China	2013	Pen & pencil	784	Chicken	MXL	1	5	5	Distribution channel, food safety information, animal welfare, price	1.54
Ortega <i>et al.</i> (2015)	China	2013	Pen & pencil	784	Eggs	MXL	1	5	5	Distribution channel, food safety information, animal welfare, price	1.07
Peterson and Li (2011)	USA	2008	Web survey	220	Garden vegetable baby meals	MXL	1	5	3	Processing claim, origin, brand, price	0.37
Pozo <i>et al.</i> (2009)	USA	2009	Web survey	234	Apples	CLM	1	5	3	Origin, farm scale, retail store, price	0.04
Risius and Hamm (2017)	Germany	2013	Pen & pencil	676	Beef steak	MXL	1	3	4	Animal husbandry, price	1.64
Rousseau and Vranken (2013)	Belgium	2010	Web survey	226	Apples	CLM	2	6	3	Taste, size, origin, shape and skin, price	0.21
Rousseau (2015)	Belgium	2012	Web survey	601	Chocolate	CLM	1	5	4	Taste, Fairtrade, origin, price	-0.13
Tempesta <i>et al.</i> (2016)	Italy	2014	Pen & pencil	181	Fish	MXL	1	5	3	Origin, farmed or wild fish, mercury free claim, price	0.16
Van Loo <i>et al.</i> (2011)	USA	2008	Web survey	976	Chicken	MNL & MXL	2	2	4	Price	0.17
Van Loo <i>et al.</i> (2015)	USA	2013	CAPI	81	Coffee	MXL	1	2	4	Price	0.16
Wendler <i>et al.</i> (2012)	Germany	2009	Web survey	781	Olive oil	CLM & MXL	2	3	4	Origin, price	0.32
Wendler <i>et al.</i> (2012)	UK	2009	Web survey	675	Olive oil	CLM & MXL	2	3	4	Origin, price	0.16
Wendler <i>et al.</i> (2012)	Germany	2009	Web survey	781	Tomatoes	CLM & MXL	2	3	4	Origin, price	0.45

Wendler <i>et al.</i> (2012)	UK	2009	Web survey	675	Tomatoes	CLM & MXL	2	3	4	Origin, price	0.18
Yangui <i>et al.</i> (2014)	Spain	2009	Pen & pencil	401	Olive oil	MXL	1	4	3	Origin, brand, price	-0.14
Zheng (2014)	Canada	2013	Web survey	1197	Whole Grain Bread	CLM	1	4	4	Distributional channel, food miles, price	0.05
Zheng (2014)	Canada	2013	Web survey	1197	Pork Tenderloin	CLM	1	4	4	Distributional channel, food miles, price	0.05
Zheng (2014)	Canada	2013	Web survey	1197	Cheese	CLM	1	4	4	Origin, brand, price	0.05
Zhou <i>et al.</i> (2017)	China	2015	CAPI	949	Rice	MXL	2	4	3	Origin, brand, price	0.72

<sup>a</sup> CAPI = Computer assisted personal interview

<sup>b</sup> MXL = mixed logit models; MNL = multinomial logit models; CLM = conditional logit models

<sup>c</sup> Relative WTP estimate is calculated by taking the WTP estimate divided by the average price value of all pricing points used for the price attribute in the DCE design.

**Table 2.3** Outlook of consumers' WTP studies regarding domestic COO labelling based on discrete choice experimental methods

Author(s) and year of publication	Country	Survey year	Survey mode <sup>a</sup>	Sample size	Product analysed	Analytic model used <sup>b</sup>	Number of WTP obs. reported	Number of attribute included	Number of pricing level included	Additional attributes included in the DCE	Relative WTP <sup>c</sup>
Agnoli <i>et al.</i> (2016)	Ireland	2014	Web survey	700	Lasagne	MXL	1	5	6	Food safety, meat authenticity, nutritional value, price	0.86
Agnoli <i>et al.</i> (2016)	Norway	2014	Web survey	700	Lasagne	MXL	1	5	6	Food safety, meat authenticity, nutritional value, price	0.10
Agnoli <i>et al.</i> (2016)	France	2014	Web survey	790	Lasagne	MXL	1	5	6	Food safety, meat authenticity, nutritional value, price	1.97
Agnoli <i>et al.</i> (2016)	Germany	2014	Web survey	798	Lasagne	MXL	1	5	6	Food safety, meat authenticity, nutritional value, price	1.49
Agnoli <i>et al.</i> (2016)	Italy	2014	Web survey	813	Lasagne	MXL	1	5	6	Food safety, meat authenticity, nutritional value, price	1.06
Agnoli <i>et al.</i> (2016)	Spain	2014	Web survey	797	Lasagne	MXL	1	5	6	Food safety, meat authenticity, nutritional value, price	1.87
Forbes-Brown <i>et al.</i> (2016)	Canada	2012	Web survey	453	Milk	MXL	2	4	4	Brand, price	0.52
Forbes-Brown <i>et al.</i> (2016)	Canada	2012	Web survey	453	Ice cream	MXL	2	4	4	Brand, price	0.25

Gao and Schroeder (2009)	USA	2006	Web survey	211	Beef steak	MXL	2	3	4	Tenderness, price	0.89
Gao and Schroeder (2009)	USA	2006	Web survey	211	Beef steak	MXL	2	4	4	Tenderness, leanness, price	0.61
Gao and Schroeder (2009)	USA	2006	Web survey	187	Beef steak	MXL	2	4	4	Tenderness, leanness, price	0.49
Gao and Schroeder (2009)	USA	2006	Web survey	187	Beef steak	MXL	2	5	4	Tenderness, leanness, best before date, price	0.84
Mueller and Umberger (2010)	Australia	2008	Web survey	1228	Wine	MNL	1	6	4	Brand, alcohol level, product type, price	0.46
Peterson and Li (2011)	USA	2008	Web survey	220	Vegetable baby food	MXL	1	5	3	Brand, production methods, price	0.37
Pozo <i>et al.</i> (2009)	USA	2009	Web survey	234	Apples	CLM	1	5	3	Production methods, farm scale, retail store, price	1.17
Profeta (2008)	Germany	2003	CAPI	1070	Beef	MXL	2	3	4	Food quality and safety label, price	0.48
Vaca Moran (2014)	USA	2012	Web survey	2000	Beef	MXL	1	4	3	Production methods, quality grade, price	0.14
Xie <i>et al.</i> (2013)	Belgium	2010	Pen & pencil	176	Apples	MNL	1	3	3	Product type, price	0.79
Xie <i>et al.</i> (2013)	France	2010	Pen & pencil	197	Apples	MNL	1	3	3	Product type, price	0.82
Xie <i>et al.</i> (2013)	Germany	2010	Pen & pencil	177	Apples	MNL	1	3	3	Product type, price	0.09
Xie <i>et al.</i> (2013)	Spain	2010	Pen & pencil	188	Apples	MNL	1	3	3	Product type, price	1.17

Xie <i>et al.</i> (2013)	Japan	2010	Pen & pencil	331	Apples	MNL	1	3	3	Product type, price	0.89
Xie <i>et al.</i> (2013)	USA	2010	Pen & pencil	377	Apples	MNL	1	3	3	Product type, price	0.82
Zheng and Peterson (2013)	China	2010	Pen & pencil	300	Soy milk	MXL	1	4	3	Production methods, certification agencies, price	0.56

<sup>a</sup> CAPI = Computer assisted personal interview

<sup>b</sup> MXL = mixed logit models; MNL = multinomial logit models; CLM = conditional logit models

<sup>c</sup> Relative WTP estimate is calculated by taking the WTP estimate divided by the average price value of all pricing points used for the price attribute in the DCE design.

**Table 2.4** Descriptive analysis of organic label and domestic origin MRA data

Variables	Description	Organic labelling (N=74)		Domestic COO labelling (N=31)	
		Mean	Std. Dev.	Mean	Std. Dev.
<b><i>Dependent variable:</i></b>					
Relative WTP estimates <sup>a</sup>	Continuous variable (Relative WTP value is calculated by taking the reported WTP for organic or domestic COO labelling divided by the average price value of all prices points defined in the respective DCE)	0.35	0.39	0.72	0.49
<b><i>Study context variables:</i></b>					
Geographical location: East Asia <sup>a</sup>	1= Yes; 0= No	0.08	0.27	n.a.	n.a.
Geographical location: Other <sup>b</sup> (including east Asia and Oceania)	1= Yes; 0= No	n.a.	n.a.	0.12	0.25
Geographical location: Europe	1= Yes; 0= No	0.58	0.50	0.39	0.50
Geographical location: North America	1= Yes; 0= No	0.34	0.48	0.52	0.51
Web survey	1= Yes; 0=No (including CAPI interview, or pen-and-pencil survey)	0.59	0.49	0.29	0.46
<b><i>Experimental settings:</i></b>					
Animal-based product selected as study object	1= Animal-based product categories including meat products and dairy products; 0= Plant-based product categories including fruits and vegetables, and planted based beverages	0.49	0.50	0.68	0.48

Number of attributes defined in the DCE design $\geq 4$	1= 4 or more attributes defined in the DCE design; 0= Up to 3 attributes defined in the DCE design;	0.80	0.40	0.68	0.48
Number of pricing levels defined in the price attribute $\geq 4$	1= 4 or more pricing levels defined in the price attribute; 0= Up to 3 pricing levels defined in the price attribute	0.83	0.38	0.68	0.48
<b><i>Methodological issues:</i></b>					
Applying aggregate logit models applied	1= Yes; 0 = No	0.20	0.40	0.26	0.44

<sup>a</sup>This variable is only applicable in organic labelling dataset.

<sup>b</sup>This variable is only applicable in domestic COO labelling dataset.

**Table 2.5** Relevance of geographical location where the survey was conducted and average of the relative WTP estimates for organic and domestic origin labelling by location

	<i>N</i>	<i>K</i>	<b>Europe</b>	<b>North America</b>	<b>Asia</b>	<b>Oceania</b>
Organic studies	74	37	58.1%	33.8%	8.1%	n.a.
Avg. relative WTP (S.D.)			0.42 (0.37)	0.08 (0.12)	0.97 (0.31)	n.a.
Domestic COO studies	31	10	38.7%	51.6%	6.5%	3.2%
Avg. relative WTP (S.D.)			0.89 (0.66)	0.61 (0.34)	0.72 (0.23)	0.46 (--) <sup>a</sup>

*N* = Total number of WTP estimates; *K* = Number of studies; the percentage value is calculated by dividing the respective number of WTP observations by total number of WTP estimates. Note that no data collection was conducted in Oceania in the selected organic DCE studies.

<sup>a</sup> (--) indicates that there is no variability due to the single observation.

**Table 2.6** Relevance of animal- versus plant-based products and average of the relative WTP estimates for organic and domestic origin labelling by product group

	<i>N</i>	<i>K</i>	<b>Animal based product<sup>a</sup></b>		<b>Plant based product</b>			
			Fresh or processed meat-based products	Dairy products	Fresh or processed fruit & vegetables	Non-alcoholic beverage	Alcoholic beverage	Pastry products
Organic studies	74	37	40.5%	8.1%	44.6%	1.5%	2.7%	2.7%
Avg. relative WTP (S.D.)			0.45 (0.49)	0.08 (0.38)	0.33 (0.27)	0.16 (--) <sup>b</sup>	0.14 (0.06)	0.06 (0.02)
Domestic COO studies	31	10	54.8%	12.9%	25.8%	3.2%	3.2%	n.a.
Avg. relative WTP (S.D.)			0.80 (0.59)	0.38 (0.16)	0.71 (0.34)	0.56 (--)	0.46 (--)	n.a.

*N* = Total number of WTP estimates; *K* = Number of studies; the percentage value is calculated by dividing the respective number of WTP observations by total number of WTP estimates. Note that no pastry product was used in the selected domestic COO DCE studies.

<sup>a</sup> Lasagne is coded underlying the category of meat-based products.

<sup>b</sup> Non-alcoholic (e.g. coffee) and alcoholic beverage (e.g. wine), and pastry products (e.g. bread) are coded underlying the category of the plant-based products.

<sup>c</sup> (--) indicates that there is no variability due to the single observation.

**Table 2.7** Relevance of elicitation models utilized and average of the relative WTP estimates for organic and domestic origin labelling by location by elicitation model

	<i>N</i>	<i>K</i>	Heterogeneity specified logit	Aggregated logit models	
			model	Mixed logit model	Multinomial logit model
Organic studies	74	37	79.9%	4.1%	16.2%
Avg. relative WTP (S.D.)			0.38 (0.41)	0.44 (0.45)	0.14 (0.15)
Domestic COO studies	31	10	74.2%	22.6%	3.2%
Avg. relative WTP (S.D.)			0.70 (0.53)	0.72 (0.34)	1.17 (--) <sup>a</sup>

*N* = Total number of WTP estimates; *K* = Number of studies; the percentage value is calculated by dividing the respective number of WTP observations by total number of WTP estimates.

<sup>a</sup> (--) indicates that there is no variability due to the single observation.

**Table 2.8** Relevance of the survey method applied and average of the relative WTP estimates for organic and domestic origin labelling by survey method

	<i>N</i>	<i>K</i>	Web survey	Personal involved interview	
				<i>CAPI<sup>a</sup> interview</i>	<i>Pen and pencil interview</i>
Organic studies	74	37	59.5%	5.4%	35.1%
Avg. relative WTP (S.D.)			0.22 (0.30)	0.54 (0.27)	0.53 (0.45)
Domestic COO studies	31	10	71.0%	6.5%	22.5%
Avg. relative WTP (S.D.)			0.76 (0.53)	0.24 (0.16)	0.73 (0.33)

*N* = Total number of WTP estimates; *K* = Number of studies; the percentage value is calculated by dividing the respective number of WTP observations by total number of WTP estimates.

<sup>a</sup> CAPI = computer assisted personal interview

**Table 2.9** Relevance of the number of attributes in the DCE design applied and average of the relative WTP estimates for organic and domestic origin labelling by number of attributes

	<i>N</i>	<i>K</i>	<b>Up to 3 attributes defined in the DCE</b>	<b>4 or more attributes defined in the DCE</b>
Organic studies	74	37	20.3%	79.7%
Avg. relative WTP (S.D.)			0.41 (0.40)	0.33 (0.39)
Domestic COO studies	31	10	32.3%	67.7%
Avg. relative WTP (S.D.)			0.68 (0.39)	0.74 (0.53)

N = Total number of WTP estimates; K = Number of studies; the percentage value is calculated by dividing the respective number of WTP observations by total number of WTP estimates.

**Table 2.10** Relevance of the number of prices levels in the DCE design applied and average of the relative WTP estimates for organic and domestic origin labelling by number of price levels

	<i>N</i>	<i>K</i>	<b>Up to 3 pricing levels defined in the price attribute</b>	<b>4 or more pricing levels defined in the price attribute</b>
Organic studies	74	37	17.6%	82.8%
Avg. relative WTP (S.D.)			0.27 (0.31)	0.36 (0.40)
Domestic COO studies	31	10	32.2%	67.8%
Avg. relative WTP (S.D.)			0.68 (0.38)	0.74 (0.54)

N = Total number of WTP estimates; K = Number of studies; the percentage value is calculated by dividing the respective number of WTP observations by total number of WTP estimates.

### 2.2.3 The dependent variable of the MRAs: relative WTP estimates

In MRA, the dependent variable is the effect size of interest which in our case refers to consumers' WTP value for products carrying an organic-/ domestic origin label versus the none label alternative. To ease comparison between WTP estimates expressed in different currencies and obtained in different years as well as between products of considerable different value per kilogram or liter (e.g. milk versus Oyster) we follow the procedure of e.g. Lusk *et al.* (2005), Dannenberd (2009) and Dolgoplova and Teuber (2017) and use the percentage price premium consumers are willing to pay for OL and DOL, respectively. This relative WTP value is calculated by taking the reported WTP estimate divided by the average price values of all pricing points used in the empirical DCE survey<sup>17</sup>.

### 2.2.4 The explanatory variables of the MRAs

Table 2.4 describes the explanatory variables included in our MRA. Those explanatory variables represent potential factors that drive the heterogeneity in WTP estimates for organic and domestic origin labels. The explanatory variables are classified into three categories: study context, DCE experimental design, and elicitation models (see table 2.4). To control for differences in WTP estimates due to study context we included several dummy variables. 1) *Geographical location*: The WTP estimates our MRA are based on were derived from analysis in four continents (East Asia, Oceania, Europe and North America). However, as there exist for Asia only two studies (6 observations) in case of our OL and two studies (2 observations) in case of our DOL sample, and for Oceania the respective observation numbers are with 0 and 1 even lower we decided only to differentiate in our MRA between three regions (*Europe*, *North America*, *East Asia* in the organic studies and *Other* in the domestic origin studies). 2) *Survey method*: We capture whether the data was collected via online questionnaire versus surveys with an interviewer involved.

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<sup>17</sup> The same rescaling ratio applied on the respective standard error of the reported WTPs in order to hold the identical significance between the WTP and standard error.

To assess the relevance of the DCE experimental design in driving heterogeneity in reported WTP estimates the following dummy variables are included: 3) *Product categorization*: Due to the large variety of products investigated in the literature and the impossibility to consider all of them we decided only differentiate between two big product categories, animal based products (meat, and meat products, seafood, eggs, and dairy product) and plant-based products (vegetable, fruit, bread, wine, beer and coffee). 4) *Number of attributes*: We differentiate studies with a number of attributes equal or greater than four from those with less than four attributes. 5) *Number of pricing levels*: Here we also distinguish those studies with four and more price levels from those with less than four price levels. Finally, to control for the valuation methods, we include dummies capturing the model types used to estimate the WTP values for OL and DOL. More specifically, we capture whether WTP has been derived using 6) an *aggregate logit model applied* such as multinomial logit or conditional logit model versus analytic methods of mixed logit models that consider individual-specific preference heterogeneity.

### **2.3 Method: Meta regression analysis**

Meta-regression analysis provides a quantitative and objective way to integrate and summarize the findings of a collection of individual empirical studies (Stanley, 2001) by investigating the sources of heterogeneity in reported WTP estimates across primary studies. Sources of heterogeneity can be identified through MRA by taking the standardized WTP as the dependent variable and factors related to the study context, methodological issues, and differences in the experimental setting as exploratory variables.

However, before analysing MRA it is important to first assess the presence of publication bias and thus to determine whether a “true” WTP effect exists. In the past decades, “publication selection bias” has been widely recognized as a potential hazard to the validity of empirical research (Thornton and Lee, 2000; Dickersin, 2005; Rothstein *et al.*, 2006; Stanley, 2008; Stanley and Doucouliagos, 2012 & 2014; Alinaghi and Reed, 2018). Publication bias occurs when researchers, referees, or editors have a

preference for selectively reporting certain findings such as statistically significant results or findings that have the “right” sign in that they confirm a specific theory. In turn, studies not in line with those expectations tend to be suppressed and left in the researchers’ “file drawer” (Stanley, 2005 & 2017). We investigate whether or not publication selection bias is present regarding the WTP estimates in the organic and domestic origin labelling literature. This is important as it allows to identify possible exaggeration or inflation of the magnitude of the empirical effect reported (Stanley and Doucouliagos, 2012). The presence of publication bias can be assessed by the relationship of WTP estimates and estimation precision (e.g. measured by the estimates’ standard error).

We first conduct a funnel asymmetry test and precision-effect test (FAT-PET) via the weighted least square (WLS) regression model (Egger *et al.*, 1997; Stanley, 2008; Stanley and Doucouliagos, 2014; Gallet and Doucouliagos, 2017) to quantify the publication selection bias and to verify if a genuine relative WTP effect exists after controlling for publication selection. The FAT-PET model is specified as follows:

$$relative\ WTP_i = \beta_0 + \beta_1(SE_{WTP_i}) + \varepsilon_i, \text{ with } i = 1, 2, \dots, m \quad (1)$$

where *relative WTP<sub>i</sub>* refers to the *i*th reported WTP estimate in relation to the average price value of all pricing points defined in the respective DCE design, and *SE<sub>WTP<sub>i</sub></sub>*

 is the related standard error of the reported WTP which is as well divided by the average price value of all pricing points defined in the DCE.  $\varepsilon_i$  is a stochastic i.i.d. error term. The Egger model (1) is estimated by the linear regression using  $\frac{1}{SE_{WTP_i}^2}$  as the weights. When synthesizing WTP values from multiple studies, it is important to account for differences in the precision of the WTP estimates. We therefore weighted each observation by the inverse of its standard error (or squared standard error) because those estimates with smaller standard error should receive relatively more weight in the statistical analysis as they contribute more precise information. This and the following analysis were carried out separately for the WTP estimates of the OL and DOL literature.

The estimate of  $\beta_1$  and the test for  $H_0: \widehat{\beta}_1 = 0$  which is known as the FAT test can be used to quantify the degree of publication bias (Egger *et al.* 1997, Stanley, 2008). In the case of publication

bias, relative WTP estimates will be correlated with their respective standard error resulting in a certain level of statistical significance (Oczkowski and Doucouliagos, 2015). Thus, in such cases, the estimate of  $\beta_1$  will be significantly different from zero (i.e. Reject  $H_0: \widehat{\beta}_1 = 0$ ).

According to Stanley (2005), even if publication bias is detected based on equation (1), an effect may still be present in the empirical evidence - i.e. if  $H_0: \widehat{\beta}_0 = 0$  is rejected. This test is called PET test.  $\widehat{\beta}_0$  is the mean of the distribution of estimated relative WTP when  $SE_{WTP_i}$  is zero. However,  $\widehat{\beta}_0$  from equation (1) tends to underestimate the true empirical effect when there is a nonzero effect (Stanley, 2010; Doucouliagos et al., 2014; Stanley et al., 2017). In such cases, Stanley and Doucouliagos (2014) and Stanley (2017) recommend to use of the squared standard error,  $SE_{WTP_i}^2$ , instead of  $SE_{WTP_i}$  in equation (1) as the WTP estimate and its standard error could have a nonlinear relationship if the PET test indicates the presence of a genuine effect (Stanley and Doucouliagos, 2012). This will provide a better estimate of  $\widehat{\beta}_0$  and a more accurate reflection of publication bias and leads to the following specification of the FAT-PET model (Stanley and Doucouliagos 2012 & 2014):

$$relative\ WTP_i = \beta_0 + \beta_1(SE_{WTP_i}^2) + u_i, \text{ with } i = 1, 2, \dots, m \quad (2)$$

The  $\widehat{\beta}_0$  from equation (2) is the known test called precision-effect estimate with the standard error (PEESE) testing the hypothesis  $H_0: \beta_0 = 0$  (Stanley and Doucouliagos, 2012 & 2014; Stanley, 2017), which allows to identify the presence of a “true” empirical effect after controlling for potential publication bias (Stanley and Doucouliagos, 2014; Stanley, 2008). Doucouliagos and Stanley (2013) indicate that the degree of publication bias should be considered as substantial if  $|\beta_1| \geq 1$  and severe if  $|\beta_1| \geq 2$ . Stanley (2008) examined the properties of this test and concluded that it is an effective tool for testing the presence of a genuine effect even in small samples and regardless of the extent of publication selection bias.

Furthermore, since 16 studies (11 regarding organic labelling and 5 related to domestic COO labelling) out of the total set of 47 primary studies reported more than one WTP estimate, the independence of error assumption is violated. This is caused by the fact that multiple estimates from the same study are

unlikely to be independent of each other (Hedges *et al.*, 2010) leading to heteroscedasticity in the error terms of the MRA models. We therefore account for multiple WTP estimates from a single study by allowing each study to represent a cluster of estimates (Genc *et al.*, 2012), irrespective of the number of estimates the study reports. We then adjust for this within-study dependence through cluster robust standard errors. In addition, there are also some estimates from the same author published in different articles<sup>18</sup>, and it can be presumed that the same author might repeat the same analytic procedure/ analytic mistake during his or her research process. Therefore, we also pre-grouped the MRA dataset to test for heteroscedasticity using a WLS-MRA with author cluster robust standard errors. To explain variation in the relative WTP estimates related to organic and domestic origin labelling we added a number of explanatory variables as discussed in 2.2.4. The WLS-MRA model in equation (2) can accordingly be written as:

$$relative\ WTP_i = \alpha_0 + \alpha_1(SE_{WTP_i}^2) + \sum \beta_w x_{wi} + \sum \beta_m x_{mi} + \sum \beta_n x_{ni} + v_i \quad (3)$$

where the intercept  $\widehat{\alpha}_0$  denotes the true empirical effect beyond publication bias if all explanatory variables related to the underlying study design are equal to zero (Stanley *et al.*, 2013).  $\widehat{\alpha}_1$  represents the degree of publication bias when accounting for variations in reported relative WTP estimates driven by underlying study-design characteristics including study context, DCE experimental design, and elicitation model. The  $\widehat{\beta}_w$ ,  $\widehat{\beta}_m$ , and  $\widehat{\beta}_n$  vectors represent the estimated coefficients on the respective classification of explanatory variables. The  $\widehat{\beta}_w$  vector indicates the regression coefficients related to the vector of study context features, the  $\widehat{\beta}_m$  vector denotes the regression coefficients related to a vector of DCE experimental design characteristics, and  $\widehat{\beta}_n$  vector refer to the regression coefficients related to the vector of elicitation models. Finally,  $v$  is the error term.

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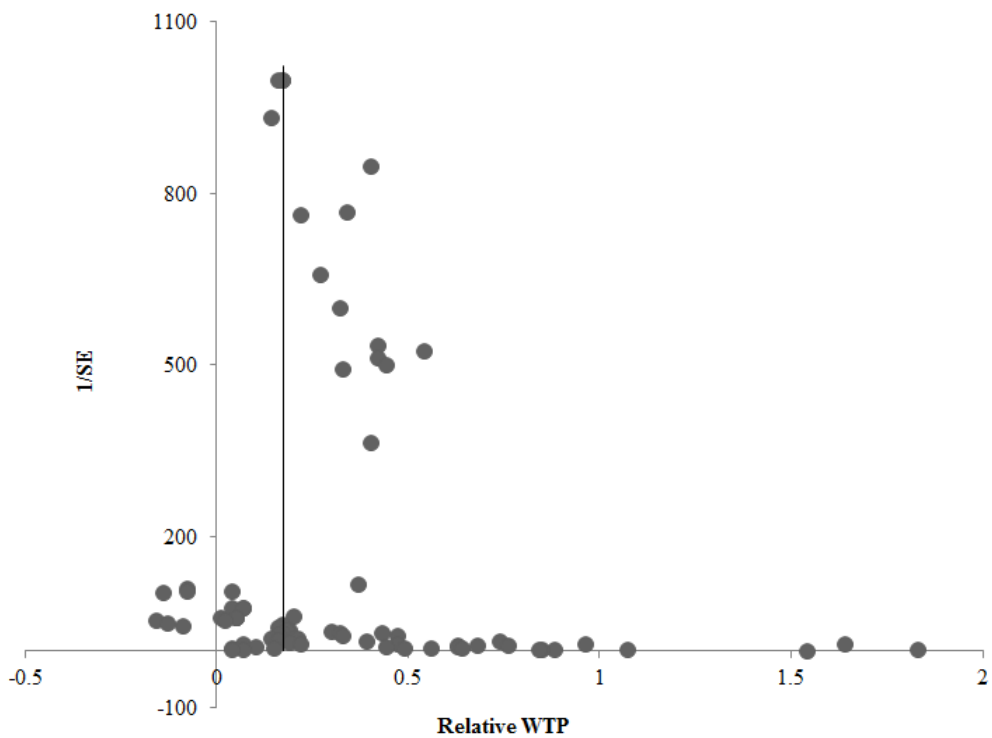
<sup>18</sup> We only focus on the first authorship of each primary study to identify author clusters. In addition, we also controlled for the fact that the same author did not publish exactly the same result in more than one study.

## 2.4 Results

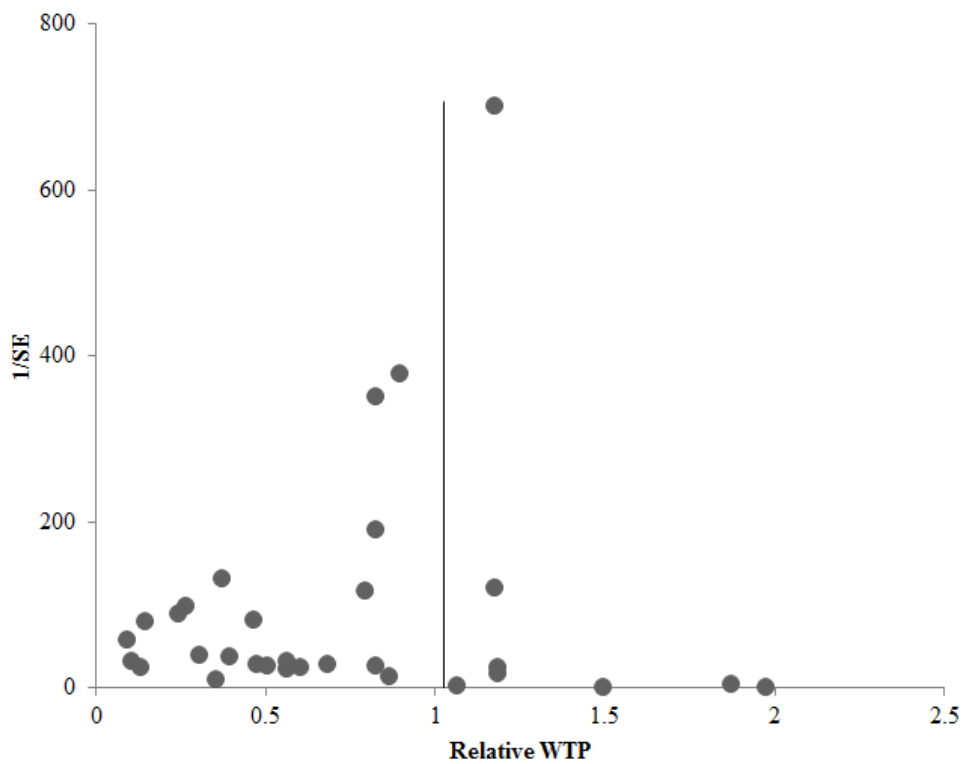
In section 2.4.1 we provide an initial analysis of the reported WTP values to derive first insights about the publication bias and the test of the “true” empirical effect. In section 2.4.2, we present results for several multiple MRA models that control for the presence of publication selection bias and the impact of study design characteristics. All steps are conducted separately for WTP values derived from the OL and the DOL literature, respectively. Note that our MRA follows the reporting guideline suggested by Stanley *et al.* (2013).

### 2.4.1 Results of the publication bias analysis and the true effect test

First of all, we provide funnel graphs for visual inspections of publication selection bias with respect to the organic and domestic COO labelling studies. A funnel plot is a scatter diagram of WTP estimates versus the estimates’ standard errors, which serves to provide an initial impression of the relationship. In the absence of publication selection bias, the funnel graph should be symmetric and shaped approximately as an inverted funnel around the “true” WTP estimate. Asymmetric or skewed funnel is the sign of publication selection bias. Based on Stanley (2005) and Hirsch (2017) we average the top 10% of the estimated relative WTP values to derive the proxies for the “true” level of relative WTP estimates for organic and domestic origin labelling. Figure 2.3 and 2.4 demonstrates the funnel plot for OL and DOL studies. However, the funnel graphs illustrated in figure 2.3 and 2.4 are not distinct enough to visually determine the skewness of the both funnel graphs for the presence of the publication selection bias. There seems to be no distinct evidence of publication bias as the point estimates are not strongly asymmetrically distributed around the “true” effect regarding both the WTP estimates for organic and domestic origin labelling. In figure 2.3 and 2.4 the vertical black line at 0.22 for organic labelling studies and at 1.02 for domestic COO labelling studies denote the proxies for the respective “true” relative WTP estimates. Nevertheless, the informal visual inspections of funnel graphs are subject to subjective interpretation. In the next step we present meta regression tests using the statistical FAT-PET and PEESE tests.



**Figure 2.3** Funnel graph for the WTPs of the organic labelling studies



**Figure 2.4** Funnel graph for the WTPs of the domestic COO labelling studies

Table 2.11 and 2.12 presents the results of the “FAT-PET” and “PET-PEESE” analyses for the organic and domestic origin WTP estimates using WLS with the defined standard error correction approaches: robust standard errors, author-cluster robust standard errors, and study-cluster robust standard errors, respectively. It needs to be mentioned that in the case of included literature on WTPs for domestic origin each study is linked to a specific author, which implies that author and study-clusters of WTP estimates are the same. In the following we focus on the WLS models with the author/study-cluster standard errors. The result of the FAT test reported in table 2.11 for quantifying the degree of publication bias with respect to the OL WTP estimates is insignificant ( $\widehat{\beta}_{1-\text{organic}} = 6.95, p > 0.1$ ), where the FAT test reported in table 2.12 for the DOL WTP estimates is significant ( $\widehat{\beta}_{1-\text{COO}} = -26.72, p < 0.05$ ) for the WLS models with author-cluster robust and study-cluster robust standard errors. Moreover, in table 2.11 and 2.12 the significant  $\beta_0$  coefficients for organic labelling WTP ( $\widehat{\beta}_{0-\text{organic}} = 0.22, p < 0.01$ ) and for domestic origin WTP ( $\widehat{\beta}_{0-\text{COO}} = 1.08, p < 0.01$ ) reveal the evidence for the presence of a “true” relative WTP effect after controlling for publication bias. As known that  $\widehat{\beta}_0$  from the FAT test associated with the equation (1) tends to underestimate the true empirical effect when there is nonzero effect detected, we then further conduct the PET-PEESE test based on equation (2) assuming that the standard error could have a nonlinear relationship (Stanley and Doucouliagos, 2012) in order to provide a better estimate of  $\widehat{\beta}_0$  and a more accurate reflection of publication bias.

With respect to the PET-PEESE results shown in table 2.11 and 2.12 we now reject the null hypothesis ( $H_0: \widehat{\beta}_1 = 0$ ) for the organic labelling ( $\widehat{\beta}_{1-\text{organic}} = 5.41, p < 0.1$ ) but fail to reject the null hypothesis for the domestic origin literature ( $\widehat{\beta}_{1-\text{COO}} = -13.90, p > 0.1$ ). This indicates that there is an evidence for the presence of a publication bias in the analysed OL literature, however, no significant evidence exists for a publication bias with respect to the DOL literature. Finally, the positive significant coefficient  $\beta_0$  for organic ( $\widehat{\beta}_{0-\text{organic}} = 0.22, p < 0.01$ ) in table 2.11 and domestic COO-WTP ( $\widehat{\beta}_{0-\text{COO}} = 0.99, p < 0.01$ ) in table 2.12 again provides evidence for the existence of a “true” positive relative WTP effect for organic and domestic COO labelling.

### 2.4.2 Results of meta regression analysis

Though our analysis so far points to a publication bias regarding WTP estimates for OL it also confirms the existence of a true effect for both WTP values for OL and DOL. Therefore, we further proceed with our analysis and estimate the MRA model specified by equation (3) in order to account for the relevance of study design characteristics in driving heterogeneity in reported WTP measures. Results from the estimation of equation (3) for relative WTP estimates for organic and domestic origin-labelling are provided in tables 2.13 and 2.14, respectively. The tables summarize the results for WLS models with heteroscedasticity robust standard errors as well as for models that additionally account for potential heteroscedasticity caused by study or author cluster dependency. In the case of the DOL related analysis each study is related to a unique author, which implies that author and study-clusters robust standard error models are identical. In the following we focus on the MRA model using the WLS specification associated with the author/study cluster robust standard errors.

Table 2.13 reveals that the MRA models explain over 30% of the variation in reported relative WTP estimates for OL literature. The constant is insignificant which indicate that the overall WTP effect of organic labelling becomes irrelevant when we control for publication bias and the underlying study design with study (author) cluster robust standard errors<sup>19</sup>. The coefficients of  $SE^2$  in the MRA model is positive and significant, pointing to the existence of publication bias towards significant positive WTP estimates, after controlling for heterogeneity in study design characteristics and for accounting for the study/cluster error structure. Furthermore, as the absolute value of the coefficient of  $SE^2$  exceeds 1, this suggests that the publication bias is of substantial degree (Doucouliagos and Stanley, 2013). Our MRA results reveal positive and significant coefficients for *East Asia* and *Europe* indicating that primary studies focusing on this geographical region generate significantly higher relative WTP estimates compared to those estimated for North America. In addition, we find that the estimates of consumers' WTP for organic labelling is slightly lower when the *aggregated logit model*

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<sup>19</sup> The base group captured in the constant is: correcting for any public selection bias; that was conducted in North America; where plant-based product was selected as studying object; using non-web surveying mode to collect DCE data; that its DCE design has four or more attributes involved; that up to three pricing levels defined in the price attribute; and utilizing heterogeneity specific logit models as analytic method.

(i.e. multinomial logit models or conditional logit models) is applied in the DCE data analysis compared to the use of models that consider heterogeneity such as the mixed logit models.

Table 2.14 presents the respective results for the MRA focusing on the DOL literature and shows that the model explains over 85% of the variation in reported relative WTP estimates for DOL. The constant term is insignificant suggesting that the relative WTP estimates are not significantly different from zero for DOL when all explanatory variables are set equal to zero. The coefficients of  $SE^2$  is significant. This provides evidence that the relative WTP estimates for DOL suffer from publication bias after controlling for study design characteristics and accounting for the cluster error structure. Furthermore, our results reveal that the relative WTP estimates for DOL are higher if the *the aggregated logit model* is applied.

Finally, tables 2.13 and 2.14 show that factors such as the selected product categories, the number of attributes and the number of pricing level defined in the DCE design seem to have no systematic influence on consumers' WTP for OL and DOL, respectively.

**Table 2.11** Results of FAT-PET and PET-PEESE for organic labelling studies

	<b>FAT-PET</b>									<b>PET-PEESE</b>								
	WLS robust			WLS author cluster			WLS study cluster			WLS robust SEs			WLS author cluster			WLS study cluster		
	standard errors			robust standard errors			robust standard errors						robust standard errors			robust standard errors		
<b>N</b>	74			74			74			74			74			74		
<b>K</b>	37			37			37			37			37			37		
<b>R<sup>2</sup></b>	0.020			0.020			0.020			0.000			0.000			0.000		
<b>Relative WTP</b>	<b>Coef.</b>	<b>S.E.</b>	<b>Sig.</b>	<b>Coef.</b>	<b>S.E.</b>	<b>Sig.</b>	<b>Coef.</b>	<b>S.E.</b>	<b>Sig.</b>	<b>Coef.</b>	<b>S.E.</b>	<b>Sig.</b>	<b>Coef.</b>	<b>S.E.</b>	<b>Sig.</b>	<b>Coef.</b>	<b>S.E.</b>	<b>Sig.</b>
Constant: $\beta_0$	0.22	0.03	***	0.22	0.04	***	0.22	0.04	***	0.22	0.03	***	0.22	0.04	***	0.22	0.04	***
$SE: \beta_1$	6.95	3.55	*	6.95	7.28		6.95	7.24										
$SE^2: \beta_1$										5.41	2.17	**	5.41	2.74	*	5.41	2.72	*

\*, \*\*, \*\*\*; p &lt; 0.1, 0.05, 0.01

N = Number of WTP estimates; K = Number of studies

**Table 2.12** Results of FAT-PET and PET-PEESE for domestic COO labelling studies

	<b>FAT-PET</b>						<b>PET-PEESE</b>					
	WLS robust standard errors			WLS author/study cluster robust standard errors			WLS robust SEs			WLS author/study cluster robust standard errors		
<b>N</b>	31			31			31			31		
<b>K</b>	10			10			10			10		
<b>R<sup>2</sup></b>	0.290			0.290			0.002			0.002		
<b>Relative WTP</b>	<b>Coef.</b>	<b>S.E.</b>	<b>Sig.</b>	<b>Coef.</b>	<b>S.E.</b>	<b>Sig.</b>	<b>Coef.</b>	<b>S.E.</b>	<b>Sig.</b>	<b>Coef.</b>	<b>S.E.</b>	<b>Sig.</b>
Constant: $\beta_0$	1.08	0.10	***	1.08	0.11	***	0.99	0.11	***	0.99	0.12	***
$SE: \beta_1$	-26.71	7.65	***	-26.71	10.48	**						
$SE^2: \beta_1$							-13.90	12.34		-13.90	18.37	

\*, \*\*, \*\*\*;  $p < 0.1, 0.05, 0.01$

N = Number of WTP estimates; K = Number of studies

Note that literature on WTP for domestic COO each study is related to a unique author implies author and study-clusters of WTP estimates are identical in this case.

**Table 2.13** Meta regression analysis: Organic labelling studies

	Organic labelling meta dataset								
	WLS robust			WLS author cluster			WLS study cluster		
				robust standard errors			robust standard errors		
N	74			74			74		
K	37			37			37		
R squared	0.31			0.31			0.31		
Dependent variable: Relative WTP	<b>Coef.</b>	<b>S.E.</b>	<b>Sig.</b>	<b>Coef.</b>	<b>S.E.</b>	<b>Sig.</b>	<b>Coef.</b>	<b>S.E.</b>	<b>Sig.</b>
Constant: $\alpha_0$	0.04	0.20		0.04	0.20		0.04	0.20	
$SE^2: \alpha_1$	6.35	2.88	**	6.35	3.45	*	6.35	3.37	*
East Asia	0.66	0.16	***	0.66	0.17	***	0.66	0.17	***
Europe	0.20	0.06	***	0.20	0.08	***	0.20	0.08	***
Web survey	0.16	0.14		0.16	0.15		0.16	0.15	
Animal-based product	0.02	0.05		0.02	0.06		0.02	0.06	
Number of attributes defined in the DCE $\geq 4$	-0.09	0.05	*	-0.09	0.07		-0.09	0.07	
Number of pricing levels defined in the DCE $\geq 4$	-0.04	0.15		-0.04	0.15		-0.04	0.15	
Aggregated logit model	-0.01	0.00	***	-0.01	0.00	***	-0.01	0.00	***

\*, \*\*, \*\*\*;  $p < 0.1$ ,  $p < 0.05$ ,  $p < 0.01$

N = Number of WTP estimates; K = Number of studies

**Table 2.14** Meta regression analysis: COO labelling studies

	COO labelling meta dataset					
	WLS robust			WLS author/study cluster robust standard errors		
	Coef.	S.E.	Sig.	Coef.	S.E.	Sig.
N		31			31	
K		10			10	
R squared		0.85			0.85	
Dependent variable: Relative WTP						
Constant: $\alpha_0$	0.08	0.06		0.08	0.06	
$SE^2: \alpha_1$	15.52	7.78	*	15.52	8.09	*
Other (East Asia and Oceania)	0.03	0.04		0.03	0.05	
Europe	0.01	0.10		0.01	0.03	
Web survey	0.46	0.40		0.46	0.43	
Animal-based product	0.16	0.36		0.16	0.37	
Number of attributes defined in the DCE $\geq 4$	-0.13	0.40		-0.13	0.43	
Number of pricing levels defined in the DCE $\geq 4$	-0.33	0.35		-0.33	0.37	
Aggregated logit model	0.76	0.05	***	0.76	0.05	***

\*, \*\*, \*\*\*;  $p < 0.1$ ,  $p < 0.05$ ,  $p < 0.01$

N = Number of WTP estimates; K = Number of studies

Note that literature on WTP for domestic COO each study is related to a unique author implies author and study-clusters of WTP estimates are identical in this case.

## 2.5 Discussion and Conclusion

This paper aims to provide a comprehensive overview of the evaluation empirical DCE literature on consumers' WTP towards two credence attributes, production methods and domestic COO labels. To understand consumers' use of those labels during their food purchase procedure, we conducted two meta-regression analyses (MRAs) to identify systematic patterns in consumers' WTP for OL and DOL. A total of the reported 74 WTP estimates for OL (extracted from 37 DCE primary studies) and the published 31 WTP estimates related to DOL (obtained from 10 DCE literatures over the time period from 2007 to 2017) were synthesized and employed in the MRAs. In both MRAs, we provided evidence for determinants potentially driving the heterogeneity in the study results such as the study country, product type, and methodological characteristics of the study that impact consumers' WTP for OL and DOL in the stated preference DCE framework. We also examined whether the results on WTP for OL and DOL were affected by publication selection bias or whether the presence of the true effect exists. These MRAs, to our knowledge, are the most recent on consumers' WTP for OL and DOL, and the food-related MRAs that study WTP on the two credence attributes simultaneously.

In this paper, we present several useful findings associated with this quantitative review. First, given the nature of the FAT-PET and PET-PEESE tests, we assessed for the presence of the true effect and publication selection bias across the empirical DCE literature, with respect to OL and DOL. The outputs of FAT-PET and PEESE show that consumers are generally willing to pay a positive price premium for OL and DOL, and a true empirical effect of OL and DOL on consumers' WTP exists. The findings are consistent with the current literature in which consumers are generally willing to pay higher price premium for organic (see the review by Rana and Paul, 2017; Aschemann-Witzel and Zielke, 2017) and domestic products (see the review by Newman et al., 2014; Thøgersen et al., 2017). Moreover, we also discovered that the publication selection bias is present in the OL literature, but do not exist in the DOL studies.

Second, when accounting for the heterogeneity in study characteristics with the consideration of the cluster error structure in the multivariate MRA models, publication selection bias was again found to

be an important issue for both OL and DOL literature about consumers' WTP and the respective labels.

Third, we found evidence identifying the key drivers of heterogeneity of reported WTP estimates for OL and DOL across empirical DCE surveys. Our MRA results indicate that analytic elicitation methods have significant impacts on both OL and DOL in the primary DCE studies. No similar findings have been found in the previous OL MRA studies, however, our DOL MRA finding is in line with one finding presented in Yu et al. (2016) that a mixed logit model could significantly yield lower WTP values since mixed logit models can capture some heterogeneity in consumer preference, thus reducing the extreme values/outliers in the estimation process and potentially making the WTP values more robust. Furthermore, our MRA results show that the interview location has significant effects in the primary DCE studies regarding OL. It implies that the research locations do play significant roles for studying consumers' WTP for OL. Primary DCE studies focusing on the geographical region of East Asia and Europe generate significantly higher WTP estimates compared to those estimated for North America. This result might be explained by the finding presented in prior literature that European consumers are most concerned about food safety due to increasing globalization (Bonti-Ankomah and Yiridoe, 2006; Rana and Paul, 2017), while Asian consumers gravitate towards organic food due to apprehensions about conventionally grown food being risky (Bonti-Ankomah and Yiridoe, 2006; Rana and Paul, 2017). Finally, the results of MRA findings indicate that the selected product categories employed for DCE survey, number of attributes defined in the DCE, and number of pricing level designed in the price attribute are unimportant factors for the relationship between consumers' WTP and the respective labels.

There are limitations in our MRAs that should be acknowledged, so caution should be taken when interpreting and generalizing the results of this study. First of all, our meta datasets have relatively small sample size and the MRA results might need to be seen as the initial approximations of the meta datasets extracted from the literature sample. Despite a relatively small sample size in this study, our MRA models provided acceptable statistical measures. Overall, the MRA method is a useful technique for proper exploration of the empirical data, providing a more systematic and robust

assessment of the effects compared to a guideless ad hoc literature review approach. Still, a greater sample size would allow for greater confidence in results, so we therefore look forward to more DCE empirical studies being done on WTPs for organic and domestic COO labels. This would lead to more comprehensive MRAs that would better understand the variability of WTPs. Second, future studies should also consider extending the literature time frame when collecting meta observations. It might be interesting to also include different types of methods used in their empirical work, such as contingent valuation, hedonic price regression, and experimental auctions approach, when searching for WTP elicitation literature. Third, the mean of relative WTP values reported in tables 2.5 to 2.10 and the true effect reported in figures 2.3 and 2.4 may have overstated the WTP value of organic and COO labelled food because there are still non-covered population in African countries, southern America, middle and southern Asian countries, etc. that have not been included in our meta datasets. It can be expected that the mean of relative WTP values would be likely to be below the current mean. Therefore, there is indeed a need for new empirical DCE studies among those areas. Fourth, there is the unavoidable exclusion of some relevant studies that provide insufficient information and do not meet our literature selection criteria. For instance, there are primary DCE studies do not report equivalent dispersion statistics for the respective WTP estimates, or studies focused on organic versus other alternative labels rather than a “no-label” level, or domestic COO versus foreign COOs instead of a “no-COO level”. We are, nevertheless, fairly confident that we have included most of the relevant empirical works and that the WTP estimates obtained from those studies are rescaled in a relative manner to be comparable and testable. Fifth, we did not consider sociodemographic and socioeconomic traits of the primary studies in our MRA models; therefore, for further research we recommend to use model specifications that incorporate additional sociodemographic and socioeconomic characteristics extracted from previous empirical works.

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## **Chapter 3:**

# **Consumers' Preference for Sweet Peppers with Different Process Attributes: A Discrete Choice Experiment in Taiwan**

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This paper was published in *Journal on Food System Dynamics* (2016), Vol. 7, No. 4, 293-310.

The electronic version of the original publication is available at <http://centmapress.ilb.uni-bonn.de/ojs/index.php/fsd/article/view/596>

## **Consumers' Preference for Sweet Peppers with Different Process Attributes: A Discrete Choice Experiment in Taiwan**

### **Abstract**

Based on an online discrete choice experiment (DCE) this study investigates the relative importance of food label information (country of origin, production methods, chemical residue testing (CRT)) and price for Taiwanese consumers' in their purchase of sweet peppers. Results show that respondents focus mostly on the COO labelling during their sweet-pepper shopping, followed by price. Information concerning CRT results and production methods are of less importance. Our findings also indicate that interaction between attributes matter and that preference for attribute levels differs depending on socioeconomic characteristics.

***Keywords:** choice experiment, food safety information, production methods, country of origin, logit models*

### **3.1 Introduction**

Agricultural practices in Taiwan are very intensive and characterized by an extensive use of chemical inputs (Mao and Schive, 1995; Francks *et al.*, 1999; Lin, 2002; Yang, 2013; Yang, 2014). Furthermore, due to the high population density and the growing demand for food, Taiwan substantially depends on agricultural and food imports. This holds especially with respect to organic products. Over the last decade China and Japan have emerged as the two biggest sources of Taiwanese food imports, though from a quality and safety perspective Taiwanese consumers consider these two trading partners different (Customs Administration, 2014).

Thus, with a rising health consciousness on the one hand and frequent food scandals over the last years on the other hand consumers' interest in COO and food safety labelling as well as in organic food products is on the rise (Hsieh, 2005; Chen, 2009; Chen, 2012; Liu *et al.*, 2013; Tung *et al.*, 2012). In order to increase transparency for consumers and thus to allow consumers to select the

products according to their preferences the labelling of country of origin (COO) as well as of production methods (organic certified labelling) have been introduced in Taiwan (Food and Drug Administration, 2012; 2014; Council of Agriculture, 2007). Additionally, information on chemical residue testing (CRT) of food products are in some cases reported by food retailers and sellers in Taiwanese market (Hsu *et al.*, 2006; Greenpeace, 2012; Liu, 2013; Greenpeace 2016)<sup>20</sup>. Given this background the objective of the study is to understand Taiwanese consumers' preference for food safety, production methods and origin labelling as well as the utility derived from the combination of the various attributes. More specifically, we want to test whether consumers differentiate between organic products depending on the COO and how CRT information and organic production is perceived on its own as well as in combination. As no chemicals are allowed to be applied in organic production, thus, chemical residuals should play no role in organic products. In addition, we are interested to gain insights with respect to the relevance of sociodemographics for consumer preferences regarding the purchase of sweet peppers.

This paper is organized as follows. First, the method and data applied are presented. Second, the paper provides insights regarding the relative relevance of different product and process characteristics in determining Taiwanese consumers' purchase decision of sweet papers taking into consideration potential interdependencies between those characteristics as well as of socio-demographics. The paper concludes with a discussion of the results.

### **3.2 Methods**

To analyze Taiwanese consumers' purchase decision we make use of the methodology of discrete choice experiment (DCE) (McFadden, 1974) which is derived from Lancaster's new demand theory (Lancaster, 1966). The latter assumes that a consumer's utility depends on product characteristics instead of the product itself. In accordance with utility maximizing behaviour, consumers choose the

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<sup>20</sup> Pesticide residues are a problem in the Taiwanese vegetable market as a recent study by Greenpeace confirms (see <http://www.taipeitimes.com/News/taiwan/archives/2016/01/22/2003637796>).

product among the given alternatives that possesses the combination of attributes that maximizes his/her utility (Rachlin, 1980; McFadden, 1986). Assuming a linear indirect utility function, the utility of alternative  $j$  in choice situation  $s$  for individual  $i$  is

$$U_{ijs} = \beta X_{ijs} + \varepsilon_{ijs} \quad (1)$$

where  $X_{ijs}$  is the attribute vector and  $\beta$  is the corresponding parameter vector.  $\varepsilon_{ijs}$  is the stochastic components of the utility function which is assumed to be ‘identically and independently distributed’ (IID) (Carson *et al.*, 1994; Train, 2009).

DCE data is firstly, analyzed using aggregate-level logit models. Calculated partworth utilities provide information on the values consumers assign to each attribute level. In addition, aggregate-level logit models allow to determine the interaction effects among attributes, and thus to investigate whether the combined effect of two attribute levels is significant different from the sum of the two main effect utilities. However, aggregate-level logit models assume that the coefficients of variables that enter the model are identical for all consumers, implying that different consumers with the same observed characteristics have the same values for each factor of the model which likely is not the case. Furthermore, aggregate-level logit models are based on the ‘independence from irrelevant alternatives’ (IIA) assumption. This implies that the odds of choosing product A over product B should not depend on whether some other alternative C is present or absent (Train, 2009).

The hierarchical Bayesian inferences of random effect logit model can take care of the above-mentioned limitations. It was utilized to estimate part worth utility values taking into account the heterogeneity of consumers regarding their preferences for sweet peppers (Train and Sonnier, 2005; Train, 2009).

Fresh unpacked sweet pepper was chosen as study object as it is part of Taiwanese people’s daily diet (The Committee of Agricultural Extension, 2014; Taichung District Agricultural Research and Extension Station, 2016). Furthermore, sweet pepper is a suitable product because it is one of the few fresh agri-products permitted to be imported into Taiwan from mainland China. Thus, it is available on the Taiwanese domestic market in conventional and organic quality from the three countries

considered in the study: Taiwan, China, and Japan. Besides COO and production methods, two additional characteristics were considered in the choice experiment: price and CRT information (shown in table 3.1).

An optimal orthogonal design was used to generate 36 choice scenarios. This fractional factorial design technique is based on the consideration of maintaining the properties of orthogonality in alternatives' attributes that are uncorrelated with one another among the choice sets in the whole experiment (Scarpa and Rose, 2008; Burgess and Street, 2005). Those were blocked into six groups with six choice situations, respectively. A choice task consisted of the option to buy one of three peppers that differed in the levels of the four product attributes (see table 3.1). Participants could also decide to buy none of the three peppers ("opt-out" option) (see figure 3.1 for the original and figure 3.2 for the English version).

**Table 3.1** Attribute and attribute levels used in DCE

<b>Attributes</b>	<b>Levels</b>
Country of origin (COO)	1. Taiwan 2. Japan 3. China
Production methods	1. Organic 2. Conventional
Chemical residue test (CRT) information	1. CRT approved in the production country 2. CRT approved in Taiwan 3. No CRT
Price <sup>¶</sup>	1. NT 65 2. NT 85 3. NT 105 4. NT 125

<sup>¶</sup>In July 2014, 1 US Dollar = 29.98 New Taiwanese (NT) Dollars  
1 Taiwanese catty = 600 grams

以下三種甜椒，請問您會購買哪一種？

產品編號	1	2	3	4
				
	 <p>新鮮紅甜椒 產地：<u>台灣</u> 通過<u>台灣</u>的農藥殘留檢測 NT 85 /600g</p>	 <p>新鮮紅甜椒 <u>有機生產</u> 產地：<u>日本</u> 通過<u>日本</u>的農藥殘留檢測 NT 65 /600g</p>	 <p>新鮮紅甜椒 <u>有機生產</u> 產地：<u>中國</u> 通過<u>台灣</u>的農藥殘留檢測 NT 85 /600g</p>	我不會購買這些甜椒。
請問您會購買哪一種甜椒？	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 3.1 A choice task example in DCE (Mandarin version)

The following fresh sweet peppers are available. Which one would you buy?







Product number	1	2	3	4
				
	 <p>Red Sweet Pepper Taiwan Passed Taiwan-authorized chemi-residue test NT 85 / 600g</p>	 <p>Red Sweet Pepper Organic Japan Passed Japan-authorized chemi-residue test NT 65 / 600g</p>	 <p>Red Sweet Pepper Organic China Passed China-authorized chemi-residue test NT 85 / 600g</p>	I will not buy any of them
Which product do you want to buy?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 3.2 A choice task example in DCE (English translation)

Data was collected in April 2014 using a pre-tested self-administered online questionnaire addressing Taiwanese consumers. The survey was designed as a 15 minutes online questionnaire including a Discrete Choice Experiment (DCE) and questions to obtain information on respondents' food consumption behaviour and socio-demographics. Potential respondents were informed about the

survey via author's social media groups and e-mail (e.g. family members and alumni of author). Contacted persons were asked to circulate the link to the questionnaire (snow balling procedure) to increase the number of participants of the survey.

### **3.3 Results**

A total of 814 people took part in the survey. Of these only respondents fulfilling the following three criteria were considered: being a Taiwanese citizen and inhabiting in Taiwan, being responsible for their household's food shopping and consuming sweet peppers. Overall, 290 valid responses for data analysis were obtained.

With regard to demographics women are slightly overrepresented (55.9%) in the sample and 35.9% of participants were fully responsible for their household food purchase. Compared to the Taiwanese population the sample is biased towards younger, better educated and wealthier inhabitants. Table 3.2 summarizes the structure of the sample.

For data analysis Sawtooth Software v.8 was used for estimating aggregate-level logit models as well as for the hierarchical Bayes estimation of random parameter logit models.

**Table 3.2** Sample structure

<i>Number of respondents</i>		290	
		<b>Freq.</b>	<b>(%)</b>
<i>Gender</i>			
	Male	128	44.1
	Female	162	55.9
<i>Responsibility for household food shopping</i>			
	Fully	104	35.9
	Partly	186	64.1
<i>Age</i>			
	Up to 29	21	7.2
	30-49	180	62.1
	50 and over	88	30.3
	Missing	1	0.3
<i>Marital status</i>			
	Single	78	26.9
	Married	201	69.3
	Other (widowed/ divorced)	5	1.7
	Missing	6	2.1
<i>Education</i>			
	Up to senior high (12 years)	35	12.1
	College	66	22.8
	University	186	64.1
	Missing	3	1.0
<i>Average monthly net income in a household</i>			
	Up to NT 40000	56	19.3
	NT 40001 - 80000	110	37.9
	NT 80001 - 120000	71	24.5
	NT 120001 and over	23	7.9
	Missing	30	10.3
<i>Monthly household food expenses</i>			
	Up to NT 15000	158	54.5
	NT 15001 - 25000	83	28.6
	NT 25001 and over	49	16.9

### 3.3.1 Aggregate-level logit models

The empirical models developed in this study are based on the choice experimental structure as depicted in table 3.1. The results for the aggregate-level logit models are illustrated in table 3.3. Model 1 reveals the utility scores for the main effects with respect to the four attributes considered, while Models 2 and 3 consider the interaction effect between the attributes COO and production methods and between production methods and CRT, respectively. The interaction between CRT and COO was as well investigated but proved to be insignificant leading to a lower overall model fit. Thus, the results are not presented.

According to the results of model 1, all levels of the four considered attributes proved to be significant at the 5% level. The price coefficient is negative as expected. The coefficient of organic is positive, indicating that respondents are willing to pay a premium for organically produced sweet peppers compared to conventional ones. The positive signs for Taiwan and Japan show that survey participants preferred sweet peppers from these countries compared to the COO China (negative main effect). Respondents also value products with CRT information (positive main effect).

Model 2 indicates that the relevance of the production methods increases relative to Model 1 and the utility derived from organic (conventional) production differ depending on the COO (see table 3.3). It is negative (positive) for the COO Taiwan and positive (negative) for China, while there is no significant interaction effect between production methods and the COO Japan. Having a closer look at the results of the second model reveal that in the case of Taiwanese organic sweet peppers, the two positive main effects for the COO Taiwan and the production method organic are corrected downward. The situation is different with respect to China. Consumers have the lowest preference for the COO China (negative main effect). In the case of organic products originating from China the interaction effect is positive. Thus, the production method organic can mitigate the negative evaluation of the COO China to some extent beyond the general positive effect organic production has. Comparing model 1 and model 2 reveals, however, that the inclusion of the interaction terms (model 2) leads only to a very slight increase (0.13%) in the percent certainty measure while there is no improvement in the root likelihood (RLH) as the goodness-of-fit measure.

Model 3 considers besides the main effects and the interactions between COO and production methods also the interaction between production methods and CRT (see table 3.3). The results, confirm the findings of model 2 regarding the main effects as well as the interaction effect for COO and production methods, with the significance of the latter being higher in the case of COO Taiwan combined with production method.

The combination of the two attributes CRT approved and organic production both with a positive main effect can be assumed to be negative and thus adjusted downward as standards for organic production do not allow the use of chemical inputs. Indeed, table 3.3 reveals a significant negative effect for the interaction between organic production and CRT in the production country while the effect for organic production and CRT in Taiwan is slightly positive, though not significant. Along the same lines we can assume that lack of CRT is less relevant in the case of organic products implying a positive interaction effect. Our results confirm this assumption. Furthermore, in the case of conventional products CRT testing gains in relevance, the interaction effect for conventional products and CRT testing in the production country is significant and as expected positive. However, the respective effect for conventional products and CRT testing in Taiwan proves to be insignificant and slightly negative. Finally, consumers evaluate conventional production on the one hand and No CRT on the other hand negative. Our results reveal that the combination of those two attribute levels further reinforces the negative evaluation of consumers.

**Table 3.3** Aggregate-level logit models

(N=290)		Aggregate logit models								
Discrete choice models		Model 1			Model 2			Model 3		
<b>RLH</b>		0.51			0.51			0.51		
<b>Null log-likelihood</b>		-2412.15			-2412.15			-2412.15		
<b>Restricted log-likelihood</b>		-1169.24			-1165.95			-1157.82		
<b>Percent Certainty</b>		51.53			51.66			52.00		
<b>BIC</b>		2405.64			2413.98			2412.64		
<b>CAIC</b>		2414.64			2424.98			2425.64		
<b>Chi-Square</b>		2485.82			2492.41			2508.67		
		Util.	Sig.	S.E.	Util.	Sig.	S.E.	Util.	Sig.	S.E.
<b>COO</b>										
	Taiwan	1.47	**	0.06	1.50	**	0.07	1.59	**	0.07
	Japan	0.58	**	0.06	0.60	**	0.07	0.59	**	0.07
	China	-2.04	**	0.10	-2.10	**	0.12	-2.17	**	0.12
<b>Production method</b>										
	Organic	0.15	**	0.04	0.25	**	0.06	0.28	**	0.06
	Conventional	-0.15	**	0.04	-0.25	**	0.06	-0.28	**	0.06
<b>CRT information</b>										
	CRT appr. in prod. country	0.23	**	0.05	0.25	**	0.05	0.27	**	0.05
	CRT approved in Taiwan	0.22	**	0.05	0.22	**	0.05	0.22	**	0.05
	No CRT	-0.45	**	0.05	-0.47	**	0.05	-0.50	**	0.05
<b>Price</b>										
	NT 65	1.05	**	0.06	1.03	**	0.06	0.98	**	0.06
	NT 85	0.38	**	0.06	0.40	**	0.06	0.49	**	0.07
	NT 105	-0.47	**	0.07	-0.45	**	0.07	-0.40	**	0.07
	NT 125	-0.97	**	0.07	-0.98	**	0.07	-1.07	**	0.08
<b>COO × Production methods</b>										
	Taiwan × Organic				-0.19	*	0.08	-0.23	**	0.08
	Taiwan × Conventional				0.19	*	0.08	0.23	**	0.08
	Japan × Organic				-0.08		0.08	-0.08		0.08
	Japan × Conventional				0.08		0.08	0.08		0.08
	China × Organic				0.27	*	0.12	0.31	*	0.12
	China × Conventional				-0.27	*	0.12	-0.31	*	0.12
<b>Production methods × CRT</b>										
	Organic × CRT prod. country							-0.28	**	0.07
	Organic × CRT Taiwan							0.07		0.07
	Organic × No CRT							0.21	**	0.07
	Conv. × CRT prod. country							0.28	**	0.07
	Conv. × CRT Taiwan							-0.07		0.07
	Conv. × No CRT							-0.21	**	0.07
<b>None</b>		-1.85	**	0.17	-1.81	**	0.18	-1.82	**	0.18

\*Statistical significant level at 1%; \*\*Statistical significant level at 5%;

Util: Utility score - the higher the value, the more the attribute level is preferred.

Util.= utility; Sig.= significance; S.E.=standard error

### 3.3.2 Random effect logit models

The results of the random effect logit models for the whole sample (model 4 exclusively main effects; model 5 in addition to main effects the interaction term COO and production methods, and model 6 in addition to main effects the interaction terms of COO and production methods as well as production methods and CRT; see table 3.4) confirm the findings of the aggregate-logit models regarding the relative relevance of the different attributes and the partworth utilities of the attribute levels. In model 4, respondents perceive COO as by far the most important attribute (attribute importance: 53.99%), followed by price (29.84%), and CRT information (11.10%) while production methods (5.07%) prove to be of lower relevance in the purchase decision. The ranking remains the same in models 5 and 6 though the difference between CRT and production methods is considerable smaller in Model 5 compared to Models 4 and 6. The percent certainty and root likelihood (RLH) value for model 6 is slightly higher as for models 4 and 5 indicating a higher goodness of fit of the former compared to the latter two models.

Though the random parameter logit models 4 to 6 consider preference heterogeneity of consumers, they do not reveal the driving forces of heterogeneity. To explore the existence of different market segments we investigate preferences for different consumer groups based on socioeconomic characteristics. Separate random effect logit models were estimated for males (model 7) and females (model 8) and for four consumer groups depending on their income and education level (models 9 to 12). Regarding the latter, consumer's preference formation is investigated for the following four consumer segments: high income high education (model 9), high income lower education (model 10), lower income higher education (model 11) and lower income lower education group (model 12). High (lower) income is defined as a monthly income above (below or equal) to NT 80,000 in a household. High (lower) education is understood that respondents (don't) have a university degree. The results of models 7 and 8 are summarized in Ttable 3.5, the ones for models 9 to 12 are reported in table 3.6.

Male and female consumer reveal similar attribute importance for food price (male: 30.75%; female: 29.21%) and production method (male: 5.01%; female: 5.30%). Considerable differences in preferences, however, exist with respect to the other two attributes. For male consumers CRT

information is more important in their preference formation than for female consumers (male: 14.57%; female: 9.66%), whereas the opposite holds for the attribute production origin (male: 49.67%; female: 55.84%).

With respect to income and education level the following findings can be summarized. Respondents belonging into the high income, high education cluster perceive organic certified products as more important than all other consumer segments (see table 3.6). At the same time our results reveal that the two lower education segments (models 10 and 12) attach a higher relevance to CRT information compared to those consumer segments with a university degree (15.91% in model 10 and 14.46% in model 12 compared to 11.16% in model 9 and 10.15% in model 11). Income seems the decisive characteristics for the overall importance assigned to COO as a comparison of the results of models 9 and 10 with models 11 and 12 reveals (relative importance 48.81% and 46.29% versus 55.25% and 55.36%, respectively). Though the overall importance consumers attach to the attribute COO appears to be primarily driven by income, the evaluations of different origins seems largely dependent on the education level; e.g. consumers with a university degree (models 9 and 11) evaluate the COO Japan much more favourable than those without a university degree (models 10 and 12). Finally, price is according to our findings more important for the high-income segments (32.38% in model 9 and 32.87% in model 10) compared to the low-income groups (29.59% in model 11 and 25.42% in model 12).

Table 3.4 Random effect logit models

(N=290)		Model 4				Model 5				Model 6			
RLH (Model fit measure)		0.76				0.78				0.79			
Percent certainty measure		0.80				0.82				0.83			
	Rk.	Avg. Imprt.	S.D.	Avg. Utl.	S.D.	Avg. Imprt.	S.D.	Avg. Utl.	S.D.	Avg. Imprt.	S.D.	Avg. Utl.	S.D.
<b>COO</b>	<b>1</b>	53.99	13.48			52.14	11.98			54.56	13.61		
	Taiwan			87.77	32.66			83.62	29.44			87.07	31.18
	Japan			35.60	32.72			37.23	29.06			40.17	28.49
	China			-123.36	31.09			-120.85	27.53			-127.24	30.13
<b>Price</b>	<b>2</b>	29.84	14.24	-37.66	22.94	27.47	13.39	-34.65	21.46	28.35	14.30	-35.94	22.40
<b>CRT information</b>	<b>3</b>	11.10	6.42			10.69	5.88			11.52	5.87		
	CRT appr. in prod. country			13.22	10.32			13.04	9.38			14.15	9.48
	CRT approved in Taiwan			12.40	11.43			12.06	10.34			12.77	10.74
	No CRT			-25.63	16.79			-25.11	15.24			-26.92	15.20
<b>Production method</b>	<b>4</b>	5.07	3.49			9.70	3.41			5.57	3.01		
	Organic			8.78	8.64			19.13	7.57			10.74	6.69
	Conventional			-8.78	8.64			-19.13	7.57			-10.74	6.69
<b>COO × Production methods</b>													
	Taiwan × Organic							-12.74	8.35			-5.24	6.79
	Taiwan × Conventional							12.74	8.35			5.24	6.79
	Japan × Organic							-10.17	9.76			1.76	4.81
	Japan x Conventional							10.17	9.76			-1.76	4.81

China x Organic	22.91	10.89	3.48	7.97
China × Conventional	-22.91	10.89	-3.48	7.97
<b><i>Production methods × CRT</i></b>				
Organic × CRT prod. country			-16.24	9.32
Organic × CRT Taiwan			12.63	8.41
Organic × No CRT			3.61	10.97
Conv. × CRT prod. country			16.24	9.32
Conv. × CRT Taiwan			-12.63	8.41
Conv. × No CRT			-3.61	10.97
<b><i>None</i></b>	-50.40	38.33	-46.51	40.51

Rk.=rank; Avg. Imprt.=average importance; Avg. Util.=average utility; S.D.=standard deviation

Table 3.5 Random effect logit models (continued)

(N=290)	Model 4				Model 7			Model 8		
	(Aggregate sample)				(Male sample)			(Female sample)		
Sample size	290				128			162		
RLH	0.76				0.75			0.78		
Percent certainty	0.80				0.79			0.82		
	Rk.	Avg. Imprt.	Avg. Util.	S.D.	Avg. Imprt.	Avg. Util.	S.D.	Avg. Imprt.	Avg. Util.	S.D.
<b>COO</b>	<b>1</b>	53.99			49.67			55.84		
Taiwan			87.77	32.66		78.50	34.83		91.54	29.73
Japan			35.60	32.72		33.87	35.70		37.75	26.01
China			-123.36	31.09		-112.37	36.86		-129.29	20.89
<b>Price</b>	<b>2</b>	29.84	-37.66	22.94	30.75	-38.62	25.39	29.21	-36.84	21.92
<b>CRT information</b>	<b>3</b>	11.10			14.57			9.66		
CRT approved in production country			13.22	10.32		16.76	12.72		10.41	11.26
CRT approved in Taiwan			12.40	11.43		16.79	15.01		10.48	9.06
No CRT			-25.63	16.79		-33.55	20.32		-20.90	12.43
<b>Production method</b>	<b>4</b>	5.07			5.01			5.30		
Organic			8.78	8.64		7.03	10.37		9.01	10.14
Conventional			-8.78	8.64		-7.03	10.37		-9.01	10.14
<b>None</b>			-50.40	38.33		-61.99	43.50		-46.58	36.68

Rk.=rank; Avg. Imprt.=average importance; Avg. Util.=average utility; S.D.=standard deviation

**Table 3.6** Random effect logit models (continued)

(N=290)		<b>Random effect logit models</b>												
<b>Choice models</b>		<b>Model 9</b> (Higher net income + University degree)			<b>Model 10</b> (Higher net income + No university degree)			<b>Model 11</b> (Lower net income + University degree)			<b>Model 12</b> (Lower net income + No university degree)			
<b>Sample size</b>		67			26			103			62			
<b>RLH</b>		0.77			0.71			0.76			0.81			
<b>Percent certainty</b>		0.81			0.75			0.80			0.85			
		Rk.	Avg. Imprt.	Avg. Util.	S.D.	Avg. Imprt.	Avg. Util.	S.D.	Avg. Imprt.	Avg. Util.	S.D.	Avg. Imprt.	Avg. Util.	S.D.
<b>COO</b>		<b>1</b>	48.81			46.29			55.25			55.36		
	Taiwan			78.47	29.44		85.16	42.61		83.32	24.67		102.32	36.53
	Japan			36.58	24.47		7.17	18.79		47.92	28.59		15.71	29.62
	China			-115.06	29.52		-92.33	38.79		-131.24	28.10		-118.03	20.19
<b>Price</b>		<b>2</b>	32.38			-39.52			25.74			32.87		
<b>CRT information</b>		<b>3</b>	11.16			15.91			10.15			14.46		
	CRT appr. in prod. country			9.51	14.14		32.88	14.40		9.99	9.73		12.48	11.78
	CRT appr. in Taiwan			12.57	15.24		-3.97	14.56		12.32	10.84		19.91	17.25
	No CRT			-22.07	18.64		-28.90	14.88		-22.31	13.94		-32.39	19.95
<b>Production method</b>		<b>4</b>	7.65			4.92			5.00			4.76		
	Organic			14.50	9.98		4.79	11.89		7.92	9.41		6.56	11.07
	Conventional			-14.50	9.98		-4.79	11.89		-7.92	9.41		-6.56	11.07
<b>None</b>				-43.88	18.20		-75.50	77.33		-24.51	29.84		-51.74	32.38

Rk.=rank; Avg. Imprt.=average importance; Avg. Util.=average utility; S.D.=standard deviation

### 3.4 Discussion and Conclusion

The present study is the first to investigate the relevance of different product and process attributes for Taiwanese consumers purchase decision considering interaction effects between attributes and providing results for consumer segments differentiated by socio-economic criteria.

Our findings reveal respondents' high preference for COO labelling which proves to be far more important than the product price. Becker *et al.* (2000), Schnettler *et al.* (2009) as well as Baker and Ballington (2011) arrive at similar results revealing in their studies that COO has a greater importance in consumers' preference formation than price. COO seems to be the core cue for evaluating not just the origin of the food but also its quality and safety.

Compared to COO and price we find that the other two process attributes (CRT information, and organic labelling) investigated in our study provide a comparable little contribution to consumers' utility. The latter result is similar to the findings of Magnusson *et al.* (2001). An explanation might be confusion of consumers in recognizing organic labels and understanding the organic farming concept (Yiridoe *et al.*, 2005; Zakowska-Biemans, 2011; Tung *et al.*, 2012). In consequence, they might be skeptical with respect to organic certified labels. In Taiwan organic production, though it is gaining in relevance, is still a very small niche market (Chen, 2007). Thus, many consumers might not be very familiar with those labels and the respective standard underlining the explanations provided above. CRT information proves to be of slightly greater relevance for consumers despite the fact that it is only occasionally displayed on products in Taiwan. However, though consumers might also not be that familiar with this label it directly refers to food safety and thus is at least easier to understand compared to information on organic versus conventional production.

The results of the study also point to the fact that there exist interdependencies between attribute levels (e.g. COO and production methods; production methods and CRT information) which need consideration to fully understand consumers' preferences.

Finally, we detect heterogeneity between consumer groups in the importance of different product attributes as well as in the relevance of different attribute levels. Compared to men, females attach a

higher value to COO, a result confirming the finding of Hoffmann (2000). As previous studies we show that income (e.g. Tsakiridou *et al.*, 2008; Curl *et al.*, 2013; Pugliese *et al.*, 2013) and education (e.g. Solomon *et al.*, 2006; Denver and Jensen, 2014) affect consumers' preferences with respect to various product and process attributes. More precisely, our result indicate that the higher educated and higher income consumer segment has a stronger preference for organic products compared to lower educated and lower income segments, a result which is in line with the finding of Dimitri and Dettmann (2012). For better educated and more wealthy consumers it is likely not only easier to obtain and understand the information regarding organic farming and organic certification, but they also have the economic means to buy those products and thus more experience with organic products. Nevertheless, even those consumers seem not to fully understand or trust the organic label as they, as all other consumer segments, value CRT information higher than organic production, though with the latter the former should actually not be necessary.

Furthermore, our study shows that consumers with higher education differentiate stronger between foreign origins: COO originating from Japan was considerably more favourably evaluated in these consumer segments than in the one with lower education. Better educated groups seem more capable to differentiate and are likely less ethnocentric compared to lower educated consumers (e.g. Anderson and Cunningham, 1972; Mittal and Tsiros, 1995; Insch and McBride, 2004; Sharma *et al.*, 1995).

Our results also indicate that the higher income consumer segments attach a higher relative importance to price compared to the lower income groups, a result that seems to contradict the findings of previous studies (Ainslie and Rossi, 1998; Boatwright *et al.*, 2004; Hsieh, 2012).

Despite heterogeneity between consumer groups we find for all consumer segments analysed (models 7 to 12) that COO is by far the most important attribute, price takes second place, CRT third and production methods prove to be of lowest relevance.

With regard to recommendations our results suggest that firms that want to signal superior process quality should offer sweet peppers from Taiwan. Consumers with higher education will also appreciate sweet peppers originating from Japan. In addition, CRT information proves to be more important than organic production, though the latter is in fact the much broader concept. Further

research is needed to better understand whether this result can be explained by consumers' lack of knowledge regarding the different labels or a lower level of trust in the organic label compared to CRT.<sup>21</sup> Retailers that intend to promote organic sweet peppers will be most successful in high educated high-income neighbourhoods. Furthermore, the positive effect of organic is stronger for China compared to the other two COO and thus is able to slightly compensate the negative image of COO China. Finally, CRT (organic) certified is especially important for conventional (not CRT certified) products.

The findings of this study should be considered within the following limitations. First, our analysis focuses on one product, sweet pepper. Thus, our results hold for this product, though they might be transferable to other vegetables that are part of Taiwanese people's daily diet. For a better understanding of the relevance of process attributes such as COO and production method on consumers' purchase of e.g. animal products additional investigations are needed. Second, the results obtained in this study are not representative for the Taiwanese population but refers to the more educated and wealthy citizens as we relied on a convenience sample. However, as consumers' consciousness for food safety and healthy diet have started to gain in relevance especially in this segment of the population and likely will spread to larger parts of the population in the future it can serve as an interesting initial insight into the relevance of key process characteristics for Taiwanese consumers purchase decision of fresh sweet pepper.

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<sup>21</sup> The lack of trust might be explained by the fact that also in organic products chemical residues have been found in the past (Wu and Wang, 2005; Wang and Liu, 2011; Lin and Chung, 2013).

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## **Chapter 4:**

### **Does Information on Equivalence of Standards Direct Choice?**

### **Evidence for Organic Labels from Different Countries-of-Origin**

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This paper was published in Food Quality and Preference (2018), Vol. 65, 28-39.

The electronic version of the original publication is available at

<https://www.sciencedirect.com/science/article/abs/pii/S0950329317302951>

## **Does information on equivalence of standards direct choice? Evidence for organic labels from different countries-of-origin**

### **Abstract**

We examine whether an equality of organic standards (EqualOrganic) information treatment impacts Taiwanese consumers' food preference and purchasing behaviour. EqualOrganic implies that regardless of products' country-of-origin (COO), organic certifications are based on the same production regulation and managerial processes. We apply discrete choice experiments combined with a propensity score matching approach that ensures structural sample balance between EqualOrganic-treated and non-treated consumers. The analysis is based on fresh sweet pepper purchase decisions of 800 Taiwanese consumers. Results indicate that participants' product choice was sensitive to EqualOrganic information treatment, though different than expected. Information on the equality of organic standards significantly further increased the purchase likelihood for Taiwan-origin organic products, while the opposite effect is detected for Chinese organic products. In addition, we observe an increase in the utility of the opt-out option in the information treatment group. Provision of information thus failed to assure consumers about the equality of organic standards. Instead there is some indication that it eased accessibility of pre-existing doubts about the reliability and trustworthiness of products originating from China. We discuss these findings from a policy and marketing perspective.

**Keywords:** *choice experiment, information treatment, hierarchical Bayesian mixed logit model, propensity score matching*

### **4.1 Introduction**

During their daily food purchases consumers assess the safety and quality of products based on characteristics that are extrinsically visible and those that cannot be easily observed (Moser *et al.*, 2011; Fernqvist and Ekelund, 2013). Among the latter are experience attributes such as taste as well

as credence attributes such as the origin of the product and the production method. These credence characteristics are usually presented through labels, which have been shown to influence consumers' perceptions and preferences and thus purchase decisions (Janssen and Hamm, 2012; Loureiro and Umberger, 2007). Many Taiwanese retailers for instance have recently started to display chemical residue test information, particularly for fresh agri-products. This development is the response to numerous food safety incidences. High, and in parts improper, use of chemical inputs in Taiwanese intensive agriculture (Lin, 2002; Yang, 2013) has led to illegal levels of chemical residues in food products with considerable danger for the immediate and long term health of consumers (Epstein, 2014)<sup>22</sup>. Those food hazard incidences received high media scrutiny in Taiwan putting public pressure on the food supply chain (Chen, 2007). With the provision of chemical residue test information, retailers aim to improve their reputation and protect their retail brand, thereby increasing credibility and trust for consumers.

Moreover, the Taiwanese government adopted new food quality and safety standards over the last decade to secure a higher level of transparency for consumers and ease consumption decisions according to consumers' preferences. As one outcome, information with regard to country of origin (COO) information<sup>23</sup> has become mandatory for all products sold in Taiwan. In addition, in 2009 a regulatory regime governing the certification of organic foods became obligatory requiring that all agricultural and food products that are labelled as organic and sold on the Taiwanese market have to be certified based on a set of predefined certification standards. This implies that only organic products originating from countries which fulfil Taiwanese organic production regulations can be sold in Taiwan. Thus, for organic products on the Taiwanese market equality of organic standards (EqualOrganic) applies. Given the increasing relevance of organic imported products on the Taiwanese market (Executive Yuan of R.O.C., 2017b) the question arises (1) whether consumers

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<sup>22</sup> For example, Fang *et al.* (2016), as well as Liu *et al.* (2012) report an excess of the maximum residue limits set by the Ministry of Health and Welfare for herbs, spices, peas and beans caused by a misuse of pesticides in Taiwan. Chu (2006) examining 12 leafy vegetables detect 19 types of pesticide residues out of which five were considered potentially carcinogenic.

<sup>23</sup> In 2006 Taiwan passed an act mandating COO labelling on all packaged food which was implemented in 2008. In January 2010, the law for mandatory COO labelling was extended to bulk food products.

consider this equivalency rule in their purchase decision, and (2) what impact the provision of information on equal standard of organic products has on consumers' product choice.

With the exception of the study by Xie *et al.* (2015) previous research within the area of information treatment has not yet investigated the impact of information on the equivalence of label standards for product or process characteristics of different countries on consumers' preferences and purchase decisions. The present study contributes to the literature in that we apply equal standard information treatment for the attribute level organic from different countries for an emerging country and examine its effects together with a further process standard (chemical residual testing) using discrete choice experiments. In addition, to reduce imbalances in the empirical distribution of the pre-treatment confounders between the treated and control groups when estimating the EqualOrganic information treatment effect, we employ a sample matching procedure based on propensity scores (Stuart, 2010). Though propensity score matching is a popular method in the medical science literature (e.g. Austin, 2008; Islam, 2011; Shiferaw *et al.*, 2014; Rojo-Gimeno *et al.*, 2016) it has to the best of our knowledge so far not been used in studies investigating the impact of information treatment on consumers' (food) preferences.

We use fresh unpacked sweet pepper as the object of study, because it is part of Taiwanese daily diet and available in conventional and organic quality from domestic producers as well as from third countries including two of Taiwan's most important trading partners, China and Japan. Moreover, as a non-branded agri-product, fresh unpacked sweet pepper is especially well suited to investigate the impact of labels related to credence attributes on consumers' food choices (Ubilava *et al.*, 2011).

The paper proceeds by first summarizing results of previous studies on consumers' perception for those process attributes of relevance in our empirical analysis as well as on consumers' reaction to information treatment. Section 4.3 provides an overview with respect to the choice experiment model and design as well as the propensity score matching approach applied. Results are presented in section 4.4 and discussed in section 4.5 while we derive main conclusions of our research in section 4.6.

## **4.2 Previous research on consumers' perception of process attributes and the relevance of information in the food market**

### **4.2.1 Consumers' perception of selected process attributes**

Numerous studies have examined the impact of food labels on food purchase decisions providing ample evidence that consumers perceive organic certified products as safer, healthier, better tasting, and more environmental friendly than conventional alternatives (e.g. Paul and Rana, 2012; Zanolini *et al.*, 2012; Van Loo *et al.*, 2013; Schleenbecker and Hamm, 2013). In addition, previous research has investigated region or COO as a determinant for product selection. For example, Lagerkvist *et al.* (2014) show that consumers strongly prefer beef with labels providing information on specific COO compared to beef with labels on EU/non-EU origin. Pouta *et al.* (2010) found that consumers have stronger positive perceptions for domestically produced broiler meat than for foreign alternatives. In accordance, Pozo *et al.* (2009) arrived at the conclusion that consumers prefer locally grown fruits and vegetables over foreign produce. Comparing consumers' Willingness to Pay (WTP) for origin labels (which indicate domestic or local production) with organic labels James *et al.* (2009), Costanigro *et al.* (2011), and De-Magistris and Gracia (2014) reported higher values for the former compared to the latter while Yue and Tong (2009) were unable to detect significant differences in consumers' WTP between labels related to production origins and production methods. With respect to chemical residue test information, Yeh and Hartmann (2016) show that it is perceived as more important than organic labelling, but less relevant than COO labelling.

Although there exist a vast literature analyzing consumer preferences for COO on the one hand and for organic production method on the other hand, research on the impact of COO for organic products is scarce (Thøgersen *et al.*, 2017). More specifically, only few studies have as yet analyzed interaction effects between production method and COO labelling. Gracia *et al.* (2014) focused on the interaction between COO and organic labels and do not provide evidence that the two complement each other or not. Costanigro *et al.* (2014) found that provision of local and organic labels leads to a polarization with respect to conventional products, rather than increasing consumer preferences for local and/or organic alternatives. Onozaka and McFadden (2011) conclude that organic labelling mitigates the

negative valuation consumers attach to imported apples and tomatoes. Xie *et al.* (2015) and Yeh and Hartmann (2016) confirm this result for some origins but not for all. Thus, though organic labels imply that products have been produced under the same organic regulations consumers' perception of organic products from different origins can substantially deviate. This might be due to a lack of knowledge of the equivalence of organic standards from different COOs. Thus, respective information might be able to reduce existing biases which will be tested in the empirical part of the paper.

#### **4.2.2 Impact of information on food attributes**

There is already an extensive food related literature investigating the impact of information treatment on consumers' perception of product characteristics (e.g. Fox *et al.*, 2002; Scholderer and Frewer, 2003; Lusk *et al.*, 2004; Annett *et al.*, 2008; Chowdhury *et al.*, 2011; Colson *et al.*, 2011; Hellyer *et al.*, 2012; Vecchio *et al.*, 2016). Many of those studies investigate how information provision impacts the acceptance of new technologies such as irradiation or genetic modification.

Fox *et al.* (2002) showed based on the example of irradiated pork that consumers' demand is more sensitive to unfavourable compared to favourable product information. Annett *et al.* (2008) found that health-related information only combined with sensory evaluation increases hedonic liking ratings of organic food while no effect was detected with respect to environmental information. Chowdhury *et al.* (2011) assessed whether information on the nutritional value of a biofortified staple product influences consumers' WTP. Participants had tasted all products prior to the provision of the information and the choice experiment. According to their results, nutrition information increases consumers' WTP for the biofortified variety. Vecchio *et al.* (2016) investigated consumers' WTP for yogurts in two different information treatment settings and found that additional information through a health claim increases consumers' perceived value of functional yogurt compared to its organic counterpart. Hellyer *et al.* (2012) analysed the impact of health and nutrition information on food choice in an experimental auction setting and revealed a positive reaction to information on consumers' WTP. Colson *et al.* (2011) applied as well an auction mechanism examining consumers'

preference for nutritionally enhanced foods using information treatment. They found that consumers are willing to pay a premium for genetically modified (GM) products for which nutritional information treatment is provided. Also, the study of Lusk *et al.* (2004) focused on GM food using experimental auctions. The authors showed that information on environmental-, health-, and welfare benefits of GM food significantly influences the bid level for GM cookies though not in all countries in the expected direction. The latter effect, the so called communication paradox, was previously identified by Frewer (2003) who demonstrated that information on the benefits of GM food decreased consumers' preferences for those products. Xie *et al.* (2015) is the only study investigating the impact of equality of standard information treatment on US consumers' preferences for organic products from different COO. The authors conclude that the effect of the information treatment on consumers' willingness to pay for imported organic products is heterogeneous with overall relatively small effects.

## 4.3 Method

### 4.3.1 Discrete choice model

In this study, a choice modelling approach was used to uncover consumers' food preferences for product and process attributes with and without information. Discrete choice experiments have been effectively used in marketing and consumer research (e.g. Chen *et al.*, 2013; Janssen and Hamm, 2012; De-Magistris and Gracia, 2014). The analysis in choice experiments is based on random utility theory (RUT) (Thurstone, 1927; McFadden, 1973) and Lancaster's consumer theory (Lancaster, 1966). It is assumed that the expected total utility a consumer derives from a good is the sum of the (part-worths) utilities of each attribute that characterizes the good as well as a random error term. Thus, the utility  $U$  provided to individual  $n$  ( $n = 1, \dots, N$ ) from choosing alternative  $j$  ( $j = 1, \dots, J$ ) with attribute levels  $k$  ( $k = 1, \dots, K$ ) of choice task  $s$  ( $s = 1, \dots, S$ ) is the sum of a systematic observed component ( $\beta_{nk} \mathbf{X}'_{nkjs}$ ) and a random error term ( $\varepsilon_{nkjs}$ ):

$$U_{njs} = \beta_{nk} \mathbf{x}'_{nkjs} + \varepsilon_{nkjs} \quad (1)$$

$\beta_{nk}$  is a vector of individual-specific parameters, which represent the partworth utility values for individual  $n$  related to the main effects of the alternative's attribute levels reflected by vector  $\mathbf{x}'_{nkjs}$ . The error term of (1) is assumed to be attribute-specific, independent and identically distributed (*i.i.d.*) (Train, 2009). Traditionally, choice data are analysed using a multinomial model or the mixed logit model with classical maximum likelihood estimation. Train (2009) shows that the mixed logit model has specific advantages over the multinomial model in terms of flexibility. Compared to the multinomial model, the mixed logit model relaxes both the assumption that the unobserved stochastic portion in the multinomial model is distributed according to a Type I extreme value distribution as well as the assumption of the independence of irrelevant alternatives (Luce, 1959). The core property of the mixed logit model is that instead of assuming fixed partworth parameters, it allows a greater variability of preferences for choice specific attributes based on the distribution function over individuals in the sample (Train, 2009). Thus, the mixed logit model takes into account the heterogeneity in consumer preferences and allows for variation in the attribute values across the sample of consumers (Train, 2009). However, even the mixed logit model with classical maximum likelihood estimation can lead to unreliable estimates when the heterogeneity of the investigated population increases. Therefore, to increase estimation accuracy we apply the hierarchical Bayesian estimation of the mixed logit model (Akinc and Vandebroek, 2017).

The multinomial model is the first step of the hierarchical Bayesian estimation of the mixed logit model that we apply to analyse the choice experiment data. In the second step based on an iterative process the hierarchical Bayesian approach considers the joint distribution of the individual-level parameters (Allenby and Rossi, 1998; Rossi *et al.*, 2005; Train, 2009; Hole, 2013)<sup>24</sup>.

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<sup>24</sup> The joint distribution of the individual-level parameters is based on an iterative process where all parameters are randomly selected around a multivariate normal distribution.

### 4.3.2 Discrete choice experimental design and instruments

We apply discrete choice experiments to fresh unpacked sweet pepper as our study object. The following attributes and attribute levels of sweet pepper were derived from focus group discussions<sup>25</sup> and identified as most important (cf. Table 4.1): (i) *Country-of-origin* (COO) with the attribute levels, Taiwan, China and Japan, (ii) *Production method* differentiating between the two levels organic and conventional, (iii) *Chemical residue testing* which comprises three levels: respective testing approved in the production country, approved in Taiwan, and no chemical residue test information and (iv) *Price* with the levels 65 NT<sup>26</sup>, 85 NT, 105 NT, and 125 NT.<sup>27</sup>

**Table 4.1** Attributes and levels used in the discrete choice experiment.

Attribute	Definition	Levels
COO	Country where the pepper was produced	Taiwan Japan China
Production method	The practice of cultivating the soil and producing agri-products	Organic Conventional
Chemical residue testing information	Information of results on chemical residue testing	Chemical residue test approved in the production country Chemical residue test approved in Taiwan No chemical residue test
Price	Price of the pepper per Taiwanese catty	NT 65 NT 85 NT 105 NT 125

<sup>25</sup> The focus group discussion was held via video meetings with Taiwanese food market experts in March, 2014.

<sup>26</sup> New Taiwanese (NT) dollars. In July 2014, 1 US Dollar = 29.98 NT.

<sup>27</sup> At the time of the survey the price range for sweet pepper on Taiwan's market was between 65 to 125 NT per Taiwanese catty (approx.. 600 g).

Figure 4.1 provides examples on how COO, chemical residue test information and organic labelling is displayed to consumers in Taiwanese supermarkets.

An efficient unlabelled choice design was identified using Ngene version 1.1 (ChoiceMetrics, 2012) based on parameter estimates obtained from a pilot study<sup>28</sup>. Our final efficient choice design has a D-error value of 0.237<sup>29</sup> which is lower than the D-errors of other design alternatives such as the sequential orthogonal design (0.420) and the least efficient simultaneous orthogonal design (2.018)<sup>30</sup> (ChoiceMetrics, 2012). In addition, the efficient design ensures a sufficiently high occurrence of two-way combinations of attribute levels (see Appendix 4.1). Therefore, it also confirms the capability of analyzing the interaction effects in the model. The final design consists of 36 choice sets allocated in 6 blocks, with each block consisting of 6 choice situations.<sup>31</sup>

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<sup>28</sup> In April 2014, we collected piloting data from a convenience sample using an internet-based choice experiment questionnaire in Taiwan. The results were used as the prior information to construct the main experimental design as follows: 1) As prior information the pilot study's parameter estimates were used to derive the asymptotic variance-covariance matrix and subsequently the D-efficient design, 2) Based on an iterative process, the most efficient design with the smallest D-error was derived. Moreover, the pre-testing of our choice experiment questionnaire revealed the feasibility of the experiment, and provided an overview of the initial discrete choice experiment results.

<sup>29</sup> The D-error is the most common criterion for evaluating the efficiency of experimental choice designs (Zwerina *et al.*, 1996).

<sup>30</sup> The orthogonality of the sequential orthogonal design only holds within each alternative; in a simultaneous design orthogonality holds across alternatives.

<sup>31</sup> The questionnaire with all choice sets is available upon request.

Example of the COO and organic labels

Example of the chemical residue testing information provided on the shelf



Note: SGS is the chemical residue testing certification organization (<http://www.sgs.com/en/testing>)

**Figure 4.1** Exemplary illustration of COO, organic and chemical residue testing information labelling


The discrete choice experiment questionnaire was formulated in Mandarin and comprised of three sections. In the first section, respondents were screened based on two filtering questions. According to these questions, only participants who are partly or mainly responsible for their household's food shopping and who consume sweet peppers on a regular basis were asked to respond to the remaining part of the survey. In the second section information regarding participants' preferences were requested based on the choice experiment. Our main interest was in assessing the impact of information on the EqualOrganic standard, that is information on the obligation that all agricultural and food products that are labelled as organic and sold on the Taiwanese market have to fulfil Taiwanese organic production regulations. Accordingly, the following information was displayed to our treatment group in written form prior to the choice experiment:

*“No matter where an organic product sold in Taiwan has been produced, the same regulation and managerial processes apply. A product that is labelled organic and sold in Taiwan has to fulfil the Taiwanese organic production regulations and it is ensured that there are no exceptions.”<sup>32</sup>*

<sup>32</sup> The English translation of the treatment is the one closest to what is originally presented to the Taiwanese consumers in Mandarin.

Subsequently, the choice experiment started with a standardized introduction of the choice task, including a brief overview of the grocery shopping situation and a reminder to take into account the household's real budget when making the purchase decision. This introduction was identical for the treatment and control group. In order to make the choice experiment as understandable and realistic as possible, the attribute levels were visualized using pictures and text as presented in figure 4.2 (translated version). Respondents were sequentially given six choice tasks. Each choice task consisted of three sweet pepper alternatives with varying combinations of products' attribute levels. Participants were requested to make a purchase decision by indicating which of the three alternatives they prefer. We also offered as fourth alternative an "opt-out" option, which ensures that participants are not forced to choose a product they would normally not select. In the third section of the questionnaire, participants were asked to provide information with respect to their purchase behaviour, e.g. their shopping frequency, and regarding socio-demographic characteristics such as gender, age and income.

The following fresh sweet peppers are available. Which one would you buy?

Product number	1	2	3	4
				
				I will not buy any of them
Which product do you want to buy?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Figure 4.2** A choice task example (English translation)

In July 2014, a group of trained interviewers randomly encountered consumers who stepped out of supermarkets<sup>33</sup> in the three largest Taiwanese cities (Kaohsiung city, Taichung city, New Taipei

<sup>33</sup> The two hyper-supermarkets Carrefour (<http://www.carrefour.com.tw/>) and Taisuco (<http://www.tsctaisuco.com.tw/>) were selected based on the convenience of the location, the customer flow and the amount of their fresh agri-food product categories.

city)<sup>34</sup>. To reduce possible self-selection bias we trained our interviewers to actively encounter randomly every second person leaving the checkout counter of the supermarkets. This was done to ensure that e.g. not only young or female consumers were approached. The average length of the interview was 15 minutes.<sup>35</sup>

The choice experiment survey was implemented as a computer assisted web interview. Instead of implementing a traditional web survey with the known disadvantages such as coverage error<sup>36</sup> (Batinic *et al.*, 2002) and non-response error (Bethlehem and Biffignandi, 2012) we used this mixed approach by combining computer assisted personal interviews with traditional web survey techniques. On a rotating basis the control-group questionnaire and the EqualOrganic-treated group questionnaire were shown to the participants. Most people did the survey at the spot in the supermarket with the provided internet-connected electronic devices. In addition, we provided survey invitation cards with a quick response (QR) code<sup>37</sup> for those shoppers who wanted to do the web survey on their own smartphone device. The vast majority of those people did so on-site under the guidance of the interviewers. There was only a negligible group who took the QR code card to possibly do the survey at home<sup>38</sup>.

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<sup>34</sup> New Taipei city is located in the north, and the largest city in Taiwan. Taichung city is located in the central area and the third most populated area in Taiwan. Kaohsiung city is the largest city in the south, and the second largest city in Taiwan.

<sup>35</sup> Most of the composite-style (hyper) supermarkets in Taiwan have their own parking zone/parking floor within the building and there is an area between the parking zone and the supermarket where many in-door food stands or restaurants are located (with air-conditioner provided). Our interviewers encountered participants at the exit of the supermarket while they were on their way to the dining place or the parking lot in the building. Therefore, it was ensured that interviewed participants were still close to the shopping spot within the building and were not directly exposed to the sun during the interview.

<sup>36</sup> Coverage error occurs when targeted participants cannot be accessed by web surveys mode, e.g. persons who have no computer devices or internet accessibility.

<sup>37</sup> QR code is one of the most common two-dimensional barcodes in use nowadays (Gottesman and Baum, 2013; Lin *et al.*, 2012). QR codes can be scanned for access to websites, information and applications.

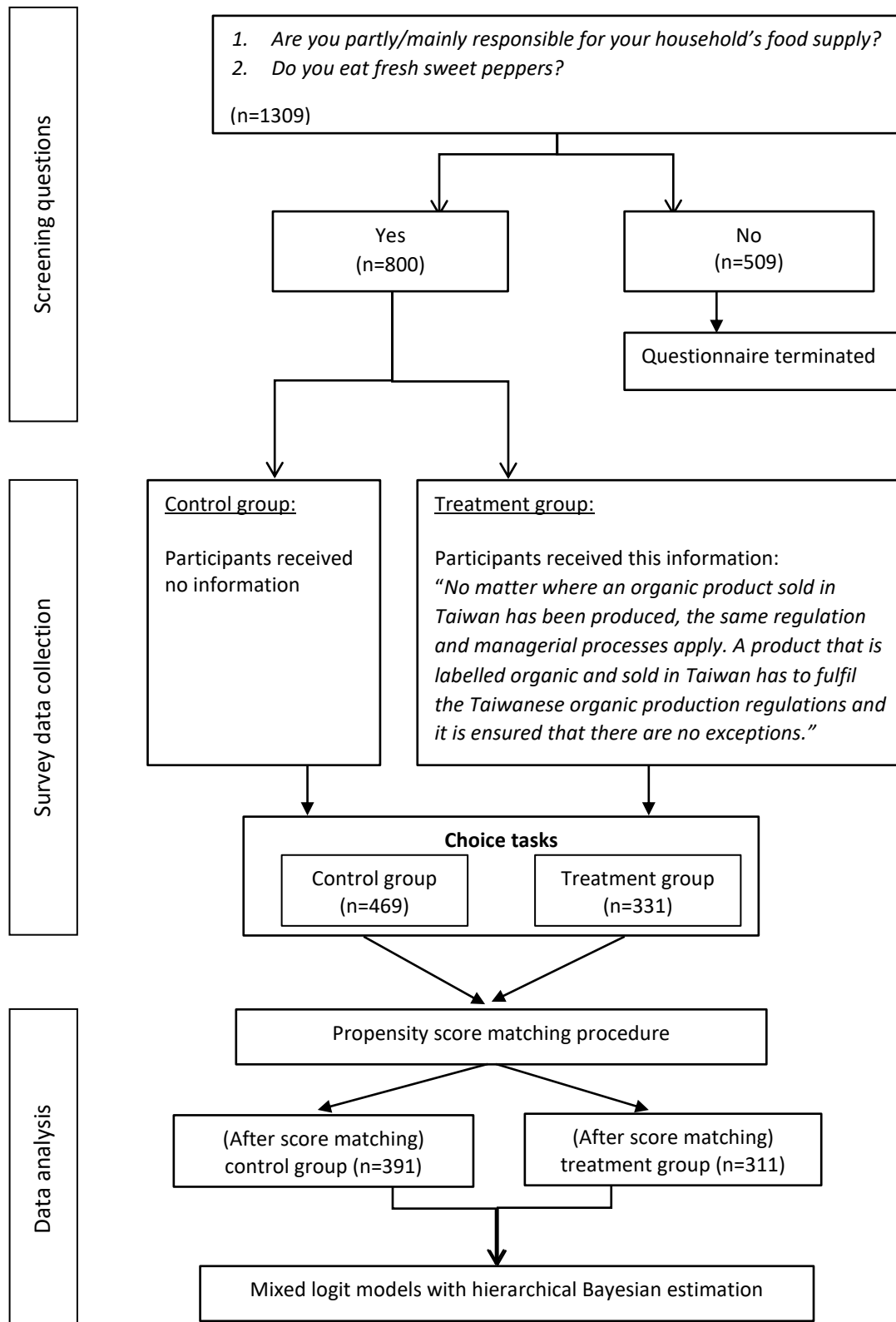
<sup>38</sup> We do not assume that those answering the survey on their own device later at home answer in a different way than those filling out the survey in front of the supermarket. Nevertheless, we cannot rule this out. Unfortunately, it is not possible to identify those who did the survey later at home. However, as indicated above this group is very small. Thus, we are confident that it has no impact on the overall results.

### 4.3.3 Examining the sample structure via propensity score matching

To secure balanced sample structures propensity score matching was applied to match surveyed participants from the EqualOrganic treated group and the control group based on a set of observed baseline characteristics (Rosenbaum and Rubin, 1983; Heckman *et al.*, 1998; Rubin, 1997; Ali and Abdulai, 2010; Oliveira *et al.*, 2017; Urama *et al.*, 2017) using the STATA package *pscore* (Becker and Ichino, 2002). Propensity score matching is based on a logistic regression where the binary dependent variable takes the value of 1 for participants that have received the EqualOrganic information treatment and zero otherwise. We included 13 independent variables that potentially have an impact on the choice experiment outcome as well as on the information treatment (Heckman *et al.*, 1997; Smith and Todd, 2005): gender, age range, living location (i.e. in the north / middle / south of Taiwan), living area (i.e. in a big city/ mid-sized city/ rural area), education, marital status, career, household size, number of children, monthly household net income, monthly household food expenses, the average share of imported food in total household and the choice experiment blocking version<sup>39</sup>. The predicted values of this regression serve as the propensity scores which reflect the probability that a participant is grouped into the EqualOrganic treated group based on her/his characteristics. Subsequently, a radius-matching process based on a 0.01 calliper range of propensity scores is applied to pair each participant of the EqualOrganic treated group with one or more participants of the non-treated group. Unmatched participants are excluded from further analysis (Dehejia and Wahba, 2002). An illustration of the survey development and research flow is provided in figure 4.3.

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<sup>39</sup>We account for incomplete survey responses by imputing missing values of the 13 covariates using the procedure of multiple imputation (MI) (Rubin, 1987; Allison, 2001).



**Figure 4.3** Survey development and research flow

## 4.4 Results

1309 people took part in the survey. Excluding those respondents not responsible for their household's food shopping and/or not consuming sweet pepper resulted in 800 (61.1% of all participants) valid responses of which 469 belong to the control group and 331 to the EqualOrganic information treated group. In the following we first describe the results for the propensity score matching (section 4.4.1). Subsequently, the findings for the discrete choice model are presented for the EqualOrganic-treated- and control group, both before and after data matching (section 4.4.2).

### 4.4.1 Analyzing differences between the control and EqualOrganic treated group using propensity score matching

78 participants of the control group and 20 participants of the treated group were excluded from the further analysis as they were not paired in the matching process. This resulted in 702 observations of which 391 belong to the control group and 311 to the EqualOrganic-treated group. The goodness of the matching process can be assessed by the balancing property which in the present case is fulfilled at  $p < 0.01$ .<sup>40</sup> This implies that after the matching process participants in both groups are similar with respect to the 13 included covariates even within quantiles of the propensity score distribution (Cavatassi *et al.*, 2011).

Table 4.2 presents an overview of the demographic characteristics of the control and EqualOrganic-treated group before and after data matching and reveals that the differences between the groups in terms of most demographical characteristics have been reduced significantly. As expected in both the matched control- and EqualOrganic treated group more than 70% of the participants are females indicating that in Taiwan the majority of grocery shopping is done by women. In addition, within the two groups, most of the participants are young (less than 49: control group 81.8%; treated group 84.2%), highly educated (university degree or higher: control group 54.9%; treated group 53.0%) and generate relatively high household incomes (monthly net household income is above NT 60,000:

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<sup>40</sup> Results of the logistic regression underlying the propensity score matching process are available upon request.

control group 55.0%; treated group 49.8%). Although the samples are not representative for Taiwan's population in general they provide an adequate reflection of food shoppers in Taiwanese cities, where younger and higher educated consumers make up the majority of the population (Executive Yuan of R.O.C., 2017a).

#### **4.4.2 Hierarchical Bayesian mixed logit model results**

The hierarchical Bayesian mixed logit model results allow to uncover participants' preference heterogeneity at the individual level and to assess the impact of EqualOrganic information treatment by comparing respondents' utilities between the control and EqualOrganic-treated group.

Table 4.3 presents average importance scores for the four included attributes separately for the control- and treated group before- and after data matching. The findings for the matched samples reveal that COO labelling is the most important attribute as 53.00% and 54.88% of the utility derived from the purchase decisions is related to this attribute in the control and EqualOrganic treated group, respectively. This is followed by the price (control group 22.02%; treated group 21.11%), chemical residue test information (control group 14.28%; treated group 17.77%) and the labelling of production methods (control group 10.71%; treated group 6.24%).

**Table 4.2** Demographical statistics of the control and the EqualOrganic-treated group before and after propensity score matching

	Before score matching			After score matching		
	Control group	EqualOrganic-treated group	Group differences	Control group	EqualOrganic-treated group	Group differences
<i>n</i>	469	331		391	311	
<b>Variables</b>	(%)	(%)	(%-points)	(%)	(%)	(%-points)
<b><i>Gender</i></b>						
Male	30.5	25.4	-5.1	28.7	26.0	-2.7
Female	69.5	74.6	+5.1	71.3	74.0	+2.7
<b><i>Age</i></b>						
Up to 29	17.1	19.3	+2.2	16.5	18.0	+1.5
30 - 49	64.1	64.7	+0.6	65.3	66.2	+0.9
50 and over	18.8	16.0	-2.8	18.2	15.8	-2.4
<b><i>Living location</i></b>						
North	24.9	23.9	-1.0	28.7	25.0	-3.7
Middle	23.5	64.4	+40.9	28.3	62.4	+34.1
South	49.0	10.8	-38.2	41.5	11.6	-29.9
Other (e.g. East or Islands)	2.6	0.9	-1.7	1.5	1.0	-0.5
<b><i>Living Area</i></b>						
Big city	55.0	35.6	-19.4	52.1	37.3	-14.8
Mid-sized city	26.0	30.8	+4.8	27.2	29.9	+2.7
Rural area or countryside	19.0	33.6	+14.6	20.7	32.8	+12.1
<b><i>Marital status</i></b>						
Single	33.0	36.2	+3.2	31.3	35.0	+3.7

Married	64.0	56.5	-7.5	65.4	58.2	-7.2
Other (e.g. divorced/ widowed)	3.0	7.3	+4.3	3.3	6.8	+3.5
<b>Education</b>						
Up to senior high school (12 years)	23.2	21.5	-1.7	22.3	22.2	-0.1
College	22.8	25.6	+2.8	22.8	24.8	+2.0
University and over	54.0	52.9	-1.1	54.9	53.0	-1.9
<b>Career</b>						
Employed with the government	11.5	16.9	+5.4	13.1	16.4	+3.3
Employed in private company	40.7	36.0	-4.7	40.5	35.7	-4.8
Self employed	15.6	22.4	+6.8	15.2	21.7	+6.5
Student	10.0	6.3	-3.7	7.9	6.8	-1.1
Houseworker	12.8	10.6	-2.2	14.1	11.3	-2.8
Retired	4.9	3.6	-1.3	4.6	3.9	-0.7
Unemployed	4.5	4.2	-0.3	4.6	4.2	-0.4
<b>Monthly net household income</b>						
Up to NT 60,000	43.3	50.1	+6.8	45.0	50.2	+5.2
NT 60,001 – 120,000	40.3	35.1	-5.2	39.7	35.9	-3.8
NT 120,001 and over	16.4	14.8	-1.6	15.3	13.9	-1.4

**Table 4.3** Differences of average percentage importance scores across discrete choice experiment hierarchical Bayesian mixed logit models

	Before score matching			After score matching		
	Control group	EqualOrganic-Treated group		Control group	EqualOrganic-Treated group	
<i>n</i>	469	331		391	311	
Attributes	Avg. Imprt. (S.D.)	Avg. Imprt. (S.D.)	Changes of Avg. Imprt.	Avg. Imprt. (S.D.)	Avg. Imprt. (S.D.)	Changes of Avg. Imprt.
<b>COO</b>	53.34 (15.20)	54.03 (13.32)	+0.69	53.00 (15.52)	54.88 (13.76)	+1.88
<b>Price</b>	21.90 (14.76)	22.75 (12.26)	+0.85	22.02 (15.49)	21.11 (12.75)	-0.91
<b>Chemical residue testing information</b>	14.27 (7.20)	16.13 (8.58)	<b>+1.86***</b>	14.28 (6.48)	17.77 (8.40)	<b>+3.49***</b>
<b>Production method</b>	10.48 (7.62)	7.09 (6.24)	<b>-3.40***</b>	10.71 (8.34)	6.24 (5.91)	<b>-4.47***</b>

Avg. Imprt. = Average importance

Standard deviations (S.D.) in parenthesis.

\*p &lt; 0.05; \*\*p &lt; 0.01; \*\*\*p &lt; 0.001

**Table 4.4** Before- and after matching discrete choice mixed logit models with hierarchical Bayesian estimation

	Before score matching					After score matching				
	Control group		EqualOrganic-Treated group			Control group		EqualOrganic-Treated group		
n	469		331			391		311		
Null-model log-likelihood	-3901.03		-2753.18			-3252.25		-2586.83		
Final-model log-likelihood	-905.04		-710.32			-800.05		-615.67		
McFadden's pseudo R <sup>2</sup>	0.76		0.74			0.75		0.76		
Avg. RLH	0.73		0.70			0.71		0.72		
BIC	1844.81		1453.40			1633.80		1263.75		
AIC	1836.08		1446.64			1626.10		1257.34		
CAIC	1857.81		1466.40			1646.80		1276.75		
	Avg. Util. <sup>a</sup> (S.D.)	t-ratio	Avg. Util. (S.D.)	t-ratio	Change of Avg. Util.	Avg. Util. (S.D.)	t-ratio	Avg. Util. (S.D.)	t-ratio	Change of Avg. Util.
<b>COO</b>										
Taiwan	71.80 (39.43)	37.92 ***	76.34 (30.99)	40.42 ***	+4.54	72.88 (36.97)	37.30 ***	75.87 (30.50)	38.45 ***	+2.99
Japan	52.20 (34.18)	31.93 ***	50.56 (35.61)	25.71 ***	-1.64	52.16 (30.76)	31.70 ***	53.57 (36.56)	25.85 ***	+1.41
China	-124.00 (39.00)	-59.86 ***	-126.90 (35.98)	-54.17 ***	-2.90	-125.04 (40.30)	-52.79 ***	-129.44 (36.62)	-54.31 ***	-4.40
<b>Production Method</b>										
Organic	18.52 (18.14)	22.85 ***	12.13 (14.48)	16.86 ***	<b>-6.39***</b>	18.74 (19.64)	19.72 ***	9.75 (14.18)	12.59 ***	<b>-8.99***</b>

Conventional	-18.52 (18.14)	-22.85 ***	-12.13 (14.48)	-16.86 ***	<b>+6.39***</b>	-18.74 (19.64)	-19.72 ***	-9.75 (14.18)	-12.59 ***	<b>+8.99***</b>
<i>Chemical residue testing information</i>										
Chemical residue testing appr. in prod. country	1.77 (9.40)	4.96 ***	-0.54 (9.19)	-1.10	<b>-2.31***</b>	-0.24 (10.77)	-0.50	-3.84 (10.94)	-6.33 ***	<b>-3.60***</b>
Chemical residue testing appr. in Taiwan	27.08 (15.48)	42.73 ***	30.90 (17.82)	33.81 ***	<b>+3.81***</b>	27.92 (13.65)	45.08 ***	34.19 (19.04)	30.28 ***	<b>+6.27***</b>
No Chemical residue testing	-28.85 (16.14)	-41.63 ***	-30.36 (22.04)	-26.95 ***	-1.51	-27.68 (15.79)	-37.24 ***	-30.35 (24.85)	-21.83 ***	-2.67
<i>Price</i>	-28.42 (20.80)	-30.91 ***	-30.19 (16.61)	-34.91 ***	-1.77	-28.54 (21.78)	-27.29 ***	-27.99 (17.25)	-32.15 ***	+0.55
<i>COO x Production Method</i>										
TW x Organic	-2.25 (8.06)	-7.24 ***	1.66 (8.41)	3.65 ***	<b>+3.91***</b>	-3.11 (8.41)	-7.94 ***	4.42 (8.70)	9.06 ***	<b>+7.52***</b>
TW x Conventional	2.25 (8.06)	7.24 ***	-1.66 (8.41)	-3.65 ***	<b>-3.91***</b>	3.11 (8.41)	7.94 ***	-4.42 (8.70)	-9.06 ***	<b>-7.52***</b>
JP x Organic	4.06 (5.83)	16.45 ***	6.50 (10.98)	13.69 ***	<b>+2.43***</b>	3.66 (5.66)	13.83 ***	6.73 (13.82)	11.01 ***	<b>+3.07***</b>
JP x Conventional	-4.06 (5.83)	-16.45 ***	-6.50 (10.98)	-13.69 ***	<b>-2.43***</b>	-3.66 (5.66)	-13.83 ***	-6.73 (13.82)	-11.01 ***	<b>-3.07***</b>
CN x Organic	-1.81 (8.15)	-5.58 ***	-8.16 (15.33)	-11.83 ***	<b>-6.35***</b>	-0.56 (7.64)	-2.15 *	-11.15 (17.74)	-13.23 ***	<b>-10.59***</b>
CN x Conventional	1.81 (8.15)	5.58 ***	8.16 (15.33)	11.83 ***	<b>+6.35***</b>	0.56 (7.64)	2.15 *	11.15 (17.74)	13.23 ***	<b>+10.59***</b>

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**COO x Chemical residue testing**

TW x Chem. resid. test appr. in prod. country	5.05 (9.14)	13.17 ***	6.74 (16.75)	8.48 ***	+1.69	10.34 (9.11)	23.30 ***	10.31 (15.28)	14.42 ***	-0.02
TWx Chem. resid. test appr. in TW	-28.39 (8.80)	-81.80 ***	-22.93 (10.08)	-44.25 ***	<b>+5.46***</b>	-30.04 (6.75)	-106.42 ***	-31.51 (11.95)	-49.70 ***	-1.47
TW x No Chem. resid. test	23.35 (14.27)	39.01 ***	16.19 (17.95)	17.41 ***	<b>-7.15***</b>	19.70 (10.71)	41.64 ***	21.20 (16.80)	24.69 ***	<b>+1.49***</b>
JP x Chem. resid. test appr. in prod. country	13.41 (8.53)	36.13 ***	23.97 (14.19)	32.14 ***	<b>+10.56***</b>	17.36 (7.35)	46.34 ***	23.02 (16.37)	27.59 ***	<b>+5.66***</b>
JP x Chem. resid. test appr. in TW	-12.81 (10.08)	-28.70 ***	-27.44 (14.13)	-35.62 ***	<b>-14.63***</b>	-12.67 (7.83)	-32.98 ***	-29.61 (13.23)	-38.09 ***	<b>-16.94***</b>
JP x No Chem. resid. test	-0.60 (7.68)	-3.04 **	3.47 (10.45)	8.19 ***	<b>+4.07***</b>	-4.68 (6.50)	-14.72 ***	6.59 (14.82)	9.59 ***	<b>+11.28***</b>
CN x Chem. resid. test appr. in prod. country	-18.46 (11.04)	-37.43 ***	-30.71 (15.20)	-39.91 ***	<b>-12.25***</b>	-27.69 (10.77)	-49.21 ***	-33.33 (20.47)	-32.25 ***	<b>-5.64***</b>
CN x Chem. resid. test appr. in TW	41.20 (15.53)	66.94 ***	50.37 (13.72)	58.32 ***	<b>+9.17***</b>	42.72 (7.89)	120.98 ***	61.12 (17.08)	59.36 ***	<b>+18.40***</b>
CN x No Chem. resid. test	-22.75 (16.75)	-32.22 ***	-19.66 (13.08)	-29.39 ***	<b>+3.08**</b>	-15.02 (11.36)	-28.81 ***	-27.79 (9.55)	-73.76 ***	<b>-12.77***</b>
<b>Constant</b>	-69.19 (51.10)	-30.94 ***	-54.08 (53.93)	-22.11 ***	<b>+15.11***</b>	-73.13 (55.23)	-28.21 ***	-47.87 (53.87)	-17.31 ***	<b>+25.26***</b>

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<sup>a</sup> Average utilities (Avg. Util.) are zero-centered. Standard deviations (S.D.) in parenthesis.

\*p < 0.05; \*\*p < 0.01; \*\*\*p < 0.001

Moreover, table 4.3 reveals that EqualOrganic information treatment has induced a shift in the average percentage importance scores from the attribute production method to the one on chemical residue test information. While the average importance of the former significantly decreased by 4.47 percentage points, the latter significantly increased by 3.49 percentage points. In addition, the results in table 4.3 demonstrate that the findings before data matching underestimate the impact of EqualOrganic information treatment regarding the shift in importance between the attributes production method and chemical residue testing.

To provide a more detailed picture of the impact of EqualOrganic information treatment, table 4.4 illustrates hierarchical Bayesian mixed logit model results<sup>41</sup> of the estimated average utilities related to all main effects as well as selected interaction effects for the pre- and post-matched samples. Positive average utility values imply that the attribute level is increasing in preference relative to the other attribute levels while the opposite holds for negative average utility values.<sup>42</sup> The constant term in the bottom row represents the average utility of the opt-out option calculated as the mean value of individual specific constants. In the following, we first focus on the results for the matched samples (see right panel of table 4.4). The findings regarding the main effects of the COO attribute reveal that participants positively value products from Taiwan and Japan with Taiwanese products providing the highest average relative utility. Products originating from China are associated with a negative relative average utility. EqualOrganic information treatment does not lead to significant shifts in the average utility values of the COO attribute. With respect to production methods the results indicate that participants are willing to pay a price premium for organically produced sweet peppers compared to conventional alternatives. However, the EqualOrganic information treatment leads to a significant decrease in the average relative utility of the former while the opposite holds for the latter. As regards the chemical residue test attribute, the one approved in Taiwan is utility increasing compared to the other attribute levels. In contrast, chemical residue testing approved in the production country is

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<sup>41</sup> The choice data was effect-coded and therefore displays parameter estimates for each single level per attribute.

<sup>42</sup> To ensure direct comparability of the utilities of the levels within an attribute without having to use a constant as reference, the average partworths reported in table 4.4 are zero-centered.

associated with a small negative relative average utility while no testing leads to a high negative relative average utility. EqualOrganic information treatment significantly increases the relative preference of participants for information on chemical residue testing approved in Taiwan. As expected, the average utility for prices is negative in the control and intervention groups implying that higher prices lead to a lower perceived utility. Moreover, the EqualOrganic information treatment does not induce a significant change in the average utility of the price.

The results in table 4.4 so far indicate that EqualOrganic information treatment has induced a significant shift in relative utility in favor of conventional compared to organic as well as in favor of chemical residue testing approved in Taiwan compared to respective testing approved in the production country. Considering the interaction effects between attributes and their respective levels allows to gain a more complete picture.

As the EqualOrganic information refers to the production method and COO and given that we observe significant changes in relative utility for the main effects of production method and chemical residue test information, we focus on the following interaction effects:  $COO \times Production\ methods$  and  $COO \times Chemical\ residue\ testing$ . The results show that EqualOrganic information treatment leads to a significant increase in average utilities related to Taiwanese organic (+7.52) as well as Japanese organic (+3.07) products relative to their conventional equivalents. The opposite holds for organic sweet peppers from China. Here we observe a significant shift in average utilities from organic (-10.59) to conventional products (+10.59). Thus, for organic products from China the negative shift in utility observed for the main effect 'organic' is reinforced. A similar finding can be detected regarding chemical residue test information as the observed shift from respective testing in the production country to the one in Taiwan (main effect) is only confirmed for products with Chinese origin while the opposite holds for Japanese products. Moreover, it can be observed that EqualOrganic information treatment has no impact on the perception of chemical residue test information for products with Taiwanese origin.

Finally, we find that the EqualOrganic information treatment significantly increases the average utility of the opt-out option (change in the constant of +25.26) which implies that consumers in our sample prefer to buy none of the sweet pepper alternatives.

Comparison of the pre- and post-matching results reveals in some cases considerable differences in the magnitude of the changes in average relative utilities caused by the EqualOrganic treatment. Moreover, in some cases, significant effects (Interaction COO and chemical residue test) detected before matching proved not to be significant after matching.

Table 4.4 also presents the major criteria to determine the model fit of mixed logit models: the null- and restricted log-likelihood, McFadden's pseudo  $R^2$ , the root likelihood (RLH)<sup>43</sup> (Sawtooth Software, 2009), Akaike Information Criterion (AIC) (Akaike, 1974), Consistent Akaike information criterion (CAIC) (Bozdogan, 1987), Bayesian Information Criterion (BIC) (Schwarz, 1978).<sup>44</sup> Our model shows a pseudo  $R^2$  of 0.75 for the control group and of 0.76 for the treated group as well as RLH values of 0.71 and 0.72 which, according to Hensher *et al.* (2005) and Louviere *et al.* (2000), represent a good model fit.

## 4.5 Discussion

Based on a sample of Taiwanese consumers living in urban areas this study investigated the impact of an equality of organic standard information treatment on preferences for sweet peppers using a discrete choice experiment framework. We focused, besides the attributes COO and production methods, on chemical residue testing and price given their relevance for Taiwanese consumers in their purchase of sweet peppers. The results reveal that COO is the most important attribute for participants in their purchase of sweet peppers, followed by price, chemical residue testing, and production

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<sup>43</sup> RLH is the  $n^{\text{th}}$  root of the likelihood (where  $n$  is the number of choice tasks), which is a geometric mean of the standardized predicted likelihood values associated with the alternatives actually selected by participants (Sawtooth Software, 2009).

<sup>44</sup> It should be noted, however, that the comparison between our four models is not possible due to the different degrees of freedom.

method. More specifically, sweet peppers originating from Taiwan are most preferred, those from Japan take second place while respective products from China are least favoured. Moreover, organically produced products are more desired than conventional ones, and products labelled with Taiwan-authorized chemical residue test information are considered superior to those approved in the respective production country and much superior to products without chemical residue test information. These results are in line with previous studies that show the dominant role COO plays in influencing consumers' product evaluation (Becker *et al.*, 2000; Bernabéu *et al.*, 2008). Becker *et al.* (2000), Schnettler *et al.* (2009) as well as Baker and Ballington (2011) support our findings that COO labelling is of greater importance for consumers' preference formation than price. Similar to Chern and Chang (2012) and Schjøll (2017) consumers in our study have a higher preference for domestically produced products compared to foreign alternatives. In addition, in line with Schjøll (2017) we show that COO seems to be much more important than production method in consumers' food choice.

As indicated above, sweet peppers from China are especially negatively evaluated. This low preference for the China COO attribute level can, however, be mitigated if combined with information on chemical residue testing approved in Taiwan revealing the joint effect quality cues can have on consumers' product evaluation. The same does not hold if the chemical residue testing is approved in China. Those results can be interpreted as a lack of trust in China's food safety authorities and confirms previous findings from Chern and Chang (2012).

The results also indicate that participants in our study attach a higher importance to chemical residue test information compared to production method. We might conclude that the relevance of the organic label is modified in the presence of chemical residue test information. Given the overlap in the content of those two quality cues with chemical residue test information being more specific might have put this label in the focus of consumers' attention. As organic certification implies the logic of zero chemicals our finding, in addition, reflect that participants do not completely understand or trust organic labels thus, confirming the findings of Yiridoe *et al.* (2005). Based on a literature review the authors conclude that consumers have difficulties in understanding the complexity of organic

standards and perceive uncertainty and skepticism about organic labels. Also Chen (2009) and Tung *et al.* (2012) who specifically focus on Taiwanese consumers support these findings. According to both studies Taiwanese consumers perceive the danger of fraud with respect to organic foods and have some doubt that products labelled as organic are indeed always grown without using synthetic fertilizers, pesticides, and chemicals. Thus, given the high level of concern about pesticides in food in Taiwan (Tung *et al.*, 2012) chemical residue test information is compared to organic standards easier to understand and potentially used as a more reliable cue for food safety.

Our study indicates that the skepticism regarding organic obviously varies depending on the COO of the product confirming again the interaction effect different quality cues can have on consumers' purchase decision (e.g. Onozaka and McFadden, 2011). As Onozaka and McFadden (2011), Schjøll (2017) and Xie *et al.* (2015) we find that consumers differentiate organic claims further if information on country of origin is provided and vice versa. Participants in our study expressed a high preference for organic sweet pepper from Taiwan and Japan and a very low one for the respective product originating from China. This holds, despite the fact that organic standards of the considered countries are equivalent. This finding indicates that consumers in our study are not aware of the equality of organic standards independent of origin or lack trust in this regulation. Also Janssen and Hamm (2014) show at the example of two organic labels that follow exactly the same standards - the German organic label and the respective EU label - considerable differences in consumers' WTP. In fact, they find skepticism regarding the trustworthiness of the organic inspection system in foreign countries as one explanation for this difference. The provision of information thus might help to overcome the deficiencies inherent in markets for credence goods.

In line with previous research focusing on the effect of information treatment (Carlucci *et al.*, 2009; Napolitano *et al.*, 2010; Stolzenbach *et al.*, 2013; Xie *et al.*, 2015), our results show that consumer's perceptions can be sensitive to information. However, unlike what might have been expected we find that information on the equality of organic standards independent of product's origin induces a significant reduction in the importance of the attribute production method while the opposite holds for

the attribute chemical residue testing. In addition, and even more surprising, EqualOrganic information further increases the likelihood to purchase organic sweet pepper from Taiwan.

We might interpret this as the communication paradox previously detected by Scholderer and Frewer (2003). The study reveals that compared to a control group without information consumers obtaining information on the benefits of GM food have a lower preference for those products, a phenomenon that can be explained by psychological theories of information processing. According to the attitude activation effect external cues can make pre-existing attitudes more accessible (Scholderer and Frewer, 2003). In our case this could imply that once primed by information on the equality of organic standards, previous attitude towards organic products from China (respectively Japan and Taiwan) stored in consumers' memory became more accessible.<sup>45</sup> Research reveals that Taiwanese consumers are skeptical with respect to the quality and safety of products originating from China (Chern and Chang, 2012). Also the findings from our study support the low preference consumers attach to Chinese sweet peppers. Thus, the information on EqualOrganic does not serve its intended purpose but increases participants' sensitivity and uncertainty regarding organic products originating in China.<sup>46</sup> Further analysis is necessary to confirm this interpretation.

What we can, however, safely conclude from our analysis is that there exists a knowledge deficit with respect to the meaning of the different quality cues and their interaction and that EqualOrganic information treatment has not eased the purchase decision for participants in our survey but has increased consumers' skepticism. The latter is reflected by the considerable and significant higher average utility of the opt-out option in the information treatment group.

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<sup>45</sup> The theory of confirmatory bias explains that people have a tendency to prevent cognitive dissonance (Frey, 1986). To do so information not in accordance to prior beliefs and attitude are neglected or even misinterpreted according to previously held views. In the latter case this new "evidence" is then used as additional support for previously held beliefs (Rabin and Schrag, 1999; LaRiviere *et al.*, 2016).

<sup>46</sup> In fact, from our results we see that the same holds with respect to products where the origin of the product is China and the chemical residue testing is approved in China which supports our interpretation.

Several points may be raised to the limitations of the present study. First, we focus in our research on an EqualOrganic information treatment at the example of sweet pepper from three origins. Though we assume that our outcomes are similar for other food products, further investigations should cover other countries of origin and different approaches of information provisions. Second, our sample provides an adequate reflection of food shoppers in Taiwanese cities; however, transferability of our results to Taiwanese consumers in general or other countries is not possible. Third, we assess in the present study only consumers' choice behaviour, however, it would be interesting to examine psychological criteria that might affect the impact of the information provided on consumer purchase behaviour such as consumers' prior knowledge with respect to EqualOrganic, their understanding and trust in the information provided as well as their attitude and trust with respect to different regions of origin.

#### **4.6 Conclusion**

Motivated by the observation that organic products from different COOs receive a highly different evaluation we use a discrete choice experiment framework to explore the impact of EqualOrganic information treatment on Taiwanese consumers' preferences at the example of sweet pepper. As all organic products sold in Taiwan have to be certified by equivalent standards we assumed that providing respective information leads to a shift in consumer preferences towards organic products in general and specifically for organic products originating from China, an origin not highly valued by Taiwanese consumers. However, EqualOrganic information had not the anticipated effects, but reduced participants' preference for organic sweet pepper especially if originating from China.

The findings of our study can provide important insights for policy makers and stakeholders along the food value chain in Taiwan. Our results suggest that information provision might not have the desired effect but to the contrary may reinforce prior skepticism. Thus, to the extent that a further growth of the organic market is desired in Taiwan, it is not enough that governmental agencies introduce new regulation such as the equality of organic standard regulation but it seems essential to implement

effective control authorities, secure a high level of transparency and gain consumers' trust. Challenges remain especially in securing Taiwanese consumers' confidence in food products from countries such as China with a somewhat mixed quality reputation. However, our findings also indicate — independent from the information treatment— that there is a lack of trust in organic labels in general and/or a lack of knowledge regarding what organic implies as consumers favour products with chemical residue test labels compared to organic despite the fact that the former is part of the latter. Thus, private and public actors should shape consumers' perceptions of the standards behind organic and most importantly raise consumers' knowledge how compliance to organic standards is secured. Finally, our findings reveal that combining choice experiment with propensity score matching to investigate the impact of information treatment on consumers' choice can be useful to reduce potential selection biases in the choice experiment outcomes caused by differences in individuals' characteristics between information treated and untreated samples.

#### Appendix 4.1: DCE design: two-way frequencies of attribute levels

Two-Way frequencies <sup>47</sup>												
Attribute/Level	1/1	1/2	1/3	2/1	2/2	3/1	3/2	3/3	4/1	4/2	4/3	4/4
1/1	36	-	-	17	19	11	11	14	3	5	11	17
1/2	-	36	-	16	20	11	11	14	9	11	11	5
1/3	-	-	36	21	15	14	14	8	15	10	6	5
2/1	17	16	21	54	-	20	21	13	14	15	14	11
2/2	19	20	15	-	54	16	15	23	13	11	14	16
3/1	11	11	14	20	16	36	-	-	10	9	11	6
3/2	11	11	14	21	15	-	36	-	9	9	8	10
3/3	14	14	8	13	23	-	-	36	8	8	9	11
4/1	3	9	15	14	13	10	9	8	27	-	-	-
4/2	5	11	10	15	11	9	9	8	-	26	-	-
4/3	11	11	6	14	14	11	8	9	-	-	28	-
4/4	17	5	5	11	16	6	10	11	-	-	-	27

<sup>47</sup> The two-way frequencies table shows how many times each combination of attribute level appears within the entire experimental design. For example, the frequency 17 in the last column (4/4) and the first row (1/1) means that the combination of the fourth level of the fourth attribute (Price: NT 125) and the first level of the first attribute (COO: Taiwan) appeared 17 times in the entire choice experimental design. Combinations of different attribute levels in the same attribute are impossible (e.g. attribute COO: attribute level 1/1 (Taiwan) and 1/2 (Japan)) which is indicated in the table as well.

## Appendix 4.2: Data-in-Brief Article

This DiB article is published in the Data-in-Brief (2018), Vol. 18, page 688- 690.

The electronic version of the original DiB publication is available at

<https://www.sciencedirect.com/science/article/pii/S2352340918302592>

### Taiwanese consumer survey data for investigating the role of information on equivalence of organic standards in directing food choice

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#### Abstract

The presentation of credence attributes such as the product's origin or the production method has a significant influence on consumers' food purchase decisions. The dataset includes survey responses from a discrete choice experiment with 1309 food shoppers in Taiwan using the example of sweet pepper. The survey was carried out in 2014 in the three largest Taiwanese cities. It evaluates the impact of providing information on the equality of organic standards on consumers' preferences at the example of sweet pepper. Equality of organic standards implies that regardless of products' country-of-origin (COO) organic certifications are based on the same production regulation and managerial processes. Respondents were randomly allocated to the information treatment and the control group. The dataset contains the product choices of participants in both groups, as well as their sociodemographic information.

#### Specifications Table

Subject area	<i>Experimental economics</i>
More specific subject area	<i>Discrete choice experiment (DCE)</i>
Type of data	<i>Excel tables, CSV file</i>
How data was acquired	<i>Personal interviews combined with internet-connected electronic</i>

	<i>devices</i>
Data format	<i>Raw</i>
Experimental factors	<i>Treatment and control group where the former was provided with information regarding the equality of organic standards independent of country-of-origin</i>
Experimental features	<i>Country-of-origin, production methods, chemical residue testing and price as well as information treatment</i>
Data source location	<i>Taipei city/Taichung city/ Kaohsiung city in Taiwan</i>
Data accessibility	<i>With this article</i>

### **Value of the data**

- This data set provides a first-hand survey that explores the relevance of process attributes for consumers` food choice in the context of an emerging nation.
- The data can be used for comparing the importance of labels related to process attributes with other case studies in a meta-analysis.
- The data allows for a comparison of the effects of information treatment regarding food process labels on the importance of those labels in consumers` choice in a meta-analysis.
- The data allows to explore the influence of alternative statistical approaches in estimating consumers` preference scores for various process attributes.

### **Data**

The dataset contains raw data collected in 2014 from 1309 Taiwanese consumers by combining personal interviews with internet connected electronic devices. The survey was carried out in the three largest Taiwanese cities: Kaohsiung city, Taichung city, New Taipei city<sup>48</sup>. The analysis focuses on sweet pepper, as this product is part of Taiwanese daily diet and available in conventional and organic quality from domestic producers as well as from third countries. The questionnaire is designed to

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<sup>48</sup> New Taipei city is located in the north, and the largest city in Taiwan. Taichung city is located in the central area and the third most populated area in Taiwan. Kaohsiung city is the largest city in the south, and the second largest city in Taiwan.

assess the impact information on the equality of organic standards has on the importance consumers attach to the attributes COO, production method, chemical residual testing and price using a choice experimental design. Additionally, the data includes 13 individual-specific sociodemographic variables. The data was first analysed in the article by Yeh et al. (2018).

### **Experimental Design, Materials and Methods**

A random sampling approach for the selection of participants and their assignment to the treatment and control group was conducted to ensure that both samples are representative of food shoppers in urban Taiwanese regions. The questionnaire started with two screening questions. The screening questions allow filtering the relevant participants for those i) responsible for their households' food shopping, and ii) regularly consuming sweet peppers. 509 respondents did not fulfil one or both of those criteria resulting in 469 consumers in the control and 331 consumers in the treatment group.

The choice experiment focused on the following attributes and attribute levels of sweet pepper that were derived from focus group discussions and identified as most important<sup>49</sup>: (i) *Country-of-origin* with the attribute levels, Taiwan, China and Japan, (ii) *Production method* with attribute levels organic and conventional, (iii) *Chemical residue testing* comprising three attribute levels: Chemical residual testing approved in the production country, respective testing approved in Taiwan, and no chemical residual information, and (iv) *Price* with the levels 65 NT<sup>50</sup>, 85 NT, 105 NT, and 125 NT.

The DCE experimental design consists of 36 choice sets each comprising three alternatives. The 36 choice sets are allocated across six blocks and participants were randomly allocated to one of these blocks. The supplementary table entitled DCE experimental design provides an overview of the distribution of choice sets and alternatives across the six blocking versions. In the dataset information on the alternative chosen in each choice set is captured by "DCE1" to "DCE6" while information on the blocking version each participant was assigned to is provided in the column "DCE blocking version".

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<sup>49</sup> The focus group discussions were held via video meetings with Taiwanese food market experts in March, 2014

<sup>50</sup> New Taiwanese dollars. In July 2014, 1 US Dollar=29.98 NT.

Prior to the discrete choice experiment participants in the information treatment group obtained the following information on the equality of organic standards:

*“No matter where an organic product sold in Taiwan has been produced, the same regulation and managerial processes apply. A product that is labelled organic and sold in Taiwan has to fulfil the Taiwanese organic production regulations and it is ensured that there are no exceptions.”*

Moreover, 13 individual-specific covariates that potentially have an impact on the DCE outcome as well as on the information treatment were included (Heckman et al., 1997; Smith and Todd, 2005) : gender, age range, living location (i.e. in the north/ middle/ south of Taiwan), living area (i.e. in a big city/ mid-sized city/ rural area), education, marital status, career, household size, number of children, monthly household net income, monthly household food expenses, the average share of imported food in total household and the blocking version of discrete choice experiment.

### **Supplementary material**

The choice experimental design, an example of a choice task as well as well as the variable descriptions are included in the supplementary file. Supplementary material Supplementary data associated with this article can be found in the online version at

<http://dx.doi.org/10.1016/j.dib.2018.03.054>.

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## **Chapter 5:**

# **The Role of Trust in Explaining Food Choice: Combining Choice Experiment and Attribute Best Worst Scaling**

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This paper is submitted to the peer review journal and currently under reviewed.

## **The Role of Trust in Explaining Food Choice: Combining Choice Experiment and Attribute Best-Worst Scaling**

### **Abstract**

This paper presents empirical findings from a combination of two elicitation techniques—discrete choice experiment (DCE) and best-worst scaling (BWS)—to provide information about the role of consumers' trust in food choice decisions in the case of credence attributes. The analysis is based on a sample of 459 Taiwanese consumers and focuses on red sweet peppers. DCE data are examined using latent class analysis to investigate the importance and the utility different consumer segments attach to production method, country of origin and chemical residual testing. The relevance of attitudinal and trust-based items is identified by BWS using a hierarchical Bayesian mixed logit model and is aggregated to five latent components by means of principal component analysis. Applying a multinomial logit model, participant's latent class membership (obtained from DCE data) is regressed on the identified attitudinal and trust components, as well as demographic information. Results of the DCE latent class analysis for the product attributes show that four segments may be distinguished. Linking the DCE with the attitudinal dimensions reveals that consumers' attitude and trust significantly explain class membership and therefore, consumers' preferences for different credence attributes. Based on our results we derive recommendations for industry and policy.

**Keywords:** *preference, trust, choice experiment, best-worst scaling, latent class analysis, hierarchical Bayesian mixed logit model, principal component analysis*

### **5.1 Introduction**

Over the last decades, food safety and quality have been highly debated and investigated topics in policy, industry and research. This holds for industrialized as well as for emerging countries such as Taiwan. In Taiwan food scares and scandals such as food adulteration (Peng *et al.* 2017), food-borne contamination (Cheng *et al.* 2013), counterfeiting (Chern *et al.* 2013), and mislabeling (Liu 2016)

have induced consumer distrust and concerns regarding the quality and safety of food. Additionally, high—and in parts improper—use of chemical inputs in Taiwanese agriculture (Yang 2013) has led to illegal levels of chemical residues in food products with considerable danger for the immediate and long-term health of consumers (Epstein 2014). Since 2011, most Taiwanese retailers reacted to the numerous food safety incidents by displaying chemical residue test information, particularly for fresh agricultural and food products.<sup>51</sup> As a consequence, consumers' interest in food labels associated with a higher level of product quality and safety has been gaining in relevance (Chern and Chang 2012; Teng and Wang 2015; Tonkin *et al.* 2016).

### 5.1.1 Thematic Background

There has been considerable interest in studying how consumers, across countries, evaluate and use food quality and safety information (Grunert 2005; Vandeplass and Minten 2015). Research shows that consumption of organic food has increased (Tung *et al.* 2012; Bravo *et al.* 2013; Moser 2016) motivated by consumers' values and health concerns (Teng and Wang 2015; Janssen and Langen 2017). Consumers also associate the origin of foods with product and process quality (Chern and Chang 2012; Klöckner *et al.* 2013). Previous studies showed that domestically-grown food is perceived as fresher and/or of higher quality (Vabø *et al.* 2017; Roos *et al.* 2016). More generally, research reveals that country (or region) of origin conveys the production country's (or area's) reputation for value and quality (Aprile *et al.* 2012; Vabø *et al.* 2017). Food labels can be a source of information for consumers with respect to a product's quality and safety characteristics. However, the usage of labels for product choice crucially depends on consumers' perception and trust in the signals (Castaldo *et al.* 2009; Hall and Osses 2013). Thus, for decision makers in policy and businesses it is central to understand how consumers perceive and trust food labels and food-related information.

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<sup>51</sup> In April 2011, the Taiwan Food and Drug Administration detected a major threat to public health caused by phthalate-contaminated foodstuffs sold on the Taiwanese market. This outbreak event is known as the "2011 Taiwan Food Scandal" (Yen *et al.* 2011; Kang *et al.* 2012). In addition, in December 2011 the Greenpeace organization (<http://www.greenpeace.org/taiwan/zh/publications/reports/food-agriculture/>) sampled 58 fresh fruits and vegetables in eight supermarket chains across Taiwan, and detected 36 different pesticide residues above the maximum allowable levels in 43 types of fruits and vegetables.

Consumer trust is a subjective concept and is influenced by an individual's past experience and perceived reputational value of the object (Yan 2010). According to Mayer *et al.* (1995) trust can be defined as:

*... the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party (Mayer et al. 1995, p.712).*

Based on previous literature, consumer trust can be divided into four specific dimensions: 1) trust belief (Mayer *et al.* 1995; McKnight *et al.* 1998); 2) trust intention (Mayer *et al.* 1995; McKnight *et al.* 1998); 3) institutional-based trust (McKnight *et al.* 2002) and 4) general trust (Couch and Jones 1997). "Trust beliefs" represent the perception of the trustworthiness of a person or object (Mayer *et al.* 1995; McKnight *et al.* 1998). Trust intention is recognized as the intention to engage in trust-related behavior with a specific willingness of the trustor to rely, or intend to rely, on other trustees based on the expectation about the behavior of others although those cannot be controlled (Mayer *et al.* 1995; McKnight and Chervany 2001). Likewise, "institutional-based trust," so-called systems trust (Zhang and Zhang 2005), is considered as an antecedent to trusting intentions and trusting beliefs (McKnight *et al.* 2002). It refers to an individual's perception that an action is constitutively embedded in an institutional environment that is conducive to a favourable outcome (McKnight *et al.* 2002; Bachmann and Inkpen 2011). "General trust," so-called dispositional trust (Mayer *et al.* 1995; McKnight and Chervany 2001), is described as the attitude of the general trusting stance and natural tendency of an individual to trust other people or an object; thus, the trustor is inherently optimistic (McKnight *et al.* 2002).

### **5.1.2 Methodological Background**

Many food-related studies investigate via choice experimental settings the role of labels in consumers' purchase decisions (see the review by Feldmann and Hamm 2015; Mørkbak *et al.* 2008; Moser *et al.*

2011), or the interaction between food labelling and consumer trust (see the review by Tonkin *et al.* 2015). The respective literature so far primarily focuses on western countries<sup>52</sup>. Parallel, extensions of the traditional discrete choice models have been developed that improve the modelling of the decision-making behaviour. Hybrid choice models (HCM)<sup>53</sup>, consisting of choice model and latent variable(s) are recent approaches in this respect (Hensher *et al.* 2015; Song *et al.* 2018; Bolduc and Alvarez-Daziano 2010; Abou-Zeid and Ben-Akiva 2014). HCM covers a number of approaches encompassing Latent Class (Langen 2011) or Mixed Logit Models (Yangui *et al.* 2016) that include besides the information obtained from the DCE also e.g. attitudinal factors. Furthermore, Integrated Choice and Latent Variable Models (O'Neill *et al.* 2014) also belong into this group.

Our study adds to the literature twofold. First, by revealing in the example of Taiwan—a newly industrialized country—the relevance selected process and food safety standards have for consumers in their purchase decisions thereby in contrast to previous studies differentiating between consumer segments (Kikulwe *et al.* 2011; Owusu-Sekyere *et al.* 2018) and identifying the role of trust for consumers when buying food products. Second, we combine the findings of two elicitation techniques—DCE and BWS—to provide information about the role of consumers' trust in food choice decisions in the case of credence attributes in a discriminant manner. While Song *et al.* (2018) also combine DCE and BWS our approach differs in that we apply DCE using Latent Class Analysis and BWS using Bayesian estimation as well as in that our analysis captures consumers' attitudinal and trust perception<sup>54</sup>. In summary, our analysis aims at providing a better understanding of consumer choices, and thus allowing for more meaningful recommendations for marketers and policy makers.

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<sup>52</sup> To the best of our knowledge, the literature in the last decade (2007-2017) that refers to non-western countries using choice experiments to investigate the importance of food labels or the interaction between labelling and consumer trust with respect to consumers' food purchase decisions is limited to two peer-reviewed papers (Kim 2008, data collected in Japan; Zheng *et al.* 2013, data collected in China) and one dissertation (Charity 2016, data collected in Kenya).

<sup>53</sup> The aim of the HCM is to extend the standard DCE by explicitly incorporating consumers' psychological or sociological factors into a random utility framework, thereby better capturing the complexity of the choice process (Bolduc and Alvarez-Daziano 2010; Abou-Zeid and Ben-Akiva 2014; Hensher *et al.* 2015).

<sup>54</sup> The study by Song *et al.* (2018) does not link consumers' choice to attitudinal and trust statements. In fact, they use the identical seven attributes in the DCE and in the BWS settings and analyzed the choice data via HCM treating each BWS importance score as a single variable. In our study the attributes in the DCE (4 attributes) and the BWS (25 statements)

This paper is structured as follows: First, the methods of the discrete choice experiment and best-worst scaling and their application are introduced, followed by a presentation of the empirical results. We conclude with a discussion of our empirical findings, derive practical implications and suggest direction for future research.

## 5.2 Methods

The study combines two elicitation techniques: discrete choice experiment (DCE) and best-worst scaling (BWS). Both methods are based on Random Utility Theory (Thurstone 1927; McFadden 1973).

### 5.2.1 Data collection

The questionnaire was formulated in Mandarin and started with two screening questions. To qualify for taking part in the survey, respondents had to be red sweet pepper consumers who were (partly) responsible for the food purchases in their family. Subsequently, participants were asked to complete two stated preference experiments (DCE and BWS as discussed in the next sections). In the last section of the questionnaire, participants were requested to provide information with respect to their food purchase behaviour, shopping frequency and socio-demographic characteristics such as gender, age and income. The questionnaire was tested to ensure the comprehension of the questionnaire. The survey was conducted by five trained interviewers in front of supermarkets<sup>55</sup> in the three largest cities (New Taipei, Kaohsiung and Taichung) of Taiwan in form of computer-assisted web interviews. The majority of the respondents completed the survey within approximately 15 minutes. To reduce possible self-selection bias we trained our interviewers to actively encounter randomly every second

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designs are different with the former referring to characteristics of the product and the latter to 25 attitudinal and trust-based items which are for the further analysis componentized to five attitudinal and trust dimensions. Thus, we provide in depth insights in explaining consumers' choice for different consumer segments by attitudinal and trust dimensions.

<sup>55</sup> The two hyper-supermarkets Taisuco (<http://www.tsctaisuco.com.tw/>) and Carrefour (<http://www.carrefour.com.tw/>) were chosen based on the convenience of the location, the customer flow and the amount of their fresh agri-food product categories.

person leaving the checkout counter of the supermarkets<sup>56</sup>. This was done to ensure that e.g. not only young or female consumers were approached. Combining computer-assisted personal interviews with traditional web survey techniques allowed us to overcome the problem of coverage error linked to the latter (Batinic *et al.* 2002) and non-response error linked to the former (Bethlehem and Biffignandi 2011).

### 5.2.2 Discrete choice experiment

Discrete choice experiments are based on Lancaster's new demand theory (Lancaster 1966; McFadden 1973) which assumes that consumers derive utility from a variety of product characteristics. Consumers choose the product among a given set of alternatives that holds the combination of attributes that maximizes his/her utility (Rachlin 1980; McFadden 1986).

Our DCE is conducted to investigate consumers' food preference and heterogeneity regarding different food quality and food safety information. In this study, fresh unpackaged red sweet peppers were selected as the study object. This product seems especially suitable for our analysis because first, it is part of Taiwanese people's daily diet (The Committee of Agricultural Extension 2014; Taichung District Agricultural Research and Extension Station 2016) and second, it is one of the few fresh agri-food products permitted to be imported into Taiwan from mainland China. In fact, red sweet peppers are available on the Taiwanese domestic market in conventional and organic quality from the three countries considered in the study: Taiwan, China, and Japan. Country of origin (COO) and production methods (organic and conventional) are both important attributes influencing perceived quality and trust in a product's overall quality (Dekhili *et al.* 2011; Fernqvist and Ekelund 2013). Besides these two attributes we considered price and chemical residue testing information (see table 5.1) as

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<sup>56</sup> Most of the composite-style (hyper) supermarkets in Taiwan have their own parking floor within the building and there is an area between the parking zone and the supermarket where many in-door food stands or restaurants are located (with air-conditioner provided). Our interviewers encountered participants at the entrance of the supermarket while they were on their way to the dining place or the parking lot in the building. Therefore, it was ensured that interviewed participants were still close to the shopping spot within the building.

characteristics in the DCE. Focus groups<sup>57</sup> with Taiwanese consumers primarily responsible for their household food purchase<sup>58</sup> revealed that these four attributes are the most relevant selection criteria for consumers in their purchase of red sweet peppers.

Based on parameter estimates obtained from a pilot study we identified an efficient unlabelled choice design with a D-error value of 0.237 using NGENE version 1.1 (ChoiceMetrics 2012)<sup>59</sup>. Our final efficient choice design has a D-error measure of 0.237 which is smaller than the D-errors of other design alternatives such as the sequential orthogonal design (0.420) and the least efficient simultaneous orthogonal design<sup>60</sup> (2.018) (ChoiceMetrics 2012). The final design consists of 36 choice sets. However, as 36 choice tasks would lead to respondents' fatigue, the choices were allocated in six blocks by NGENE software (ChoiceMetrics 2012) via the design generation process, each consisting of six choice situations. Respondents were randomly assigned to the six blocks. In each choice task consumers were asked to make a choice between three red sweet peppers that varied in the levels of the four product attributes presented in table 5.1. We also provided participants with

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<sup>57</sup> The focus group discussions (n= 17) were held via video meetings with Taiwanese food market experts in March, 2014.

<sup>58</sup> The participants for the two focus groups were recruited via social media networks based on the snowball sampling method. The first author of this paper introduced to the participants in the focus group discussions 12 potential attributes extracted from previous literature. Those attributes were: price, COO, easiness in preparation, CRT, visual appearance of the product, production methods e.g. organic certification, product's shelf life, taste of the product, health claim, word of mouth information, seasonal product, and sense of touch. Then, participants were asked to select those five attributes most important to them when buying fresh fruits and vegetables. In addition, participants were encouraged to express their opinions and reasons about why they choose the respective attributes.

<sup>59</sup> The D-error is the most common criterion for evaluating the efficiency of experimental choice designs (Zwerina *et al.*, 1996). A design with the lowest D-error measure is a D-efficient design. Efficient designs can be generated using two different approaches. The first approach assumes that prior parameters are known with certainty by the researchers (e.g., Carlsson and Martinsson 2003; Rose and Bliemer 2005), whereas the second one uses prior parameter distributions (Bayesian efficient design) (Scarpa *et al.* 2007). We used the latter approach. For that a pilot study was carried out in April 2014 with Taiwanese consumers (n = 290) from a convenience sample using an internet-based choice experiment questionnaire in Taiwan. The results were estimated via a random parameter mixed logit model and were used as the prior information to construct the main experimental design. The pilot study's parameter estimates were used as the prior information to derive the asymptotic variance-covariance matrix and subsequently the D-efficient design. Based on an iterative process, the most efficient design with the smallest D-error was derived. Moreover, the choice experiment questionnaire in the pilot study revealed the feasibility of the experiment, and provided initial choice experimental results.

<sup>60</sup> The orthogonality of the sequential orthogonal design only holds within each alternative; in a simultaneous design orthogonality holds across alternatives.

an “opt-out” option, which ensures that participants are not forced to choose a product they normally would not purchase. In order to make the choice experiment as tangible as possible, the attribute levels were visualized using pictures and text as shown in figure 5.1 (translated version).

We apply standard latent class analysis (LCA)<sup>61</sup> (Train 2009; Houghton *et al.* 2009) to the choice experimental data to identify different consumer segments. Latent class choice models assume that respondents can be categorized into two or more classes sharing unobserved characteristics that affect choice, in our case the choice of red sweet peppers differentiated by different attribute levels. Preferences are assumed to differ between latent classes but to be homogeneous within classes. LCA allows to simultaneously determine both consumer’s product choice and group membership thereby segmenting the sample in internally homogenous subgroups regarding their preferences. For each respondent the probability of belonging to a particular latent class can be computed (McCutcheon 1987, 2002; Train 2009). In addition, we calculate segment-specific Willingness-to-Pay (WTP) values<sup>62</sup> for each attribute level for the detected consumer segments by dividing the attribute level coefficient by the price coefficient. We use the delta method introduced by Hole (2007) to generate the ninety-five percent confidence intervals for the WTP estimates.

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<sup>61</sup> The model specification of LCA is shown in Appendix 5.1.

<sup>62</sup> Due to the use of effect coding in the model, we calculated the mean WTP based on the following formula:




$$WTP = -\frac{2\beta_{\text{attribute level}}}{\beta_{\text{Price}}} \text{ (Lusk } et al. \text{ 2003; Bech and Gyrd-hansen 2005; Ortega } et al. \text{ 2011; Sckokai } et al. \text{ 2014).}$$

**Table 5.1** Attributes and levels used in the DCE

Attributes	Levels
Country of origin	<ul style="list-style-type: none"> <li>Taiwan</li> <li>Japan</li> <li>China</li> </ul>
Production method	<ul style="list-style-type: none"> <li>Organic</li> <li>Conventional</li> </ul>
Chemical residue testing information	<ul style="list-style-type: none"> <li>Chemical-residue test approved in the production country</li> <li>Chemical-residue test approved in Taiwan</li> <li>No chemical-residue test information provided</li> </ul>
Price <sup>¶</sup>	<ul style="list-style-type: none"> <li>NT 65</li> <li>NT 85</li> <li>NT 105</li> <li>NT 125</li> </ul>

<sup>¶</sup>In July 2014, 1 US Dollar = 29.98 New Taiwanese (NT) Dollars.

1 Taiwanese catty = 600 grams

The following fresh sweet peppers are available. Which one would you buy?				
No.	1	2	3	4
				None of them
	Red Sweet Pepper Organic China Chemical-residue test approved in China NT 85 / 600g	Red Sweet Pepper Organic Taiwan NT 125 / 600g	Red Sweet Pepper Japan Chemical-residue test approved in Taiwan NT 105 / 600g	
Which product would you buy?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Figure 5.1** A choice task example in DCE (English translation).

### 5.2.3 Best-worst scaling

Although the DCE method allows combining product's attributes and levels to examine consumer preference with respect to a specific food product, it does not provide information on an individual's attitudinal and trust perceptions driving those choices. Therefore, many studies include rating scales (e.g. Likert measure points) to obtain information on consumers' attitudinal and trust perception. While rating tasks are easy for respondents to answer they may ineffectually discriminate between rating statements (Hein *et al.* 2008) as respondents are not forced to make a choice between items, allowing them to rate multiple items as being of equally high importance. In addition, it is difficult to interpret what the rating scale values actually mean (Flynn and Marley 2014). To overcome these weaknesses, we employ the best-worst scaling method (Finn and Louviere 1992) to uncover the attitudinal and trust factors underlying consumer's food choices on a reliable basis. Best–Worst Scaling (BWS), also known as Maximum Difference Scaling, is an annotation scheme that exploits this comparative approach (Cohen 2003; Louviere *et al.* 2015).

In BWS experiments respondents are asked to choose the best and worst option among a number of statements.<sup>63</sup> Thereby they are forced to consider trade-offs and discriminate between options as in real life (Cohen and Markowitz 2002). Choice frequencies are the metric that allow to reveal information on the order and strength of importance of all objects. The method was introduced by Louviere and Woodworth (1990) and first applied in the study of Finn and Louviere (1992).

The BWS experiment covered nine attitudinal dimensions with a total of 25 statements related to attitudinal and trust factors. These are derived from the literature as well as own consideration and were adapted to the context of the study (see table 5.2). The Balanced Incomplete Block Design (BIBD) (Smith and Street 2003) had been frequently used in the BWS setting, however, as a BIBD is subject to the symmetry condition the number of possible BIBDs is limited. In the present study, an orthogonal frequency balanced design using MaxDiff Designer v.6 (Sawtooth Software 2007) was generated to maximize the BWS design efficiency (Lagerkvist *et al.* 2012; de-Magistris and Royo

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<sup>63</sup> In this study we use the so called 'object case' of BWS (Finn and Louviere 1992).

2014). Orthogonality ensures that differences among items varied independently over choice sets while balance confirms that all items appeared with (nearly) equal frequency in the BWS questionnaire. Given a 25-statement BWS questionnaire, 300 BWS choice tasks were generated to control for context effects that may alter respondent choice processes (Sawtooth Software 2007). To avert respondent fatigue, the choice tasks were divided into 30 blocks, where each version had ten choice sets displaying five statements at a time. The generated BWS choice tasks satisfy the optimal design characteristics in terms of frequency balance, orthogonality, positional balance, and connectivity among tasks (see Appendix 5.3 for the BWS design matrices)<sup>64</sup> (Sawtooth Software 2007). After ensuring a balanced and nearly orthogonal BWS design, the BWS situations were randomized and each respondent was randomly assigned to a BWS block. Each BWS blocking version has the same sample size to maintain its statistical properties.

In addition, each statement appears equally often on each of the five positions within the BWS sets to prevent any position bias (Campbell and Erdem 2015). In each BWS task, respondents were asked to choose the statements that most and least represent their attitude when purchasing food (mix of questions regarding food purchases in general and red sweet peppers in particular) (see figure 5.2).

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<sup>64</sup> The one-way frequencies show that on average each BWS statement is displayed across all 30 blocking versions of the BWS questionnaire 60 times (i.e. perfectly balanced frequency). The two-way frequencies show that each BWS statement appears around 10 times (S.D. = 0.497) on average (i.e. nearly orthogonal). Positional frequencies show that on average each statement appears 12 times (S.D. = 0.522) (i.e. positional balance). Connectivity is meant that all statements are linked directly.

Please consider only these five statements and imagine the situation of purchasing food. Please indicate the statement would you most agree to and the one you would least agree to.

Agree least	Statements	Agree most
<input type="radio"/>	Japanese organic sweet peppers have good value for money.	<input type="radio"/>
<input type="radio"/>	It is more likely that I buy Chinese sweet peppers if information on chemical residue testing is provided.	<input type="radio"/>
<input type="radio"/>	It is more likely that I buy Chinese sweet peppers if it is on special offer.	<input type="radio"/>
<input type="radio"/>	I feel assured that the Taiwanese institutions do a good job in adequately protecting consumers.	<input type="radio"/>
<input type="radio"/>	Chinese organic sweet peppers are trustworthy.	<input type="radio"/>

**Figure 5.2** A choice task example of BWS (English translation)

First, hierarchical Bayesian estimation of the mixed logit model<sup>65</sup> was applied to analyze the BWS choice data. As a result, we obtain individual attitudinal importance scores for each of the BWS statements. Compared to the multinomial logit model or the mixed logit model with classical maximum likelihood estimation, the hierarchical Bayesian estimation allows for more precise estimates of individual-level part-worth values (Lenk *et al.* 1996; Akinc and Vandebroek 2017) by combining information on the distribution of utility values across the entire sample with the specific choices of the individual (Lusk and Briggeman 2009; Train 2009).

<sup>65</sup> The empirical derivation of hierarchical Bayesian mixed logit model is shown in Appendix 5.2.

**Table 5.2** Nine dimensions of trust constructs with 25 BWS items

Trust constructs	Items used in BWS experiment	No. of items	References
1. <b>Trust belief</b> in organic products from different COO	<ul style="list-style-type: none"> <li>Taiwanese/ Chinese/ Japanese organic sweet peppers are trustworthy.</li> </ul>	3	Adapted from the studies of McKnight and Chervany (2002); Rotter (1967).
2. <b>(Dis)trust belief</b> in the superior nutritional value of organic food	<ul style="list-style-type: none"> <li>I feel sure that organic sweet peppers contain higher vitamin C and anti-cancer substances than conventional ones.</li> <li>I feel sure that organic sweet peppers contain the same vitamin C and anti-cancer substances as conventional ones.</li> </ul>	2	Adapted from the studies of Love <i>et al.</i> (2013) and Claybaugh and Haseman (2013).
3. <b>(Dis)Trust belief</b> in the environmental benefit of organic food	<ul style="list-style-type: none"> <li>With purchasing organic sweet peppers I help preserving the environment and natural resources.</li> <li>There are no differences between buying organic sweet peppers or conventional ones with respect to preserving the environment and natural resources.</li> </ul>	2	Adapted from the studies of Love <i>et al.</i> (2013) and Claybaugh and Haseman (2013).
4. <b>Trust belief</b> in the monetary value of organic food from different COO	<ul style="list-style-type: none"> <li>Taiwanese/ Chinese/ Japanese organic sweet peppers have good value for money.</li> </ul>	3	Adapted from the studies of Love <i>et al.</i> (2013) and McKnight <i>et al.</i> (2002).
5. <b>Trust intention</b> in purchasing products produced in different COO depending on chemical residue test information	<ul style="list-style-type: none"> <li>It is more likely that I buy Taiwanese/ Chinese/ Japanese sweet peppers if information on chemical residue testing is provided.</li> </ul>	3	Adapted from the studies of Love <i>et al.</i> (2013) and McKnight <i>et al.</i> (2002).

6. <b>Trust intention</b> in purchasing products produced in different COO depending on a price discount	<ul style="list-style-type: none"> <li>• It is more likely that I buy Taiwanese/ Chinese/ Japanese sweet peppers if it is on special offer.</li> </ul>	3	Adapted from the studies of Love <i>et al.</i> (2013) and McKnight <i>et al.</i> (2002).
7. <b>Institutional-based trust</b> in governments of different countries	<ul style="list-style-type: none"> <li>• I feel assured that the Taiwanese/ Chinese/ Japanese institutions do a good job in adequately protecting consumers.</li> </ul>	3	Adapted from the studies of Love <i>et al.</i> (2013).
8. <b>General trusting stance</b> regarding products produced from different COO	<ul style="list-style-type: none"> <li>• I generally like to consume conventional sweet peppers produced in Taiwan/ China/ Japan.</li> </ul>	3	New items Based on the concept of trusting stance in the studies of McKnight <i>et al.</i> (1998) and McKnight and Chervany (2001, 2002).
9. <b>General trusting stance</b> in organic products from different COO	<ul style="list-style-type: none"> <li>• I generally like to consume organic sweet peppers produced in Taiwan/ China/ Japan.</li> </ul>	3	Based on the concept of trusting stance in the studies of McKnight <i>et al.</i> (1998) and McKnight and Chervany (2001, 2002).

Second, following the analytic methodology of Hansson and Lagerkvist (2016), a principal component analysis (PCA) with Oblimin rotation was used to identify latent constructs as the drivers of food purchasing decisions behind the 25 attitudinal items (Rodríguez-Delgado *et al.* 2002; Costello and Osborne 2005). The number of components in the PCA is determined by the scree test<sup>66</sup> and the parallel analysis method<sup>67</sup> (Horn 1965; Hayton *et al.* 2004; Dinno 2009) using STATA version 14. The parallel analysis (Horn 1965) is considered to be among the most accurate methods (Dinno 2009; Timmerman and Lorenzo-Seva 2011). Afterward, the estimated individual-level component measures across the entire BWS important scores are obtained.

#### 5.2.4 Combining DCE and BWS

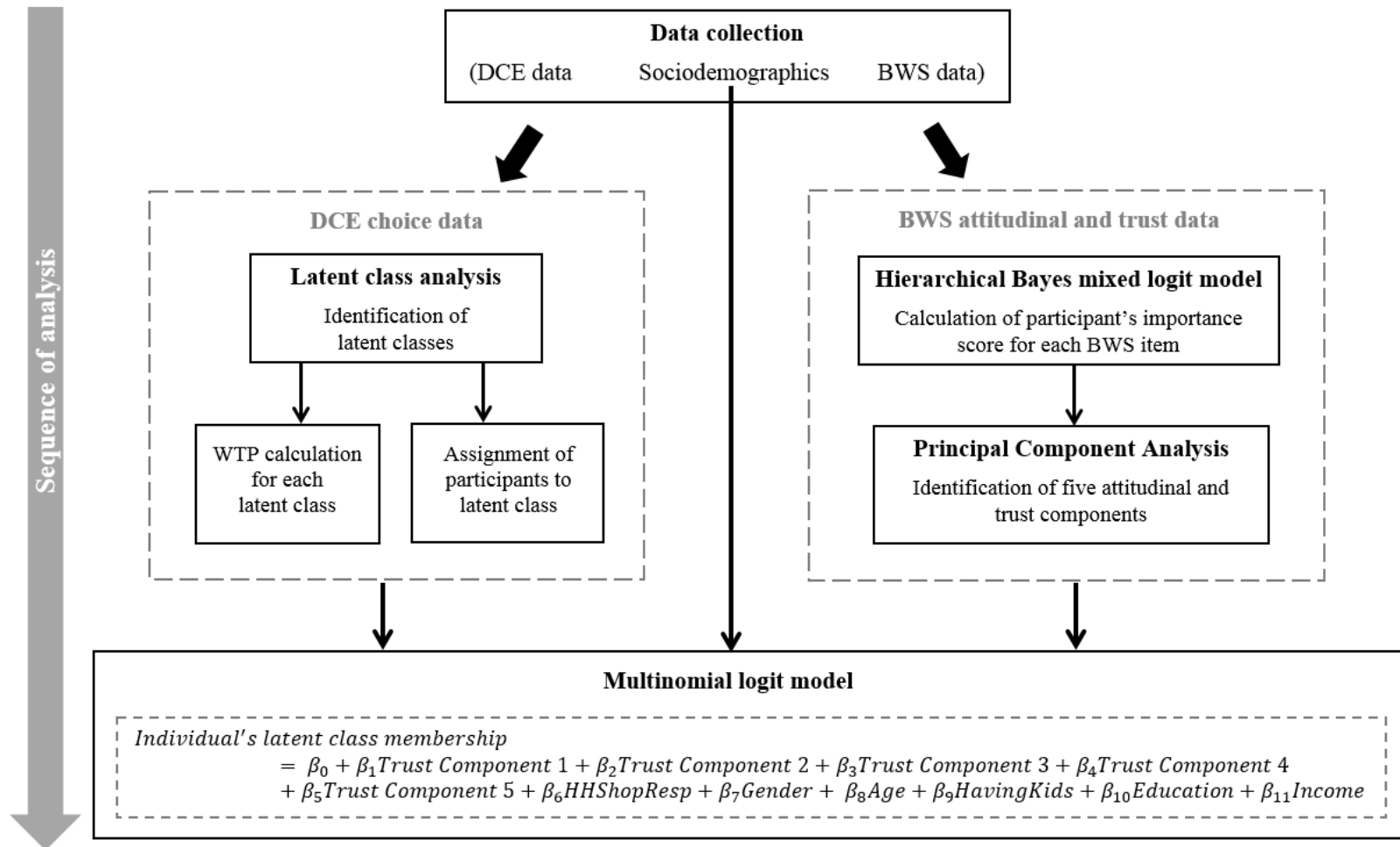
In order to better understand class membership as detected in the latent class analysis we follow the approach of Boxall and Adamowicz (2002). Thus, by estimating a multinomial logit model with participant's latent class membership as dependent variable and attitudinal as well as trust factors (from the BWS and PCA analysis) and sociodemographic characteristics as independent variables we try to explain class membership.

Figure 5.3 provides an illustration of the analysis flow.

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<sup>66</sup> The scree test involves examining the scree plot of the eigenvalues and looking for the “elbow” point in the data where the curve flattens out.

<sup>67</sup> Parallel analysis (Horn 1965) generates the random comparison eigenvalues against the actual estimated eigenvalues based on the correlation matrix that corresponds to the observed data by using the randomly generated data sets to extract the correct number of components/factors. It is considered to be among the most recommended factor/component retention methods (Fabrigar *et al.* 1999; Hayton *et al.* 2004) for assessment of the dimensionality of a variable set.



**Figure 5.3** Research flow diagram (step-wise analysis)<sup>68</sup>.

<sup>68</sup> In the (long-format) dataset, as each individual contributed to 24 rows in the DCE data and 100 rows in the BWS data, the DCE and BWS analysis were not estimated simultaneously but sequentially. This is due to the reason that none of the existing software, at current, is capable to estimate two different choice datasets concurrently in a model.

## 5.3 Results

### 5.3.1 Sample demographics

790 people joined the survey. Excluding those not responsible for their household's food shopping and/or not consuming red sweet pepper resulted in 459 (58% of all participants) valid responses<sup>69</sup>. Of the 459 respondents, 72.1% were female, 61.9% were married, 33.3% had children under the age of 18 living in their household and approximately 50.8% had completed a university or higher education, and 39.0% stated that their household average monthly net income was below NT 60,000 (approx. US\$ 2,001) (and 45.3% above NT 60,000). The respondents' average age was 39.2 years. Compared to the Taiwanese population the sample is biased towards younger and higher-educated segments. The high proportion of females in the sample is desirable because they are the primary food shoppers in most Taiwanese households (Lu Hsu and Lin 2006). Summary statistics for the demographic variables are presented in table 5.3.

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<sup>69</sup> The target sample size ( $N = 237$ ) was determined using a power analysis assuming three alternatives for each choice task, a 5% margin of error, and a desired 95% confidence interval. Our target sample size is consistent with guidelines in the conjoint analysis methodology literature (Orme 2010).

**Table 5.3** Demographical statistics of the sample

		Respondents		Taiwanese population <sup>a</sup>
<b>Number of respondents</b>		459		
		<b>Freq.</b>	<b>(%)</b>	<b>(%)</b>
<b>Gender</b>				
	Male	128	27.9	49.9
	Female	331	72.1	50.1
<b>Responsibility for household food shopping</b>				
	Fully	220	47.9	
	Partly	239	52.1	
<b>Age</b>				
	Up to 29	68	14.8	34.2
	30-49	311	67.7	32.5
	50 and over	78	17.0	33.4
	Missing <sup>70</sup>	2	0.4	
<b>Marital status</b>				
	Single	147	32.0	34.67
	Married	284	61.9	51.12
	Other (widowed/ divorced)	23	5.0	14.21
	Missing	5	1.1	
<b>Having children (&lt; 18 years old) in a household</b>		208	45.3	
<i>(dummy coded: 1 = Yes; 0 = No)</i>				
<b>Education</b>				
	Up to senior high school (12 years)	95	20.7	58.2
	College (14 years)	119	25.9	11.4
	University	233	50.8	30.4
	Missing	12	2.6	
<b>Avg. monthly net income of the household</b>				
	Up to NT 60,000	179	39.0	
	NT 60,001 – 120,000	152	33.1	
	NT 120,001 and over	56	12.2	
	Missing	72	15.7	

<sup>a</sup>Source: Ministry of the Interior, R.O.C. <https://www.moi.gov.tw/>; National Statistics, R. O. C. <https://www.stat.gov.tw/>

<sup>70</sup> Two female participants did not give information about their age. As both already obtained a university degree it seems reasonable to assume that they are above 18 years old, and thus eligible to participate in the survey. We therefore included their data in the analysis.

### 5.3.2 Identifying consumer segments based on DCE data

Determining the optimal numbers of classes requires a balanced assessment of the five major criteria reported in table 5.4 (Coltman *et al.* 2007): Log-likelihood, Percent Certainty (Pct. Cert.) (Hauser 1978; Ogawa 1987), Consistent Akaike Information Criterion (CAIC) (Bozdogan 1987), Chi-square and Bayesian Information Criterion (BIC) (Schwarz 1978). For this study, all indicators improve as more segments are added, supporting the presence of multiple segments in the sample. The four-segment solution (table 5.4) provides the best fit to the data. Although indicators further improve as more segments are added, the changes are much smaller from a four- to a five-segment model compared to the move from a three- to a four-segment model. Furthermore, the model interpretability is as important as the statistical tests (Swait 1994) and best for the four-class model.

Table 5.5 summarizes the results of the four-class model and provides information on the attribute importance scores as well as on the part-worth utilities (with respect to the attribute price information is provided on the coefficient) and the corresponding standard errors for each attribute level for the four different consumer segments identified in the latent class analysis. To allow for comparability between classes, attribute importance scores are standardized to sum up to 100% across all attributes of each segment. For the same reason part-worth utilities were re-scaled and zero-centered. Positive (negative) part-worth values indicate an increase (decrease) in utility relative to the average level of the respective attribute.

**Table 5.4** Criteria for selecting the optimal number of classes

<b>Participants</b>		459			
<b>Null log-likelihood</b>		-3817.85			
<b>Groups</b>	<b>Log-likelihood</b>	<b>Pct. Cert.</b>	<b>CAIC</b>	<b>Chi-Square</b>	<b>BIC</b>
<b>2</b>	-2691.81	29.49	5517.43	2252.09	5502.43
<b>3</b>	-2557.13	33.02	5319.43	2521.46	5296.43
<b>4</b>	-2454.62	35.71	5185.87	2726.48	5154.78
<b>5</b>	-2397.36	37.21	5142.64	2840.99	5103.64
<b>6</b>	-2358.04	38.24	5135.36	2919.63	5088.36

As shown in table 5.5, attribute importance considerably differs between the four classes. For segments 1 (*Japan Lovers*) and 2 (*Domestic Supporters*) COO is by far the most important attribute (attribute importance: 59.8% and 71.7% respectively). Consumers of both segments strongly dislike China as a COO. Price is the second most important attribute in both segments (attribute importance: 24.5% and 16.2%, respectively) followed by Chemical Residual Testing (CRT) information (attribute importance: 8.9% and 6.9%) with production methods (attribute importance: 6.8% and 5.2%) being least important. As expected, *Japan Lovers* and *Domestic Supporters*, like the other groups, reveal a negative price elasticity and prefer organic to conventional red sweet peppers. Regarding the attribute levels for CRT information preferences both groups prefer CRT information to no information. However, while *Japan Lovers* obtain above-average utility from CRT approved in either the production country or Taiwan—though with a higher preference for the former—*Domestic Supporters* highly value CRT approved in Taiwan.

In contrast to segments 1 and 2, for respondents in segment 4 (*Process Quality Supporters*) production method, COO and CRT information is of similar importance (attribute importance: 32.5%, 32.3% and 28.0%, respectively) while price plays a minor role in consumers' purchase decisions of red sweet peppers (attribute importance: 7.3%). *Process Quality Supporters* prefer Taiwanese over Japanese foods and dislike products from China. They prefer organic products and those which are CRT approved in Taiwan. Finally, for consumers of class 3 (*Price Conscious Consumers*) price is by far the most important attribute (attribute importance: 54.0%). COO takes the second place but is with an attribute importance score of 27.4% of much lower relevance. *Price Conscious Consumers* especially prefer Japanese products, but also like those from Taiwan while products originating from China are disliked, though to a lesser extent compared to the other three segments. CRT information is the third important attribute (attribute importance: 15.3%) with CRT approved in Taiwan being preferred. No CRT is less disliked than CRT approved in production country. Production method is of little relevance (attribute importance: 3.4%) for consumers of this group. For members of the *Price Conscious Consumers* the No Choice Option is linked to a high negative value (-320.63) implying not purchasing any red sweet pepper is associated with a high utility loss. Accordingly, the opt-out option is hardly chosen (0.17% for the share of the opt-out decision). In comparison, the share of deciding for the No Choice Option is with

1.24%, 8.69% and 13.87% for the *Process Quality Supporters*, *Japan Lovers*, *Domestic Supporters*, respectively seven to 82 times higher.

To ease comparison of attribute level importance between attributes of one consumer segment as well as between segments WTP measures were calculated (see table 5.6). Table 5.6 reveals that *Domestic Supporters* have a high WTP of NT 13.07 (approx. US\$ 0.44) per 600 grams for fresh red sweet peppers originating from Taiwan while they would buy red sweet peppers originating from China only at a high discount (NT -13.46) (approx. US\$ -0.45). All other attribute levels just marginally influence *Domestic Supporters'* WTP. The latter also holds for consumers belonging to the *Japan Lovers* class. This group is, however, willing to pay extra for products originating from Taiwan (NT 3.94) (approx. US\$ 0.13), and even more for those from Japan (NT 5.36) (approx. US\$ 0.18). In line with the *Domestic Supporters* they would only buy Chinese red sweet peppers at a high discount (NT -9.30) (approx. US\$ -0.31). Furthermore, *Process Quality Supporters* exhibit a high WTP for several attribute levels, e.g. organic products (NT 13.31) (approx. US\$ 0.44) and Taiwan-authorized chemical residue testing information (NT 10.90) (approx. US\$ 0.36) while they only would buy products from China (NT -15.35) (approx. US\$ -0.51), conventional products (NT -13.31) (approx. US\$ -0.44) or those with no CRT information (NT -12.05) (approx. US\$ -0.40) if they obtain a high discount. Finally, the *Price Conscious Consumers* segment is characterized by very low WTP values for every attribute level.

**Table 5.5** Latent class analysis of DCE data

<b>Null log-likelihood</b>		-3817.85							
<b>Restricted log-likelihood</b>		-2454.62							
<b>Pct. Cert.</b>		35.71							
<b>Consistent Akaike Info Criterion</b>		5185.87							
<b>Chi-Square</b>		2726.38							
<b>Bayesian Information Criterion</b>		5154.87							
<b>Segmentation</b>		<i>1. Japan Lovers</i>		<i>2. Domestic Supporters</i>		<i>3. Price Conscious Consumers</i>		<i>4. Process Quality Supporters</i>	
<b>Segment size (N=459)</b>		31.3%		26.1%		21.8%		20.8%	
		<b>Att. Imprt.</b>	<b>Rescaled Util.# (S.E.)</b>	<b>Att. Imprt.</b>	<b>Rescaled Util. (S.E.)</b>	<b>Att. Imprt.</b>	<b>Rescaled Util. (S.E.)</b>	<b>Att. Imprt.</b>	<b>Rescaled Util. (S.E.)</b>
<b>COO</b>		59.83		71.66		27.36		32.26	
	Taiwan		64.38 (0.22)***		141.18 (0.21)***		28.98 (0.18)***		54.18 (0.18)***
	Japan		87.46 (0.11)***		4.25 (0.13)		40.22 (0.10)***		20.67 (0.10)***
	China		-151.85 (0.30)***		-145.44 (0.29)***		-69.20 (0.23)***		-74.85 (0.23)***
<b>Production methods</b>		6.83		5.23		3.36		32.45	
	Organic		13.66 (0.06)***		10.46 (0.07)***		6.73 (0.07)*		64.90 (0.07)***
	Conventional		-13.66 (0.06)***		-10.46 (0.07)***		-6.73 (0.07)*		-64.90 (0.07)***
<b>CRT</b>		8.85		6.90		15.33		27.98	
	CRT appr. in prod. country		14.47 (0.08)***		-1.39 (0.10)		-23.50 (0.09)***		5.58 (0.09)
	CRT appr.in TW		6.46 (0.08)**		14.50 (0.10)***		37.84 (0.09)***		53.16 (0.09)***
	No CRT		-20.94 (0.10)***		-13.11 (0.12)**		-14.34 (0.12)**		-58.74 (0.12)***
<b>Price</b>		24.49		16.21		53.95		7.32	
			-32.65 (0.13)***		-21.61 (0.13)***		-71.93 (0.10)***		-9.75 (0.10)*
<b>No Choice</b>			-55.30 (0.19)***		-26.87 (0.17)***		-320.63 (0.37)***		-156.05 (0.37)***

\*\*\*, \*\*, \* Statistical significant level at 1%, 5%, 10%

# Rescaled part-worth utilities are zero-centered and normalized measures.

**Table 5.6** Willingness to pay of different consumer segments

Segmentation		<b>1. Japan Lovers</b>		<b>2. Domestic Supporters</b>		<b>3. Price Conscious Consumers</b>		<b>4. Process Quality Supporters</b>	
Segment sizes (N=459)		31.3%		26.1%		21.8%		20.8%	
(NT/ 600 gram)		WTP	[95% C.I. Lower, Upper <sup>§</sup> ]	WTP	[95% C.I. Lower, Upper]	WTP	[95% C.I. Lower, Upper]	WTP	[95% C.I. Lower, Upper]
<b>COO</b>									
	Taiwan	3.94	[3.16, 4.73]	13.07	[9.45, 16.68]	0.81	[0.44, 1.17]	11.11	[4.11, 18.11]
	Japan	5.36	[4.46, 6.15]	0.39	[-0.28, 1.06]	1.12	[0.96, 1.27]	4.24	[2.35, 6.12]
	China	-9.30	[-10.83, -7.77]	-13.46	[-17.05, -9.86]	-1.92	[-2.42, -1.43]	-15.35	[-24.09, -6.61]
<b>Production methods</b>									
	Organic	0.84	[0.64, 1.04]	0.97	[0.51, 1.42]	0.19	[0.05, 0.32]	13.31	[4.27, 22.35]
	Conventional	-0.84	[-1.04, -0.64]	-0.97	[-1.42, -0.51]	-0.19	[-0.32, -0.05]	-13.31	[-22.35, -4.27]
<b>CRT</b>									
	CRT appr. in prod. country	0.89	[0.65, 1.12]	-0.13	[-0.66, 0.41]	-0.65	[-0.73, -0.58]	1.14	[-0.28, 2.57]
	CRT appr. in TW	0.40	[0.21, 0.58]	1.34	[0.69, 1.99]	1.05	[0.85, 1.25]	10.90	[3.92, 17.88]
	No CRT	-1.28	[-1.59, -0.97]	-1.21	[-1.95, -0.48]	-0.40	[-0.60, -0.19]	-12.05	[-20.13, -3.96]

<sup>§</sup> Upper and lower limits from the confidence intervals of WTP values, calculated with the delta method (Hole, 2007) at 95% confidence level.

**Table 5.7** Parallel analysis performance for component retention decisions across 25 BWS statements

Component or Factor	Adjusted Eigenvalue	Unadjusted Eigenvalue	Estimated Bias
1	6.33	6.79	0.46
2	6.17	6.53	0.36
3	3.03	3.34	0.31
4	1.25	1.53	0.28
5	1.06	1.31	0.25

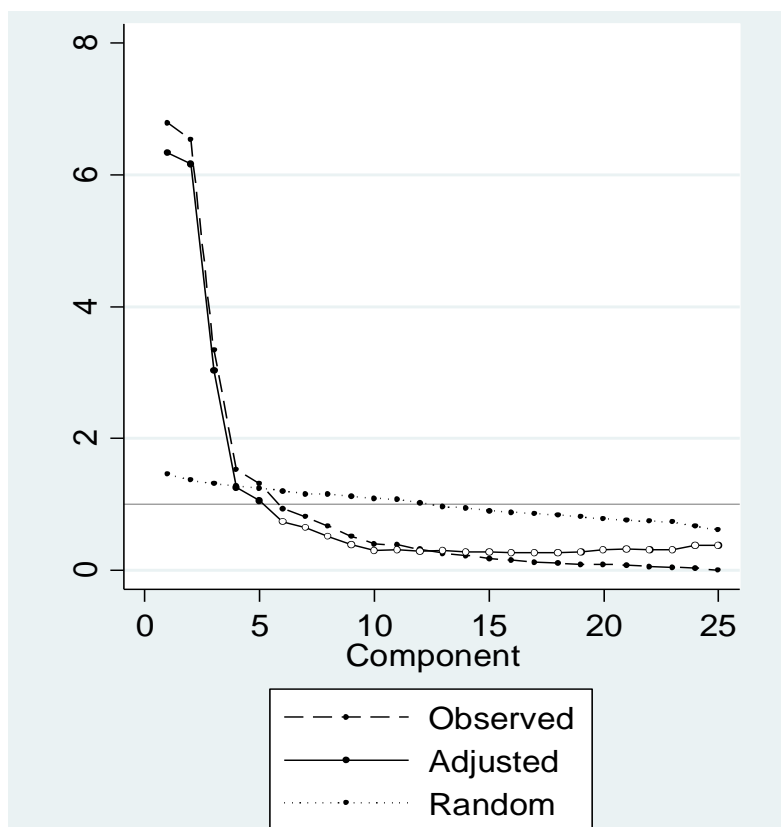
### 5.3.3 Identifying consumers' attitude and trust based on BWS data

Consumers' attitude and trust as obtained from the BWS data were estimated through hierarchical Bayesian analysis. Information on the importance consumers attach to each of the 25 attitudinal and trust statements is provided in Appendix 5.4. Appendix 5.4 reveals that respondents' trust with respect to products originating from China as well as trust in Chinese institutions is very low. All attitudinal and trust statements with reference to China (statements 2, 5, 8, 11, 18, 21, and 24) have an average importance score below one (between 0.05 and 0.75). In contrast, average importance scores for all other statements range between 1.98 (I generally like to consume conventional red sweet peppers produced in Japan) to 8.42 (It is more likely that I buy Taiwanese red sweet peppers if they have information on chemical residue testing).

Following on the analytic method presented in the paper of Hansson and Lagerkvist (2016), we performed principal component analysis (PCA) based on the individual-level importance scores obtained from the hierarchical Bayesian estimation to check the dimensionality of the BWS data. Examining the eigenvalues (table 5.7) and scree plot (figure 5.4) with a permutation test approach and applying Oblimin rotation (see table 5.9) we obtained a factor solution containing 5 components. Factor loading of all attitudinal statements exceeded the cut-off value of 0.4<sup>71</sup>. Together, the five components explained 78.03% of the total variance. Table 5.8 shows the initial Eigenvalues, variance explained by each factor and the cumulative variance.

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<sup>71</sup> A cut-off for statistical significance of the factor loadings of 0.40 was used, according to guidelines presented by Hair *et al.* (2014) for sample sizes greater than 200. A more conservative cut-off value would have been 0.50. Reasons for deciding on this lower value are first, that this is an exploratory factor analysis, and the factors detected are reasonable. Second, with a sample size of 459 it seems unlikely that the weaker factor we found ('I feel assured that the Chinese institutions do a good job in adequately protecting consumers' with a factor loading of 0.454) is random noise.



**Figure 5.4** Diagnostic scree plotting graph (performed by parallel analysis) for PCA on estimated BWS importance scores data<sup>72</sup>.

The first component includes five items related to trust and liking of organic products from Japan and skepticism towards Taiwanese conventional products (Trust in Japan), while the ten items under the second component refer to trust and liking of organic and of Taiwanese products and institutions with a skepticism towards Japan (Trust in Taiwan & organic). The third component covers three items referring to trust in Chinese products (Trust in Chinese products). The two items of the fourth component include variables relating to a lack of trust in the superiority of organic products (No trust in organic). Finally, four of the five items of the last component refer directly to the trust and liking of organic products from China as well as the trust in Chinese institutions (Trust in Chinese organic products). For the fifth item ('It is more likely that I buy Taiwanese red sweet peppers if they have information on chemical residue testing') this is not the case.

<sup>72</sup> By using scree plot the number of principal components can be obtained and verified via looking at the elbow point where the steep curve happens.

**Table 5.8** Total variance explained<sup>73</sup>

<b>Component</b>	<b>Initial eigenvalues</b>		
	Total	Percentage of variance	Cumulative percentage
1	6.79	27.17	27.17
2	6.53	26.12	53.29
3	3.34	13.38	66.67
4	1.53	6.12	72.79
5	1.31	5.24	78.03
6	0.94	3.75	81.78
7	0.81	3.24	85.02
8	0.67	2.68	87.70
9	0.52	2.06	89.76
10	0.40	1.60	91.36
11	0.39	1.54	92.90
12	0.32	1.27	94.17
13	0.26	1.04	95.21
14	0.23	0.90	96.11
15	0.18	0.73	96.84
16	0.15	0.61	97.45
17	0.12	0.49	97.94
18	0.11	0.43	98.37
19	0.09	0.38	98.75
20	0.09	0.36	99.10
21	0.08	0.32	99.42
22	0.06	0.24	99.66
23	0.05	0.19	99.85
24	0.04	0.15	100.00
25	0.00	0.00	100.00

Extraction method: PCA

<sup>73</sup> The first five rows in table 5.8 present the eigenvalues for the BWS individual-level scores and percentage of variance for the five components.

**Table 5.9** Principal component analysis with oblimin rotation of 25 BWS items

<b>BWS statement</b>		<b>Comp. 1</b>	<b>Comp. 2</b>	<b>Comp. 3</b>	<b>Comp. 4</b>	<b>Comp. 5</b>
		Trust in Japan	Trust in Taiwan & organics	Trust in Chinese products	No trust in organics	Trust in Chinese organic products
9.	I generally like to consume organic sweet peppers produced in Japan.	0.890				
12.	Japanese organic sweet peppers are trustworthy.	0.863				
4.	I generally like to consume conventional sweet peppers produced in Taiwan.	-0.817				
20.	It is more likely that I buy Taiwanese sweet peppers if it is on special offer.	-0.794				
25.	Japanese organic sweet peppers have good value for money.	0.700				
10.	Taiwanese organic sweet peppers are trustworthy.		0.866			
22.	It is more likely that I buy Japanese sweet peppers if it is on special offer.		-0.837			
7.	I generally like to consume organic sweet peppers produced in Taiwan.		0.818			
15.	With purchasing organic sweet peppers I help preserving the environment and natural resources.		0.785			
6.	I generally like to consume conventional sweet peppers produced in Japan.		-0.758			
1.	I feel assured that the Taiwanese institutions do a good job in adequately protecting consumers.		0.748			
19.	It is more likely that I buy Japanese sweet peppers if information on chemical residue testing is provided.		-0.704			
13.	I feel sure that organic sweet peppers contain higher vitamin C and anti-cancer substances than conventional ones.		0.679			
23.	Taiwanese organic sweet peppers have good value for money.		0.631			

3.	I feel assured that the Japanese institutions do a good job in adequately protecting consumers.	-0.517	
18.	It is more likely that I buy Chinese sweet peppers if information on chemical residue testing is provided.	0.906	
21.	It is more likely that I buy Chinese sweet peppers if it is on special offer.	0.749	
5.	I generally like to consume conventional sweet peppers produced in China.	0.615	
14.	I feel sure that organic sweet peppers contain the same vitamin C and anti-cancer substances as conventional ones.		-0.816
16.	There are no differences between buying organic sweet peppers or conventional ones with respect to preserving the environment and natural resources.		-0.777
8.	I generally like to consume organic sweet peppers produced in China.		0.930
24.	Chinese organic sweet peppers have good value for money.		0.928
11.	Chinese organic sweet peppers are trustworthy.		0.903
17.	It is more likely that I buy Taiwanese sweet peppers if information on chemical residue testing is provided.		-0.828
2.	I feel assured that the Chinese institutions do a good job in adequately protecting consumers.		0.454

#### 5.3.4 Characterizing consumer segments with respect to attitudes and trust

To identify the relevance of attitudes and trust in determining differences between segments in the choice model (see section 5.3.2), a latent segmentation model is estimated. For each individual in the sample, factor scores were calculated for all five attitudinal and trust components identified in Section 3.3. Subsequently, we estimated two multinomial logit models taking participant's latent class membership as the dependent variable and the individual attitudinal and trust factor scores alone (Model 1) and in combination with sociodemographic information (Model 2) as independent variables. Both models fit the data well according to the Likelihood Ratio (LR) Chi-square test (see table 5.10). Pseudo R-square measures indicate that the models explain 23% and 25% of the variance, respectively. Hence, the trust related components alone explain 23% of the variance while sociodemographics only add two percentage points to the model fit.

The segment membership parameters are summarized in table 5.10. The parameters of the class *Japan Lovers* have been normalized to zero. This is necessary to allow for identification of class membership of the three other segments. It, however, implies that the results of the segments *Domestic Supporters*, *Price Conscious Consumers* and *Process Quality Supporters* have to be interpreted relative to the segment of *Japan Lovers*.

**Table 5.10** Multinomial logit models: DCE latent class membership regressed on five trust components (Model 1) and on five trust components plus sociodemographics (Model 2)

(N = 459)	Model 1			Model 2		
Log-likelihood of null model	-629.93			-629.93		
Log-likelihood of restricted model	-484.92			-469.61		
LR test Chi-square (33)	290.02			320.64		
Prob > Chi-square	0.00			0.00		
Pseudo R-squares	0.23			0.25		
DCE four segments	<b>Coef.</b>	<b>Std. Err.</b>	<b>Sig.</b>	<b>Coef.</b>	<b>Std. Err.</b>	<b>Sig.</b>
<i>Japan lovers</i>	<i>Reference group</i>					
<i>Domestics supporters</i>						
Trust in Japan	-0.84	0.16	***	-0.81	0.17	***
Trust in Taiwan & organic	1.29	0.19	***	1.33	0.2	***
Trust in Chinese products	-0.28	0.35		-0.1	0.35	
No trust in organic	0.09	0.16		0.04	0.17	
Trust in Chinese organic prod.	-0.1	0.34		-0.14	0.35	
Full_HHShopResp				0.63	0.31	**
Female				-0.16	0.34	
Age_below40				-0.13	0.32	
Have_Kids				-0.48	0.3	
Edu_aboveCollege				-0.67	0.38	*
HHincome_above90k				-0.04	0.34	
Constant	-0.42	0.22	**	0.25	0.49	
<i>Price conscious consumers</i>						
Trust in Japan	-0.89	0.18	***	-0.86	0.18	***
Trust in Taiwan & organic	-0.03	0.17		0.09	0.18	
Trust in Chinese products	1.19	0.24	***	1.26	0.26	***
No trust in organic	0.08	0.16		-0.01	0.17	
Trust in Chinese organic prod.	0.51	0.28	*	0.49	0.28	*
Full_HHShopResp				-0.01	0.33	
Female				-0.63	0.34	*
Age_below40				0.48	0.35	
Have_Kids				-0.79	0.33	**
Edu_aboveCollege				-0.9	0.42	**
HHincome_above90k				-0.16	0.35	
Constant	-0.26	0.18		0.99	0.49	**

<i>Process quality supporters</i>						
Trust in Japan	-0.36	0.17	**	-0.36	0.17	**
Trust in Taiwan & organic	0.8	0.18	***	0.85	0.19	***
Trust in Chinese products	0.67	0.26	**	0.69	0.27	**
No trust in organic	0.23	0.17		0.23	0.18	
Trust in Chinese organic prod.	0.93	0.24	***	0.91	0.25	***
Full_HHShopResp				0.25	0.33	
Female				-0.13	0.37	
Age_below40				0.48	0.35	
Have_Kids				-0.15	0.32	
Edu_aboveCollege				-0.63	0.41	
HHincome_above90k				-0.15	0.37	
Constant	-0.26	0.18		0.06	0.52	

\*\*\*, \*\*, \*Statistical significant level at 1%, 5%, 10%

As expected, attitude towards and trust in products, labels, origins and institutions have a considerable influence on segment membership. Table 5.10 indicates that all components but ‘No trust in organic’ significantly influence class membership with respect to the purchase of red sweet pepper. Not surprisingly, high ‘trust in Japanese organic products’ reduces the likelihood of a consumer to belong into any other segment but *Japan Lovers*. Also in line with expectations, high ‘trust in Taiwan and organic’ increases the likelihood to be part of the segments *Domestic Supporters* and *Process Quality Supporters* relative to the segment *Japan Lovers*, respectively. Those consumers with high ‘trust in Chinese products’ or ‘high trust in Chinese organic products’ have a greater likelihood to be a member of the *Price Conscious Consumers* or the *Process Quality Supporters* than of the *Japan Lovers*. The influence of the trust components on class membership holds for Model 1 as well as for Model 2. The latter model also investigates the influence of sociodemographics on classification. The findings indicate that compared to *Japan lovers*, consumers belonging into the segment of *Domestic Supporters* are more likely to have full shopping responsibility for their household and to have a lower level of education. *Price Conscious Consumers* have compared to *Japan Lovers* a higher probability to be female and to have no kids. Also, this group has a lower probability to have an above-college

educational level when compared to the reference segment. Comparing *Process Quality Supporters* and *Japan Lovers*, it becomes obvious that sociodemographics have no influence on class membership.

## 5.4 Discussion

The present study is the first that combines a latent class model for discrete choices with BWS to uncover attitudinal and trust dimensions. This approach allows us 1) to distinguish consumer segments that differ in their preferences for selected process and food safety standards, and 2) to reveal the importance of consumers' attitudes and trust in explaining consumers' group membership. Our study illustrates that combining DCE and BWS allows for a better understanding of the drivers of consumers' food choices and thus provides additional important information for decision makers in the economic and policy arena.

Based on our analysis we could distinguish four segments of Taiwanese consumers based on differences they attach to various process attributes and price. The largest group can be described as *Japan lovers*. According to Huang (2011), the trend of Taiwanese consumers to buy Japanese products can be explained by the positive cultural image of "Japanese-ness." In our analysis we show that respondents belonging to the segment *Japan lovers* reveal a higher level of trust in Japan relative to the other three consumer segments identified. Furthermore, Ma *et al.* (2012) show that Japanese products have established a reputation of being of high quality. Quality seems an important driver for this consumer segment's purchase decisions as this group is not interested in special offers and perceives the generally more expensive Japanese products (Becker 2009) as better value for the money (see tables 5.9 and 5.10).

The second largest group (26.1%) identified in our study, *Domestic supporters*, has been detected in previous DCE-based research investigating the relevance of COO in consumers' food purchase decisions, however, with slightly smaller segments compared to our findings, (Dekhili *et al.* 2011; Lim *et al.* 2013). Our segment of *Domestic supporters* has a high WTP for products originating from Taiwan. According to our results this originates from a high level of institutional-based trust in the Taiwanese government and its regulatory and controlling power as well as a high level of trust belief in

the quality of Taiwanese products. *Domestic supporters* have a tendency towards ethnocentrism (Ma *et al.* 2012). As revealed in previous research, consumers with a higher level of ethnocentrism favour domestic to foreign goods, perceive the quality of domestic food products higher than those of foreign goods, and have a higher purchasing preference for the former (Rahmawati and Muflikhati 2016; Vabø *et al.* 2017). In line with Lim *et al.* (2013) less-educated consumers were found to be more likely in the segment of *Domestic supporters*.

For the *Price Conscious Consumers* identified in our study, process attributes are of relatively low relevance when buying red sweet peppers. Production method does not impact, and COO and CRT have only a small impact on consumers' WTP in this group. Price is the determinant that primarily drives consumers' purchase decisions in this segment (attribute importance 53.95%). Price-conscious consumer segments have also been found in previous DCE based studies investigating the relevance of process characteristics in consumers' food purchase decisions with some studies identifying a segment of similar size (around 20% e.g. Grunert *et al.* 2018; Koistinen *et al.* 2013; Boncinelli *et al.* 2017) while others reveal a considerably larger group of price-conscious consumers (Ortega *et al.* 2011; Apostolidis and McLeay 2016; Peschel *et al.* 2016; Janssen and Langen 2017). The class determinant estimates revealed that male respondents were more likely to be in the class of *Price Conscious Consumers*, a result in line with the findings of Grunert *et al.* (2018) and Peschel *et al.* (2016). In addition, our results indicate that respondents in this segment are less educated and more likely not to have children.

As indicated above, members of the price-conscious segment attach a higher importance to chemical residue test information compared to production method. Considering that organic certification implies the logic of zero chemicals, this either reflects that respondents are not aware of the core standards behind the organic label and/or do not trust organic labels. According to Chen (2009) and Tung *et al.* (2012), Taiwanese consumers indeed have some doubt that products labelled as organic are always grown without using synthetic fertilizers, pesticides, and chemicals. Based on a literature review, Yiridoe *et al.* (2005) come to the conclusion that consumers have difficulties in understanding the complexity of organic standards. Chemical residue test information is easier to understand when compared to organic standards, which might be of special relevance for the price-conscious segment as it consists of a higher share of less-educated consumers.

The analysis provides additional interesting insights regarding this group of consumers. *Price Conscious Consumers* are characterized by a relative low trust in Japan and a relative high trust in Chinese products in general, and in Chinese organic product more specifically (see table 5.10). This holds despite the fact that this consumer segment also has the lowest WTP for Chinese products (see table 5.6). Festinger's theory of cognitive dissonance might provide an explanation for this finding (Festinger 1957). With Chinese products typically the cheaper alternative and given the dominant relevance of price for members of this segment, price-conscious consumers often will end up with Chinese products in their shopping cart. A lack of trust in and liking of Chinese products and a high trust and liking of Japanese and Taiwanese products would lead to dissonance with the choice behaviour. The stronger the latter, the higher the attractiveness of the unchosen alternative compared to the actual choice. One way for consumers to relax or correct this disturbing and unpleasant psychological state is a dissonance-related attitude change (Losch and Cacioppo 1990), implying a correction towards a more positive perception of Chinese products and a higher trust in China.

The segment of *Process Quality Supporters* is with a share of 20.8% only slightly smaller than the group of *Price Conscious Consumers* but in contrast to the latter, price is of little importance for the former. This group attaches a much higher importance to the attributes production method and CRT information than any other segment. Members of this group are willing to pay high price premia for organically-produced red sweet peppers as well as for those with a CRT approved in Taiwan indicating that for members of this segment, health and food safety are of high importance. This assumption is supported by Chen (2009) who finds that health concerns are the most important determinant for Taiwanese consumers forming a positive attitude towards organic. Along the same line Hasimu *et al.* (2017) and Xie *et al.* (2015) show that health and food safety are the core motives for consumers in China to buy organic foods. Our analysis reveals that a high level of trust (Component 1, 2, 3 and 4 in table 5.10) increases the probability of a consumer belonging to the segment of *Process Quality Supporters*. This result is in line with Liang (2016), who showed that trust in labelling is essential for Taiwanese consumers' intent to purchase organic products.

The four segments identified reveal the difference in importance Taiwanese consumer groups attach to different attributes when buying red sweet peppers. From a marketing perspective this implies that a

'one size fits all' marketing strategy is inappropriate. Thus, marketers need to develop segment-specific offerings in order to better target the needs of their customers. For the two largest segments, the *Japan Lovers* and *Domestic Supporters*, by far the most important attribute is COO though with clearly distinct preference for the attribute levels. In addition, both groups reveal very high Opt-Out ratios (*Japan Lovers* 8.7%; *Domestic Supporters* 13.9%). Thus, to secure loyalty of customers and to extract a price premia in both groups, retailers need to have red sweet peppers from Japan as well as Taiwan in their assortment. The *Price Conscious Consumers* attach little value to any of the attributes considered in our purchase experiment but price. This group will switch products, in general choosing the cheapest alternative. According to Jing and Wen (2008) and Koçaş and Bohlmann (2008), retailers can win this group of consumers by providing low-price alternatives (e.g. conventional sweet red pepper) or by providing price discounts (e.g. potentially for larger size packages). Finally, for the *Process Quality Supporters*, all process attributes are not only of relatively high but also of about equal importance in consumers' purchase decisions, while price seems to be of minor relevance. The low Opt-Out ratio of 1.7%, in addition, signals that this group can be retained if retailers offer red sweet peppers that fulfil at least one of the desired attribute levels. This, in fact, does not require a further differentiation beyond the one already suggested for the *Japan Lovers* and *Domestic Supporters*. However, large retailers that have the possibility to further differentiate their assortment can extract high price premia by offering organic red sweet peppers and/or red sweet peppers with a CRT approved in Taiwan. Along the same lines, smaller retailers may be able to run a successful niche strategy by focusing on the needs of this smaller segment.

The recommendation so far takes class membership as given. Our findings, however, show that while sociodemographics provide little power to explain class membership (compare Models 1 and 2 in table 5.10), a result in line with previous research (Gao and Schroeder 2009; Janssen and Langen 2017; Apostolidis and McLeay 2016), attitudinal and trust perceptions significantly influence class membership, explaining 23% of the models' variance. Thus, assuming labelling to be sufficient for consumers to consider process attributes in their purchase decisions will likely prove wrong. For labelling to receive credence, it seems essential to implement effective control authorities and secure a high level of transparency to (re)gain and maintain consumers' trust. Furthermore, our findings suggest

a lack of knowledge regarding what organic implies, at least for the segment of *Price Conscious Consumers* (see discussion above). Accordingly, action is needed by private and public agencies to raise consumers' knowledge regarding the standards behind organic products.

Last, some potential limitations of this study must be acknowledged. In this study we focus on one product, fresh red sweet pepper. Whether our findings are transferrable to other products being part of Taiwanese people's daily diet should be addressed in further research. Also, our study focused on consumers in one country, Taiwan. A comparison of results across countries would be desirable. In particular, it would be interesting to carry out the same kind of study in China and/or Japan, and thus in competing markets, and investigate whether there exist segments characterized by similar preferences and characteristics across locations. Respective insights could be valuable for producers in their decision to export or concentrate on local markets. To avoid consumer fatigue we have decided for four product attributes of red sweet pepper based on a pre-study. However, it must be considered that the selection of attributes and attribute levels may impact DCE outcomes. With respect to the same argument we limited the number of BWS statements to 25<sup>74</sup>, nevertheless, there could be also argument for a different choice that might have had an impact on the results. More specifically, we suggest for future studies to give more attention to capturing consumer animosity as a means to deepen the understanding about consumers' attitude and perception, especially in the case of a negative COO image. Moreover, as we combine in our multinomial logit model the findings from a DCE latent class analysis (class membership enters as dependent variable) and the outcome of the BWS Bayesian estimation (trust components enter as independent variables) we cannot rule out that there is a problem of endogeneity. Finally, a simultaneous estimation of the DCE and BWS data would have been desirable. However, currently available software is incapable of estimating two large choice datasets (per individual 24 DCE rows and 100 BWS rows) concurrently in a single model. Therefore, such analysis will only be possible in the future with the development of more sophisticated software.

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<sup>74</sup> To be all inclusive and thus cover all different dimensions of trust, with respect to all relevant characteristics of the products would have resulted in more than 70 BWS statements, which would have not been manageable. We decided also based on considering statements from the literature for the 25 statements included.

## **5.5 Conclusion**

Our study revealed that an analysis of what Taiwanese consumers value in their purchase of red sweet peppers falls short if it does not account for market heterogeneity. This holds as consumers (consumer segments) differ in the weights they assign to different product and process attributes. The findings of this paper, in addition, strongly support the argument that consumers' attitudinal and trust perception are important determinants for class membership. These insights help to understand what actually drives class membership and to derive targeted marketing and policy strategies. From a methodological point of view, our paper is the first to combine a latent class model for discrete choices with BWS. The latter allowed us to capture consumers' attitudinal and trust perceptions in a discriminant manner. Our results show that combining those methods enriches insights gained from latent class choice analysis.

### Appendix 5.1: Standard latent class model (LCA)

Following the random utility theory (McFadden 1973), the utility of individual  $n$  ( $n = 1, \dots, N$ ) from choosing alternative  $j$  ( $j = 1, \dots, J$ ) is the sum of a systematic observed component ( $\beta_n X'_{nj}$ ) and a random error term ( $\varepsilon_{nj}$ ) (Train 2009):

$$U_{nj} = \beta_n X'_{nj} + \varepsilon_{nj}, \quad \beta_n \sim N(\alpha, D) \quad (1)$$

According to approaches utilized by Swait (1994) and Boxall and Adamowicz (2002), in the LCA model the utility of alternative  $j \in J$  to individual  $n$  who belongs to a specific class  $s$  can be expressed as:

$$U_{nj|s} = \beta_s X'_{nj} + \varepsilon_{nj} \quad (2)$$

where the  $X'_{nj}$  is a vector of explanatory variables associated with alternative  $j$  and individual  $n$ ,  $\beta_s$  is a class specific parameter vector associated with the vector of explanatory attributes variables and  $\varepsilon_{nj}$  is the error term. The probability of individual  $n$  choosing alternative  $j$  from a particular choice set of alternative  $J$  is conditional to the fitting of the individual to class  $s$ , which can be estimated using Eq. (3):

$$P_{nj|s} = \frac{\exp(\beta_s X'_{nj})}{\sum_{j=1}^J \exp(\beta_s X'_{nj})} \quad (3)$$

In addition, the belonging of individuals to the  $S$  classes is determined by a classification model as a function of individual specific invariant characteristics. The class membership probability of an individual  $n$  belonging to class  $s$  can be specified as Eq. (4):

$$C_{ns} = \frac{\exp(\gamma_s Z_n)}{\sum_{s=1}^S \exp(\gamma_s Z_n)} \quad (4)$$

Where  $\gamma_s$  is the class membership vector estimates and  $Z_n$  is a vector of individual specific invariant variables<sup>75</sup> that enter the model for class membership. The  $N$  individuals can be divided into  $S$  latent classes and individuals with the similar preferences fall into the same class. Thus, the joint probability that individual  $n$  belongs to a specific class  $s$  and selects alternative  $j$  can be shown by Eq. (5):

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<sup>75</sup> According to Boxall and Adamowicz (2002) a vector labelled  $Z_n$  as covariates can be used as a proxy for individual motivating factors influencing the choice. This vector  $Z$  consists of both, the observable indicators of the latent attitudes expressed by the respondent and of the observable socioeconomic characteristics such as gender.

$$P_{nj} = \sum_s^S P_{nj|c} C_{ns} = \sum_{s=1}^S \frac{\exp(\beta_s X'_{nj})}{\sum \exp(\beta_s X'_{nj})} \times \frac{\exp(\gamma_s Z_n)}{\sum \exp(\gamma_s Z_n)} \quad (5)$$

Where  $\beta_s$  is the parameter vector of individuals in the class  $s$ , and  $\frac{\exp(\gamma_s Z_n)}{\sum \exp(\gamma_s Z_n)}$  is the probability of the individual  $n$  falling under latent class  $s$ . The number of latent classes is determined by the researcher based on the statistical measures of fit such as Bayesian Information Criterion (BIC) and Akaike Information Criterion (AIC).

## Appendix 5.2: Hierarchical Bayesian mixed logit model

The general formula of random utility theory (McFadden 1973) is specified as:

$$U_{nj} = \beta_n X'_{nj} + \varepsilon_{nj} \quad (1)$$

where  $U_{nj}$  is the utility obtained by individual  $n$  choosing item  $j$  ( $j = 1, 2, \dots, J$ ).  $\beta_n$  is the individual-specific preference parameter vector,  $X'_{nj}$  is the vector of observable explanatory variables including the chosen alternative  $j$  (the most important item is coded as 1, where the least important item is coded as -1, and non-chosen item is coded as 0), and  $\varepsilon_{nj}$  is the stochastic error term.

Assuming that an individual  $n$  choose item  $j$  and  $j'$  as the most important and the least important item in a choice set, respectively, out of a choice set of  $J$  items. Thus, the utility difference between  $U_{njt}$  and  $U_{nj't}$  is then greater than all other  $J(J - 1)$  possible differences among the other items in the choice set. Namely, in our case each choice scenario of 5 items would have  $5(5 - 1) = 20$  possible best-worst combinations a person could choose. Following Louviere *et al.* (2015), the choice probability of the individual  $n$  of choosing item  $j$  as the best and  $j'$  as the worst can be written as:

$$P = \frac{\exp(\beta_n X'_{nj} - \beta_n X'_{nj'})}{\sum_{\substack{j, j' \in J \\ j \neq j'}} \exp(\beta_n X'_{nj} - \beta_n X'_{nj'})} \quad (2)$$

In hierarchical Bayesian estimation, based on the Eq. (1) we estimate the parameters at the individual level and the coefficient vector  $\beta_n$  for the individual  $n$  can be expressed by dividing it into individual characteristic vector ( $Z_n$ ) and the parameter matrix  $\Gamma$  shown in the Eq. (3):

$$\beta_n = \Gamma Z_n + \delta_n, \quad \delta_n \sim N(0, D) \quad (3)$$

Where the  $\delta_n$  is the error term assuming that a normal distribution with mean 0 and variance D represents the covariance between the partworth values (Allenby and Ginter 1995). During the analytical process, a parameter's posterior distribution is computed by combining its prior distribution for each partworth estimate with the likelihood determined by the choice data. Thus, Eq. (4) plays a role of identifying the prior distribution for  $\beta_n$  and the prior distributions of  $\Gamma$  (follows a multivariate normal distribution) and D (follows an inverse-Wishart distribution) are established to complete the hierarchical Bayesian modelling procedure.

$$\Gamma \sim N(a, A) \quad (4)$$

$$D \sim W(w, W)$$

Along with the above assumptions, choice data are drawn from a conditional distribution by creating the hierarchical structure shown in Eq. (5).

$$\begin{aligned} \Gamma &| D, \beta_n \\ D &| \beta_n, \Gamma \\ \beta_n &| \Gamma, \Sigma \end{aligned} \quad (5)$$

When the covariance between the partial values (D) and the individual level value of an attribute ( $\beta_n$ ) were given, the coefficient estimates ( $\Gamma$ ) for the variable of an individual characteristics ( $Z_n$ ) can be extracted. Furthermore, we are also able to extract the D when  $\beta_n$  and  $\Gamma$  were obtained, as well as  $\beta_n$  when  $\Gamma$  and D were gained. This process repeats until a parameter value converges to draw a distribution of the individual parameters.

**Appendix 5.3: BWS design matrices**

Number of statements = 25

Number of statements per choice set = 5

Number of sets per respondent: 10

Number of blocks: 30

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<b>One Way Frequencies:</b>	
Statement	Frequencies Used
1	60
2	60
3	60
4	60
5	60
6	60
7	60
8	60
9	60
10	60
11	60
12	60
13	60
14	60
15	60
16	60
17	60
18	60
19	60
20	60
21	60
22	60
23	60
24	60
25	60
Mean =	60
SD =	0

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Two Way Frequencies:																									
Statement	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	60	10	11	10	10	10	10	10	10	10	10	11	9	11	10	10	10	10	10	10	9	10	9	10	10
2	10	60	10	10	10	10	10	10	10	10	10	10	9	10	10	11	10	9	10	10	11	10	10	10	10
3	11	10	60	10	10	9	10	10	10	9	10	10	11	10	10	10	10	10	11	9	10	10	10	10	10
4	10	10	10	60	10	10	9	10	10	10	9	10	10	10	10	10	11	11	10	10	10	10	10	10	10
5	10	10	10	10	60	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	10	11	10	10	10
6	10	10	9	10	10	60	10	11	10	10	10	10	10	10	9	10	10	10	11	10	10	10	9	10	11
7	10	10	10	9	10	10	60	10	10	11	11	10	10	11	9	10	9	10	10	10	10	10	10	10	10
8	10	10	10	10	10	11	10	60	10	9	10	10	11	10	10	10	10	10	11	10	9	10	10	10	9
9	10	10	10	10	10	10	10	10	60	10	10	10	11	9	11	9	10	11	9	10	10	10	10	10	10
10	10	10	9	10	10	10	11	9	10	60	10	10	10	10	11	9	11	10	10	10	10	10	10	10	10
11	10	10	10	9	10	10	11	10	10	10	60	9	11	9	11	11	10	10	10	10	10	10	10	9	10
12	11	10	10	10	10	10	10	10	10	10	9	60	9	11	11	11	9	9	10	10	10	10	10	10	10
13	9	9	11	10	10	10	10	11	11	10	11	9	60	10	10	10	10	10	9	10	10	10	10	10	10
14	11	10	10	10	10	10	11	10	9	10	9	11	10	60	10	9	9	10	10	10	10	10	11	10	10
15	10	10	10	10	10	9	9	10	11	11	11	11	10	10	60	10	10	10	9	11	10	9	10	10	9
16	10	11	10	10	10	10	10	10	9	9	11	11	10	9	10	60	10	10	10	10	10	10	10	10	10
17	10	10	10	11	10	10	9	10	10	11	10	9	10	9	10	10	60	10	10	10	10	10	10	10	11
18	10	9	10	11	10	10	10	10	11	10	10	9	10	10	10	10	10	60	9	10	10	10	10	11	10
19	10	10	11	10	10	11	10	11	9	10	10	10	9	10	9	10	10	9	60	9	11	11	10	10	10
20	10	10	9	10	9	10	10	10	10	10	10	10	10	10	11	10	10	10	9	60	11	10	11	10	10
21	9	11	10	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10	11	11	60	9	10	10	10
22	10	10	10	10	11	10	10	10	10	10	10	10	10	10	9	10	10	10	11	10	9	60	10	10	10
23	9	10	10	10	10	9	10	10	10	10	10	10	10	11	10	10	10	10	10	11	10	10	60	10	10
24	10	10	10	10	10	10	10	10	10	10	9	10	10	10	10	10	10	11	10	10	10	10	10	60	10
25	10	10	10	10	10	11	10	9	10	10	10	10	10	10	9	10	11	10	10	10	10	10	10	10	60
Mean =	10																								
S.D. =	0.497																								

<b>Positional Frequencies:</b>					
Statement	Position in the BWS choice set				
	1	2	3	4	5
1	12	12	12	12	12
2	11	13	12	12	12
3	12	13	12	12	11
4	12	11	13	12	12
5	12	12	12	13	11
6	12	13	11	12	12
7	12	12	12	13	11
8	12	12	12	11	13
9	12	11	12	12	13
10	12	12	12	12	12
11	12	12	12	12	12
12	12	13	12	11	12
13	12	12	12	12	12
14	12	12	12	12	12
15	12	11	12	13	12
16	12	12	12	12	12
17	12	12	12	12	12
18	11	12	12	12	13
19	12	12	12	12	12
20	13	12	12	11	12
21	12	12	13	11	12
22	13	12	11	12	12
23	12	11	12	13	12
24	12	12	12	11	13
25	12	12	12	13	11
Mean =	12				
S.D. =	0.522				

#### Appendix 5.4: Results of the hierarchical Bayesian mixed logit model for BWS data

Total respondents			459
Total Best Choices			4590
Total Worst Choices			4590
Root Likelihood statistics (model fit)			0.58
<b>BWS statements</b>	<b>Rank</b>	<b>Avg. imprt. scores</b>	<b>[95% C.I. Lower, Upper]</b>
1. I feel assured that the Taiwanese institutions do a good job in adequately protecting consumers.	12	4.80	[4.50 – 5.10]
2. I feel assured that the Chinese institutions do a good job in adequately protecting consumers.	24	0.08	[0.06 - 0.11]
3. I feel assured that the Japanese institutions do a good job in adequately protecting consumers.	10	5.43	[5.18 - 5.69]
4. I generally like to consume conventional red sweet peppers produced in Taiwan	14	4.26	[4.01 - 4.51]
5. I generally like to consume conventional red sweet peppers produced in China.	25	0.05	[0.03 - 0.07]
6. I generally like to consume conventional red sweet peppers produced in Japan.	18	1.98	[1.84 - 2.11]
7. I generally like to consume organic red sweet peppers produced in Taiwan.	4	7.30	[7.09 - 7.52]
8. I generally like to consume organic red sweet peppers produced in China.	22	0.33	[0.24 - 0.42]
9. I generally like to consume organic red sweet peppers produced in Japan.	13	4.68	[4.38 - 4.98]
10. Taiwanese organic red sweet peppers are trustworthy.	2	7.73	[7.52 - 7.93]
11. Chinese organic red sweet peppers are trustworthy.	21	0.49	[0.37 - 0.61]
12. Japanese organic red sweet peppers are trustworthy.	7	5.96	[5.67 - 6.24]
13. I feel sure that organic red sweet peppers contain higher vitamin C and anti-cancer substances than conventional ones.	16	3.24	[2.98 - 3.51]
14. I feel sure that organic red sweet peppers contain the same vitamin C and anti-cancer substances as	15	3.53	[3.23 - 3.83]

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conventional ones.			
15. With purchasing organic red sweet peppers I help preserve the environment and natural resources.	11	5.29	[5.01 - 5.57]
16. There are no differences between buying organic red sweet peppers or conventional ones with respect to preserving the environment and natural resources.	17	2.32	[2.09 - 2.54]
17. It is more likely that I buy Taiwanese red sweet peppers if information on chemical residue testing is provided.	1	8.42	[8.21 - 8.62]
18. It is more likely that I buy Chinese red sweet peppers if information on chemical residue testing is provided.	19	0.75	[0.58 - 0.92]
19. It is more likely that I buy Japanese red sweet peppers if information on chemical residue testing is provided.	5	7.27	[7.07 - 7.48]
20. It is more likely that I buy Taiwanese red sweet peppers if they are on special offer.	6	6.52	[6.20 - 6.84]
21. It is more likely that I buy Chinese red sweet peppers if they are on special offer.	23	0.29	[0.19 - 0.39]
22. It is more likely that I buy Japanese red sweet peppers if they are on special offer.	8	5.78	[5.47 - 6.08]
23. Taiwanese organic red sweet peppers have good value for money.	3	7.39	[7.16 - 7.61]
24. Chinese organic red sweet peppers have good value for money.	20	0.50	[0.37 - 0.64]
25. Japanese organic red sweet peppers have good value for money.	9	5.61	[5.31 - 5.92]

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Avg. imprt. scores=Average importance scores

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## Chapter 6: Conclusion

A summary and the conclusions drawn from the results of this dissertation will be presented in this chapter. The chapter is comprised of three sections. The first subsection summarizes the findings from the meta analysis (chapter 2) and the field choice experiments (chapters 3 to 5). The next subsection highlights the organizational and marketing implications of this research. Finally, the last subsection will conclude with reflections on the limitations of this study and recommendations for future research.

### 6.1 Summary of Findings

This dissertation provides insights into the decision-making processes and preferences of consumers pertaining to agri-food products differentiated by quality labels. It aims to deliver a more detailed understanding of consumers' food choices and preferences with a specific focus on the role of two credence attributes—organic production and country-of-origin—and of interdependencies between food quality attributes.

To accomplish this task, four studies were conducted that make use of a variety of methods and combinations of methods. The research starts with a meta regression analysis (MRA) (*Chapter 2: Willingness-to-Pay for Organic and Domestic Origin Labelling Using the Evaluation of Choice Experiments: Evidence from a Meta-Regression Analysis*), acting as a quantitative method that reviews the relevant literature systematically and quantitatively. Meta regression analysis in this thesis allows for the examination of the presence of publication selection bias and the identification of the determinants of systematic differences in the variable of interest. The results of our analysis provide evidence for the presence of publication bias in both the literature investigating consumers' WTP for organic labelling (OL) and domestic COO labelling (DOL). Our results of MRAs show that the location that the survey was conducted in is shown to be an important factor influencing the WTP values for OL. Furthermore, the findings reveal that the elicitation methods used to derive WTP estimates have a significant effect on the WTP for both OL and DOL. In addition, when controlling for heterogeneity in study design characteristics and for accounting for the study/cluster error structure

in the multivariate MRA models, there is evidence pointing to the existence of publication selection bias towards significant positive WTP estimates, and of no true value for consumers' WTP. Moreover, we also find that the WTP values ascertained from the stated preference empirical studies can be influenced by study characteristic and methodological factors.

The second, third, and fourth empirical study focus on Taiwanese consumers and take fresh sweet peppers as study object. Discrete choice experiments (DCE) and best-worst scaling (BWS) were applied as key empirical methods. Both methods allow for elicitation of consumers' preferences for selected product attributes and attribute levels of a product. The DCE design applied included four attributes—COO, production methods, chemical residue testing information (CRT), and price.

The second paper (*Chapter 3: Consumers' Preference for Sweet Peppers with Different Process Attributes: A Discrete Choice Experiment in Taiwan*) provides the pilot study for the DCE research design in the subsequent chapters and allows to gain first insights into Taiwanese consumers' preference for sweet peppers for different consumer segments. The data was obtained by means of a web-survey based on convenience sampling in spring 2014. The findings show that the four selected product attributes—COO, production methods, chemical residue testing information, and price—significantly influence purchases of sweet peppers. We detect heterogeneity between consumer groups in the importance of different product attributes as well as in the relevance of different attribute levels. Despite heterogeneity between consumer groups we find for all consumer segments analysed that COO is by far the most important attribute, price takes second place. Compared to COO and price we notice that the other two process attributes (CRT information, and organic labelling) provide a comparable little contribution to consumers' utility. Furthermore, our findings also indicate that interaction between attributes matter and that preference for attribute levels differs depending on socioeconomic characteristics.

The third and fourth study is based on data obtained by means of a street-intercept computer-assisted approach in summer 2014. In the third article (*Chapter 4: Does Information on Equivalence of Standards Direct Choice? Evidence for Organic Labels from Different Countries-of-Origin*), we investigate whether an equality of organic standards (EqualOrganic) information treatment impacts Taiwanese consumers' food preferences and purchasing behaviour using DCE and propensity score

matching. EqualOrganic information implies that regardless of a product's country-of-origin (COO), organic certifications are based on the same regulations. As all organic products sold in Taiwan must be certified by equivalent standards, we assumed that providing EqualOrganic information would lead to a shift in consumer preferences towards organic products in general and specifically for organic products originating from China, an origin not highly valued by Taiwanese consumers. However, our findings show that consumers' product choice was sensitive to 'EqualOrganic' information treatment. Previous attitudes towards organic products from China (and respectively Japan and Taiwan) that have been already stored in consumers' memory became more accessible. Therefore, the "EqualOrganic" information did not create the anticipated effects, but rather reduced participants' preference for organic sweet peppers, especially those originating from China. We find that consumers differentiate organic claims further if information on the country of origin is provided and vice versa. The EqualOrganic information treatment did not ease the purchase decision for participants in our survey but increased consumers' skepticism. Furthermore, from a methodological viewpoint, our findings also show that combining choice experiment with propensity score matching to investigate the impact of information treatment on consumers' choice can be useful to reduce potential selection biases in the choice experiment outcomes caused by differences in individuals' characteristics between information treated and untreated samples.

In the final article (*Chapter 5: The Role of Trust in Explaining Food Choice: Combining Choice Experiment and Attribute Best-Worst Scaling*), a combination of two elicitation techniques—the DCE and BWS—provides information about the role of consumers' trust in food choice decisions in the case of products carrying an organic and COO label. Our study revealed that an analysis of what Taiwanese consumers value in their purchase of red sweet peppers falls short if it does not consider market heterogeneity. This result indicates that consumers (consumer segments) differ in the weights they assign to different product and process attributes. Moreover, the findings of this study strongly support the argument that consumers' attitudinal and trust perception are important determinants for class membership. Combining DCE and BWS methods enriches insights gained from latent class choice analysis and better reveals attitudinal factors that drive class membership, therefore allowing us to capture consumers' attitudinal and trust perceptions in a discriminant manner.

## 6.2 Implications

The findings presented in the latter three articles of this dissertation provide useful insights into the value Taiwanese consumers assign to food quality attributes, such as COO and production methods, as well as to the combination of food quality attributes. Such a comprehensive understanding of consumers' preference for different quality attributes is essential for food producers, marketers and policy makers alike. There is motivation to offer products to boost the market demand for unconventionally-produced and quality-labelled products only if consumers value food quality attributes. Accordingly, our findings reveal that consumers do positively value CRT labelling and organic, versus conventional products.

With regard to beneficial implications, our findings in the second article suggest that food producers and traders that want to signal superior process quality of fresh agri-food should offer products from Taiwan (domestic COO). Retailers that intend to promote organic sweet peppers will be most successful in high-educated high-income neighbourhoods. This consumer group will also appreciate products originating from Japan. We also learn that the provision of CRT information has been identified as the best means of increasing the credibility of organic agri-food by strengthening consumer confidence in organic food. The value of domestically-grown organic agri-produce, especially those that carry CRT information, is even greater than that of imported organic alternatives.

In the third article our findings reveal that Taiwanese consumers are skeptical of the quality and safety of products originating from China, even after being primed by information on the equality of organic standards (EqualOrganic). Our results also indicate—independent from the EqualOrganic information treatment—that there is a lack of trust in organic labels in general and/or a lack of knowledge regarding what organic implies as consumers favour products with CRT labels compared to organic despite the fact that the former is part of the latter.

Furthermore, as we found heterogeneity and homogeneity in consumers' preference and perception in the last study, it is essential to identify target groups before marketing products. From a marketing perspective, this implies that marketers need to develop segment-specific offerings in order to better target the needs of their customers. For example, to secure the loyalty of customers and to extract a

price premium in the segments that are in favour of Taiwan-COO (*Domestic Supporters*) and Japan-COO sweet peppers (e.g. *Japan Lovers*), retailers need to have product varieties from Japan as well as Taiwan in their assortment. Additionally, the *Price Conscious Consumers* attach little value to any of the attributes considered in our purchase experiment other than price. Thus, retailers can win this group of consumers by providing low-price alternatives (e.g. conventional sweet red pepper) or by providing price discounts (e.g. potentially for larger size packages). For the *Process Quality Supporters*, all process attributes are not only of relatively high but also of about equal importance in consumers' purchase decisions, while price seems to be of minor relevance. Retailers that could have the possibility to further differentiate their assortment can extract high price premiums by offering organic red sweet peppers and/or red sweet peppers with a CRT approved in Taiwan.

In addition, it must be noted that there is a lack of trust and knowledge about what 'organic' implies in organic labels in general. Consumers favour products with CRT information rather than products which are merely labelled as organic with no additional information (despite the fact that the former is part of the latter). On the one hand, from a governmental or regulative standpoint, it seems essential to institute effective control authorities to increase transparency and (re)gain the trust of consumers. On the other hand, there is indeed a need to improve consumers' knowledge about the standards necessary for organic certification. Private and public actors should shape consumers' perceptions of the standards behind organic and most importantly raise consumers' knowledge how compliance to organic standards is secured. With that said, the results from this study do shed light on health-focussed consumer perspectives conveyed through perceptions of CRT information. The findings suggest that it may be beneficial for producers, marketers and distributors of agri-food to consider the inclusion of CRT information alongside an organic label on conventional (foreign) produce as marketing instruments.

### **6.3 Limitation and recommendations for future research**

This final section of the dissertation provides an outlook on the limitations of this study and some suggestions for further research. The first limitation refers to the MRA conducted. This analysis is

based on a relatively small number of studies. Future studies should consider extending the literature time frame when collecting meta observations. Moreover, it might be interesting to also include different types of methods used in their empirical work, such as contingent valuation, hedonic price regression, and experimental auctions approach, when searching for WTP elicitation literature (see Yu *et al.*, 2016). This would lead to more comprehensive MRAs that would better understand the variability of WTPs.

Second, all of the empirical choice experiments were conducted and focused in one county, Taiwan. A comparison of results across other countries would be desirable. In particular, it would be interesting to carry out the same kind of study in China and/or Japan, and thus in competing markets, to investigate whether segments characterized by similar preferences and characteristics exist across locations. Respective insights could be valuable for producers in their decision to export or concentrate on local markets. Another limitation of the empirical results presented in this dissertation is that they are not easily generalized to the entire population of food shoppers in Taiwan, due to the fact that the sample used in the analysis was not representative of the entire population of potential decision-makers, which was hard to assess within the boundaries of this research. Nevertheless, the results presented in this thesis do provide useful insights into the decision-making processes of Taiwanese consumers with respect to fresh agri-food purchase.

Third, our analysis focuses on one product: fresh sweet peppers. Thus, our results hold for this product, though they might be transferable to other vegetables that are a part of Taiwanese people's daily diet. For a better understanding of the relevance of production and process attributes, such as COO and production method, on consumers' purchase of other product categories, additional investigations are needed.

Fourth, since the DCE method applied was mainly hypothetical in nature, in which participants were asked to make hypothetical decisions from hypothetical choice tasks, 'hypothetical bias' (Cummings *et al.*, 1995; Tesler and Zweifel, 2007; Loomis, 2011; Fifer *et al.*, 2014) is a key concern when using stated preference DCE choice data. In light of the fact that we cannot determine whether participants' decision in an actual purchasing situation will correspond to their stated decision from such kinds of

surveys, we attempted to use cheap talk scripts to reduce potential bias while acknowledging that bias still cannot be totally eliminated (Carlsson *et al.*, 2005; Cummins and Taylor, 1998).

The fifth limitation is referred to the BWS conducted in the last article. To avoid consumer fatigue, we have decided on four product attributes of fresh sweet peppers based on a pre-study, and only considered statements from the literature as well as limited the number of BWS statements to 25. However, it must be noted that the selection of attributes and attribute levels may impact analytic outcomes of (the combination of) choice data. Accordingly, we suggest that future studies give more attention to capturing the psychological aspects of trust-building with regard to food labelling. For instance, considering consumer animosity as a means to deepen the understanding about consumers' attitude and perception (especially in the case of a negative COO image), and combining use of well-established attitudinal and behaviour scales with actual decision-making behaviour data (Ojea and Loureiro, 2017), would be a relevant and worthwhile pursuit.

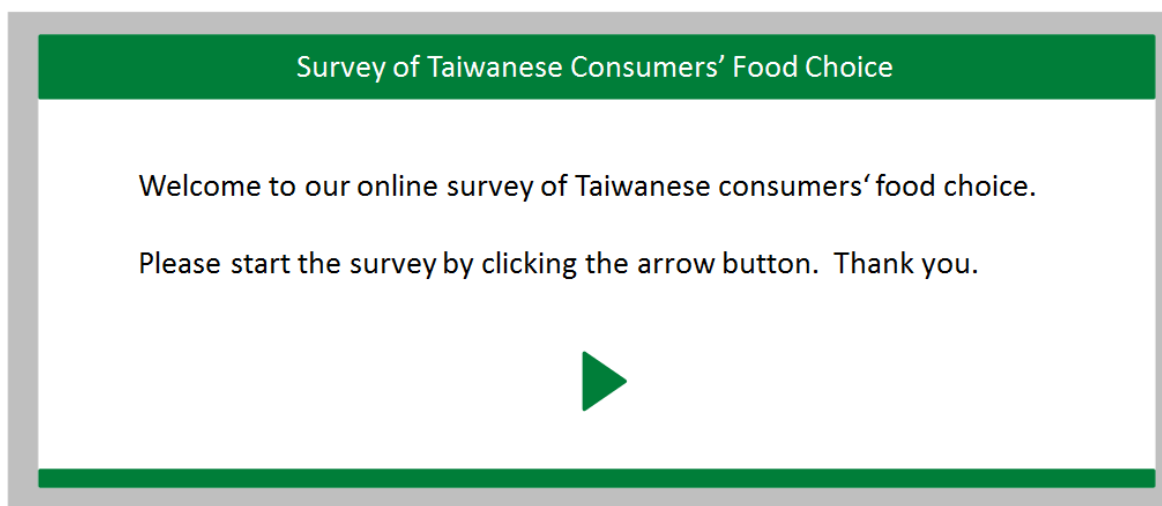
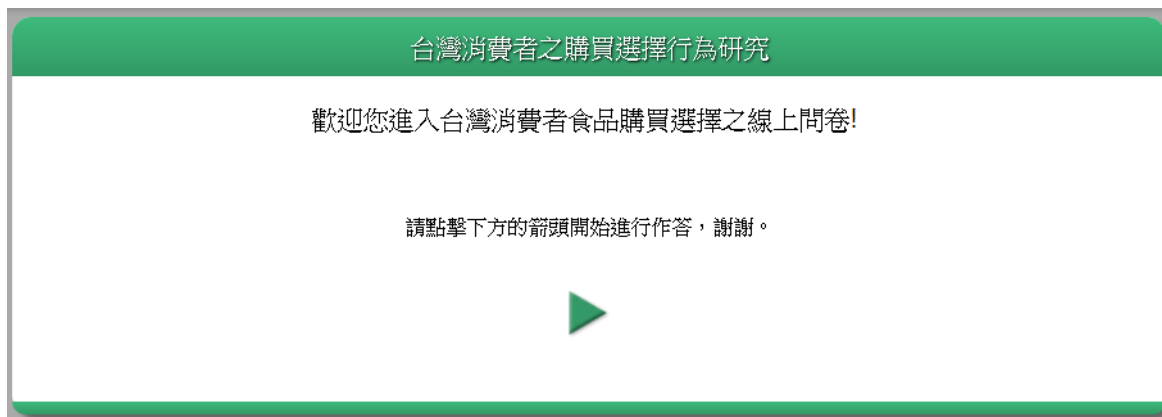
Finally, future research may also focus on examining the constancy of consumers' values with respect to different product categories and processing characteristics at different periods of time. This may be particularly interesting for exploring and understanding how consumers prioritize their preferences when making purchase decisions on food products over a longer period.

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## Appendix A: Questionnaire

We provided a version of the questionnaire with original mandarin version and English translated version in the following pages:



[Page break]

台灣消費者之購買選擇行為研究

A. 您負責自己或是您的家庭的食物採買嗎?

我負責採買食物。

我部分負責採買食物。

我不負責。



0%  100%

Survey of Taiwanese Consumers' Food Choice


**A. Are you responsible for food shopping of your own consumption or/and of household consumption?**

1. I am

2. I partly am

3. I am not

(if 3 is chosen, then survey is terminated.)



[Page break]

台灣消費者之購買選擇行為研究

B. 您吃甜椒嗎？

(請選出一個最常食用的方式)

- 直接吃新鮮的紅甜椒。
- 吃煮過後的紅甜椒。
- 把紅甜椒榨汁飲用。
- 吃醃漬的紅甜椒。
- 其它
- 我不吃紅甜椒



0%  100%

Survey of Taiwanese Consumers' Food Choice

**B. Do you consume sweet pepper?**

*(Please tick one option that mostly apply.)*

1. I eat it fresh directly
2. I eat it warmly cooked
3. I eat it crashed in a juice form
4. I eat it cured
5. Others
6. I do not eat sweet pepper at all

**(if 6 is chosen, then survey is terminated.)**



[Page break]

## 台灣消費者之購買選擇行為研究

C. 請問您的家庭平均每周會採購多少甜椒？

- 低於一顆以下
- 一顆
- 兩顆
- 三顆
- 四顆
- 五顆以上



0%  100%

## Survey of Taiwanese Consumers' Food Choice

C. How many sweet peppers you or your family buy per week, on average?

1. Less than one piece
2. One piece
3. Two pieces
4. Three pieces
5. Four pieces
6. Five pieces or more



[Page break]

### 台灣消費者之購買選擇行為研究

接下來的問題是有關您在採購紅甜椒時的購買選擇行為。首先，您將會面對一共六個採購選擇的問題。請您想像自己正處於平時會去購物的那間超市內，您正準備採買紅甜椒。

在進行購買選擇時，請您先假設所有紅甜椒的大小，顏色，成熟度，氣味等都是完全相同的。然而，那些擺在架上的紅甜椒會被提供四種不同的產品特徵做為商品資訊，以供您進行購買選擇。所以，當您看到那些產品選項出現在您購物的商店內時，請您選出您最想購買的紅甜椒產品。

當然，您也可以自由選擇不想購買任何產品。不過，請注意，您所花費在購買紅甜椒的支出將會減少您能購買其它產品的預算！

祝您購物愉快！



0%  100%

### Survey of Taiwanese Consumers' Food Choice

In the following we will ask you six times to make a shopping choice.

Please imagine that you are grocery shopping in a store that you usually choose. You will see three fresh red sweet peppers displayed. Below you will face six shopping tasks and will see the products' information presented in these displays; simultaneously we assume that the red sweet peppers are identical in terms of size, color, ripeness, smell, etc. please decided which type of sweet pepper you would buy.

Of course, you are free to make a decision of not buying any product, and please note that any purchase that you make will reduce the amount of money that you and your family have available for other purchases.

Enjoy shopping!



[Page break]

台灣消費者之購買選擇行為研究

在您眼前的這三種甜椒正擺在架上，請問您會購買哪一種甜椒？  
(1 of 6)




產品編號	1	2	3	
	 <div style="border: 1px solid black; padding: 5px; background-color: #e0e0e0;">                     新鮮紅甜椒                      產地：<u>日本</u>                      NT 85 /600g                 </div>	 <div style="border: 1px solid black; padding: 5px; background-color: #e0e0e0;">                     新鮮紅甜椒                      產地：<u>日本</u>                      通過日本的農藥殘留檢測                      NT 105 /600g                 </div>	 <div style="border: 1px solid black; padding: 5px; background-color: #e0e0e0;">                     新鮮紅甜椒                      有機生產                      產地：<u>台灣</u>                      通過台灣的農藥殘留檢測                      NT 125 /600g                 </div>	我不會購買這些甜椒。
請問您會購買哪一種甜椒？	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

請點擊箭頭圖案繼續，謝謝。




Survey of Taiwanese Consumers' Food Choice

The following sweet peppers are available. Which one would you buy?  
(1 of 6)

No.	1	2	3	
	 <div style="border: 1px solid black; padding: 5px; background-color: #e0e0e0;">                     Red Sweet Pepper                      Japan                      NT 85 / 600g                 </div>	 <div style="border: 1px solid black; padding: 5px; background-color: #e0e0e0;">                     Red Sweet Pepper                      Japan                      Passed Japan-authorized                      chemical residue test                      NT 105 / 600g                 </div>	 <div style="border: 1px solid black; padding: 5px; background-color: #e0e0e0;">                     Red Sweet Pepper                      Organic                      Taiwan                      Passed Taiwan-authorized                      chemical residue test                      NT 125 / 600g                 </div>	I wouldn't buy any of these
Which one do you want to buy?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please continue the survey by clicking the arrow button.



[Page break]

台灣消費者之購買選擇行為研究

在您眼前的這三種甜椒正擺在架上，請問您會購買哪一種甜椒？  
(2 of 6)

產品編號	1	2	3	4
	 <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <p>新鮮紅甜椒</p> <p>產地：<u>中國</u></p> <p>通過<u>中國</u>的農藥殘留檢測</p> <p>NT 105 /600g</p> </div>	 <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <p>新鮮紅甜椒</p> <p>有機生產</p> <p>產地：<u>台灣</u></p> <p>通過<u>台灣</u>的農藥殘留檢測</p> <p>NT 105 /600g</p> </div>	 <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <p>新鮮紅甜椒</p> <p>產地：<u>日本</u></p> <p>通過<u>台灣</u>的農藥殘留檢測</p> <p>NT 65 /600g</p> </div>	<p>我不會購買這些甜椒。</p>
請問您會購買哪一種甜椒？	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

請點擊箭頭圖案繼續，謝謝。

◀ ▶

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台灣消費者之購買選擇行為研究

在您眼前的這三種甜椒正擺在架上，請問您會購買哪一種甜椒？  
(3 of 6)

產品編號	1	2	3	4
	 <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <p>新鮮紅甜椒</p> <p>產地：<u>日本</u></p> <p>NT 105 /600g</p> </div>	 <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <p>新鮮紅甜椒</p> <p>有機生產</p> <p>產地：<u>中國</u></p> <p>通過<u>台灣</u>的農藥殘留檢測</p> <p>NT 85 /600g</p> </div>	 <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <p>新鮮紅甜椒</p> <p>有機生產</p> <p>產地：<u>中國</u></p> <p>通過<u>中國</u>的農藥殘留檢測</p> <p>NT 65 /600g</p> </div>	<p>我不會購買這些甜椒。</p>
請問您會購買哪一種甜椒？	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

請點擊箭頭圖案繼續，謝謝。

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台灣消費者之購買選擇行為研究

在您眼前的這三種甜椒正擺在架上，請問您會購買哪一種甜椒？  
(4 of 6)

產品編號	1	2	3	4
				
	新鮮紅甜椒 有機生產 產地:台灣 NT 105 /600g	新鮮紅甜椒 產地:台灣 NT 105 /600g	新鮮紅甜椒 產地:日本 通過日本的農藥殘留檢測 NT 105 /600g	我不會購買這些甜椒。
請問您會購買哪一種甜椒？	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

請點擊前項圖案繼續，謝謝。

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台灣消費者之購買選擇行為研究

在您眼前的這三種甜椒正擺在架上，請問您會購買哪一種甜椒？  
(5 of 6)

產品編號	1	2	3	4
				
	新鮮紅甜椒 有機生產 產地:中國 通過台灣的農藥殘留檢測 NT 65 /600g	新鮮紅甜椒 產地:中國 通過中國的農藥殘留檢測 NT 85 /600g	新鮮紅甜椒 產地:台灣 NT 125 /600g	我不會購買這些甜椒。
請問您會購買哪一種甜椒？	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

請點擊前項圖案繼續，謝謝。

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台灣消費者之購買選擇行為研究

在您眼前的這三種甜椒正擺在架上，請問您會購買哪一種甜椒？

(6 of 6)


產品編號	1	2	3	4
	 <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> <p>新鮮紅甜椒 有機生產 產地：<u>台灣</u> NT 125 /600g</p> </div>	 <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> <p>新鮮紅甜椒 產地：<u>日本</u> 通過日本的農藥殘留檢測 NT 105 /600g</p> </div>	 <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> <p>新鮮紅甜椒 有機生產 產地：<u>日本</u> 通過台灣的農藥殘留檢測 NT 125 /600g</p> </div>	<p>我不會購買這些甜椒。</p>
請問您會購買哪一種甜椒？	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
請點擊箭頭圖案繼續，謝謝。				

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台灣消費者之購買選擇行為研究

接下來的四個問題是有關您在採購紅甜椒的準則。




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The image shows a slide with a green header and footer. The main content area is white. At the top, the title '台灣消費者之購買選擇行為研究' is centered. Below it, the text '接下來的四個問題是有關您在採購紅甜椒的準則。' is centered. In the middle, there are two green navigation arrows pointing left and right. At the bottom, there is a progress bar starting at 0% and ending at 100%.

Survey of Taiwanese Consumers' Food Choice

The following four questions are regarding your shopping criteria.



The image shows a slide with a green header and footer. The main content area is white. The header contains the title 'Survey of Taiwanese Consumers' Food Choice'. The main content area contains the text 'The following four questions are regarding your shopping criteria.'. In the middle, there is a green navigation arrow pointing left.

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## 台灣消費者之購買選擇行為研究

只考慮下面五個項目，請您指出，當您在購買紅甜椒時，哪一項對您是**最重要的**，哪一項對您是**最不重要的**。

(1 of 4)

最不重要	項目	最重要
<input type="radio"/>	包裝的尺寸 (例如：散裝/小包裝/大包裝)	<input type="radio"/>
<input type="radio"/>	生產方式 (例如：有機農法生產/慣性農法生產)	<input type="radio"/>
<input type="radio"/>	產品外觀 (例如：產品外觀無瑕疵/有可接受的小黑點/有多處黑點)	<input type="radio"/>
<input type="radio"/>	價格 (例如：NT65/NT85/NT105/NT125)	<input type="radio"/>
<input type="radio"/>	購買產品的地點 (例如：商店離家距離300公尺內/600公尺內/900公尺內)	<input type="radio"/>

請點擊箭頭符號繼續，謝謝。



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## Survey of Taiwanese Consumers' Food Choice

Please only consider the 5 items shown below, and indicate which one is the **Most Important** to you and which one is the **Least Important** to you when shopping sweet peppers.

(1 of 4)

Least Important	Items	Most Important
<input type="radio"/>	Package size (i.e. bulk food, small package, big package)	<input type="radio"/>
<input type="radio"/>	Production method (i.e. organic, conventional)	<input type="radio"/>
<input type="radio"/>	Visual appearance (i.e. nice looking, acceptable looking with small spot)	<input type="radio"/>
<input type="radio"/>	Price (i.e. NT 65, 85, 105, 125)	<input type="radio"/>
<input type="radio"/>	Shopping location (i.e. within 0.5 km away from home, within 1 km away from home)	<input type="radio"/>

Please continue the survey by clicking the arrow.



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台灣消費者之購買選擇行為研究

只考慮下面五個項目，請您指出，當您在購買紅甜椒時，哪一項對您是**最重要的**，哪一項對您是**最不重要的**。  
(2 of 4)

最不重要	項目	最重要
<input type="radio"/>	<b>產品外觀</b> (例如：產品外觀無瑕疵/有可接受的小黑點/有多處黑點)	<input type="radio"/>
<input type="radio"/>	<b>重要人士的推薦</b> (例如：父母的推薦/男女朋友的推薦/伴侶的推薦)	<input type="radio"/>
<input type="radio"/>	<b>生產國</b> (例如：台灣/中國/日本)	<input type="radio"/>
<input type="radio"/>	<b>通過農藥殘留檢驗的告示</b> (例如：通過農藥殘留檢驗/無農藥殘留檢驗)	<input type="radio"/>
<input type="radio"/>	<b>價格</b> (例如：NT65/NT85/NT105/NT125)	<input type="radio"/>

請點擊箭頭符號繼續，謝謝。

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台灣消費者之購買選擇行為研究

只考慮下面五個項目，請您指出，當您在購買紅甜椒時，哪一項對您是**最重要的**，哪一項對您是**最不重要的**。  
(3 of 4)

最不重要	項目	最重要
<input type="radio"/>	<b>生產方式</b> (例如：有機農法生產/慣性農法生產)	<input type="radio"/>
<input type="radio"/>	<b>觸摸產品的感覺</b> (例如：新鮮多汁的觸感/老化乾癟的觸感)	<input type="radio"/>
<input type="radio"/>	<b>重要人士的推薦</b> (例如：父母的推薦/男女朋友的推薦/伴侶的推薦)	<input type="radio"/>
<input type="radio"/>	<b>產品外觀</b> (例如：產品外觀無瑕疵/有可接受的小黑點/有多處黑點)	<input type="radio"/>
<input type="radio"/>	<b>生產國</b> (例如：台灣/中國/日本)	<input type="radio"/>

請點擊箭頭符號繼續，謝謝。

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## 台灣消費者之購買選擇行為研究

只考慮下面五個項目，請您指出，當您在購買紅甜椒時，哪一項對您是**最重要的**，哪一項對您是**最不重要的**。  
(4 of 4)

最不重要	項目	最重要
<input type="radio"/>	通過農藥殘留檢驗的告示 (例如：通過農藥殘留檢驗/無農藥殘留檢驗)	<input type="radio"/>
<input type="radio"/>	購買產品的地點 (例如：商店離家距離300公尺內/600公尺內/900公尺內)	<input type="radio"/>
<input type="radio"/>	觸摸產品的感覺 (例如：新鮮多汁的觸感/老化乾癟的觸感)	<input type="radio"/>
<input type="radio"/>	包裝的尺寸 (例如：散裝/小包裝/大包裝)	<input type="radio"/>
<input type="radio"/>	生產方式 (例如：有機農法生產/慣性農法生產)	<input type="radio"/>

請點擊前頭符號繼續，謝謝。



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### 台灣消費者之購買選擇行為研究

您做得真棒! 接著, 您將會面臨最後十道的購買選擇題, 每一題會有五個陳述。請加油!



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### Survey of Taiwanese Consumers' Food Choice

Good work so far!

In the following, you will face the last 10 choice tasks in this section, and 5 statements for each task. Cheer up!



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## 台灣消費者之購買選擇行為研究

請只考慮下面這五個陳述，並且想像您正在採購食物。請指出您最同意哪一個陳述，及最不同意哪一個陳述。

(1 of 10)

最不同意	陳述	最同意
<input type="radio"/>	我認為「有機紅甜椒」含有比較高含量的維生素C與抗癌成份。	<input type="radio"/>
<input type="radio"/>	若是臺灣的國產農產品有附上通過農藥殘留檢驗的告示，我會更可能考慮購買。	<input type="radio"/>
<input type="radio"/>	日本有機農產品所提供的價值，值得我花這個錢。	<input type="radio"/>
<input type="radio"/>	我喜歡購買日本生產的非有機紅甜椒。	<input type="radio"/>
<input type="radio"/>	我喜歡購買中國生產的有機紅甜椒。	<input type="radio"/>

請點擊箭頭符號繼續，謝謝。



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## Survey of Taiwanese Consumers' Food Choice

Please only consider these five statement and imagine the situation of purchasing food. Please indicate the statement would you most agree to and the one you would least agree to.

(1 of 10)

Agree Least	Statements	Agree Most
<input type="radio"/>	I feel sure that organic sweet peppers contain higher vitamin C and anti-cancer substances than conventional ones.	<input type="radio"/>
<input type="radio"/>	It is more likely that I buy Taiwanese sweet peppers if information on chemical residue testing is provided.	<input type="radio"/>
<input type="radio"/>	Japanese organic sweet peppers have good value for money.	<input type="radio"/>
<input type="radio"/>	I generally like to consume conventional sweet peppers produced in Japan.	<input type="radio"/>
<input type="radio"/>	I generally like to consume organic sweet peppers produced in China.	<input type="radio"/>

Please continue the survey by clicking the arrow.



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台灣消費者之購買選擇行為研究

請只考慮下面這五個陳述，並且想像您正在採購食物。請指出您最同意哪一個陳述，及最不同意哪一個陳述。  
(2 of 10)

最不同意	陳述	最同意
<input type="radio"/>	台灣國產的有機紅甜椒值得信賴。	<input type="radio"/>
<input type="radio"/>	我相信台灣政府已經盡最大的努力，訂定食品法規並落實食品檢驗流程，所有的消費者能夠因此受到週全的保護。	<input type="radio"/>
<input type="radio"/>	我喜歡購買日本生產的有機紅甜椒。	<input type="radio"/>
<input type="radio"/>	若是中國進口農產品有附上通過農藥殘留檢驗的告示，我會更可能考慮購買。	<input type="radio"/>
<input type="radio"/>	我喜歡購買台灣生產的有機紅甜椒。	<input type="radio"/>

請點擊箭頭符號繼續，謝謝。

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台灣消費者之購買選擇行為研究

請只考慮下面這五個陳述，並且想像您正在採購食物。請指出您最同意哪一個陳述，及最不同意哪一個陳述。  
(3 of 10)

最不同意	陳述	最同意
<input type="radio"/>	我相信中國政府已經盡最大的努力，訂定食品法規並落實食品檢驗流程，所有的消費者能夠因此受到週全的保護。	<input type="radio"/>
<input type="radio"/>	中國有機農產品所提供的價值，值得我花這個錢。	<input type="radio"/>
<input type="radio"/>	我喜歡購買台灣生產的有機紅甜椒。	<input type="radio"/>
<input type="radio"/>	日本有機農產品所提供的價值，值得我花這個錢。	<input type="radio"/>
<input type="radio"/>	我認為「有機紅甜椒」與「非有機紅甜椒」的維生素C與抗癌成份的含量一樣。	<input type="radio"/>

請點擊箭頭符號繼續，謝謝。

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台灣消費者之購買選擇行為研究

請只考慮下面這五個陳述，並且想像您正在採購食物。請指出您最同意哪一個陳述，及最不同意哪一個陳述。  
(4 of 10)

最不同意	陳述	最同意
<input type="radio"/>	假如中國進口農產品有折扣優惠，我比較會考慮購買。	<input type="radio"/>
<input type="radio"/>	中國有機農產品所提供的價值，值得我花這個錢。	<input type="radio"/>
<input type="radio"/>	購買「有機紅甜椒」能令我感到開心，因為我同時對環境自然資源的維護作出貢獻。	<input type="radio"/>
<input type="radio"/>	中國進口的有機紅甜椒值得信賴。	<input type="radio"/>
<input type="radio"/>	日本進口的有機紅甜椒值得信賴。	<input type="radio"/>

請點擊箭頭符號繼續，謝謝。

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台灣消費者之購買選擇行為研究

請只考慮下面這五個陳述，並且想像您正在採購食物。請指出您最同意哪一個陳述，及最不同意哪一個陳述。  
(5 of 10)

最不同意	陳述	最同意
<input type="radio"/>	假如台灣國產農產品有折扣優惠，我比較會考慮購買。	<input type="radio"/>
<input type="radio"/>	台灣國產的有機紅甜椒值得信賴。	<input type="radio"/>
<input type="radio"/>	假如中國進口農產品有折扣優惠，我比較會考慮購買。	<input type="radio"/>
<input type="radio"/>	我認為「有機紅甜椒」含有比較高含量的維生素C與抗癌成份。	<input type="radio"/>
<input type="radio"/>	中國進口的有機紅甜椒值得信賴。	<input type="radio"/>

請點擊箭頭符號繼續，謝謝。

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台灣消費者之購買選擇行為研究

您做得很好！

我們了解這些選擇題非常地有挑戰性，接下來只剩下最後的五道選擇題，煩請您務必要完成，以幫助我們能更加地了解哪些重要的因素會影響您的購物決定。請加油！

請點擊箭頭符號繼續，謝謝。



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Survey of Taiwanese Consumers' Food Choice

Good work so far!  
We know that some of these tradeoffs are challenging. We need to ask you to evaluate 5 more sets. Please complete the all choice tasks, so we can better understand what influence consumers' shopping decision.  
Cheer up!

Please continue the survey by clicking the arrow.



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台灣消費者之購買選擇行為研究

請只考慮下面這五個陳述，並且想像您正在採購食物。請指出您最同意哪一個陳述，及最不同意哪一個陳述。  
(6 of 10)

最不同意	陳述	最同意
<input type="radio"/>	我相信日本政府已經盡最大的努力，訂定食品法規並落實食品檢驗流程，所有的消費者能夠因此受到週全的保護。	<input type="radio"/>
<input type="radio"/>	購買「有機紅甜椒」對維護環境自然資源的貢獻與購買「非有機紅甜椒」是一樣的。	<input type="radio"/>
<input type="radio"/>	假如台灣國產農產品有折扣優惠，我比較會考慮購買。	<input type="radio"/>
<input type="radio"/>	我喜歡購買日本生產的非有機紅甜椒。	<input type="radio"/>
<input type="radio"/>	我喜歡購買中國生產的有機紅甜椒。	<input type="radio"/>

請點擊箭頭符號繼續，謝謝。

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台灣消費者之購買選擇行為研究

請只考慮下面這五個陳述，並且想像您正在採購食物。請指出您最同意哪一個陳述，及最不同意哪一個陳述。  
(7 of 10)

最不同意	陳述	最同意
<input type="radio"/>	我相信日本政府已經盡最大的努力，訂定食品法規並落實食品檢驗流程，所有的消費者能夠因此受到週全的保護。	<input type="radio"/>
<input type="radio"/>	我喜歡購買中國生產的非有機紅甜椒。	<input type="radio"/>
<input type="radio"/>	我相信中國政府已經盡最大的努力，訂定食品法規並落實食品檢驗流程，所有的消費者能夠因此受到週全的保護。	<input type="radio"/>
<input type="radio"/>	若是中國進口農產品有附上通過農藥殘留檢驗的告示，我會更可能考慮購買。	<input type="radio"/>
<input type="radio"/>	我喜歡購買台灣生產的非有機紅甜椒。	<input type="radio"/>

請點擊箭頭符號繼續，謝謝。

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台灣消費者之購買選擇行為研究

請只考慮下面這五個陳述，並且想像您正在採購食物。請指出您最同意哪一個陳述，及最不同意哪一個陳述。  
(8 of 10)

最不同意	陳述	最同意
<input type="radio"/>	我喜歡購買中國生產的非有機紅甜椒。	<input type="radio"/>
<input type="radio"/>	若是日本進口農產品有附上通過農藥殘留檢驗的告示，我會更可能考慮購買。	<input type="radio"/>
<input type="radio"/>	若是臺灣的國產農產品有附上通過農藥殘留檢驗的告示，我會更可能考慮購買。	<input type="radio"/>
<input type="radio"/>	我相信臺灣政府已經盡最大的努力，訂定食品法規並落實食品檢驗流程，所有的消費者能夠因此受到週全的保護。	<input type="radio"/>
<input type="radio"/>	台灣有機農產品所提供的價值，值得我花這個錢。	<input type="radio"/>

請點擊箭頭符號繼續，謝謝。

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台灣消費者之購買選擇行為研究

請只考慮下面這五個陳述，並且想像您正在採購食物。請指出您最同意哪一個陳述，及最不同意哪一個陳述。  
(9 of 10)

最不同意	陳述	最同意
<input type="radio"/>	我認為「有機紅甜椒」與「非有機紅甜椒」的維生素C與抗癌成份的含量一樣。	<input type="radio"/>
<input type="radio"/>	若是日本進口農產品有附上通過農藥殘留檢驗的告示，我會更可能考慮購買。	<input type="radio"/>
<input type="radio"/>	我喜歡購買日本生產的有機紅甜椒。	<input type="radio"/>
<input type="radio"/>	日本進口的有機紅甜椒值得信賴。	<input type="radio"/>
<input type="radio"/>	假如日本進口農產品有折扣優惠，我比較會考慮購買。	<input type="radio"/>

請點擊箭頭符號繼續，謝謝。

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台灣消費者之購買選擇行為研究

請只考慮下面這五個陳述，並且想像您正在採購食物。請指出您最同意哪一個陳述，及最不同意哪一個陳述。  
(10 of 10)

最不同意	陳述	最同意
<input type="radio"/>	台灣有機農產品所提供的價值，值得我花這個錢。	<input type="radio"/>
<input type="radio"/>	我喜歡購買台灣生產的非有機紅甜椒。	<input type="radio"/>
<input type="radio"/>	假如日本進口農產品有折扣優惠，我比較會考慮購買。	<input type="radio"/>
<input type="radio"/>	購買「有機紅甜椒」對維護環境自然資源的貢獻與購買「非有機紅甜椒」是一樣的。	<input type="radio"/>
<input type="radio"/>	購買「有機紅甜椒」能令我感到開心，因為我同時對環境自然資源的維護作出貢獻。	<input type="radio"/>

請點擊箭頭符號繼續，謝謝。

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台灣消費者之購買選擇行為研究

非常棒！您終於完成以上所有的選擇題。


接下來，您將會找到關於自己的幾個問題。請注意，您所填寫的資料將會被嚴格保密，僅用於學術使用，均以總計方式呈現，請您安心填答。

1. 您的性別。

男

女



0%  100%

Survey of Taiwanese Consumers' Food Choice


Well done! You completed all the choice tasks.

In the following section, you will find a few questions about yourself. Please note that this information will remain strictly anonymous and confidential and will be used for statistical analysis only.

1. Your gender.

Male

Female



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## 台灣消費者之購買選擇行為研究

## 2. 您的年齡範圍。

- 19歲以下
- 20歲-29歲
- 30歲-39歲
- 40歲-49歲
- 50歲-59歲
- 60歲以上
- 無可奉告



0%  100%

## Survey of Taiwanese Consumers' Food Choice

## 2. Your age range.

- 19 and under
- 20-29
- 30-39
- 40-49
- 50-59
- 60 and over
- No comment



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## 台灣消費者之購買選擇行為研究

## 3. 您所居住的地理位置。

- 北部
- 中部
- 南部
- 東部
- 外島



0%  100%

## Survey of Taiwanese Consumers' Food Choice

## 3. Please indicate the location where you live.

- Northern part
- Middle part
- Southern part
- Eastern part
- Offshore islands



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### 台灣消費者之購買選擇行為研究

4. 請指出最佳的描述,您在台灣所居住的地區。

- 都市或大城市地區
- 中型城市地區
- 郊區或小型都市



0%  100%

### Survey of Taiwanese Consumers' Food Choice

4. Please indicate which area you are living in Taiwan.

- Urban and large city area
- Medium size city area
- Rural and small city area





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台灣消費者之購買選擇行為研究

5. 請問包含您自己，一共有多少人住在您的家庭內？  
(請鍵入數字)

6. 從這些人內，請問有幾位是為未滿 18 歲的小孩？  
(請鍵入數字)




0%  100%

Survey of Taiwanese Consumers' Food Choice

**5. How many people are there in your household, including yourself?**  
(Only numbers allowed in the textbox)

**6. Of them, how many children (<18 years old) currently live in your household?**  
(Only numbers allowed in the textbox)



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台灣消費者之購買選擇行為研究

7. 您的婚姻狀況。

- 單身
- 單身，但有感情伴侶
- 結婚
- 其它（例如離婚或寡夫寡婦等）
- 無可奉告

◀ ▶

0%  100%

Survey of Taiwanese Consumers' Food Choice

7. Please indicate your marital status.

- Single
- Single but in a relationship
- Married
- Others (i.e. Divorced, widowed etc.)
- No comment

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台灣消費者之購買選擇行為研究

8. 您的最高學歷。

國中（九年教育）

高中（十二年教育）

專科院校

大學以上

無可奉告



0%  100%

Survey of Taiwanese Consumers' Food Choice

8. Please indicate the highest level of education you have achieved.


Up to secondary school (or 9-year-education)

High school (or 12-year-education)

College

University and higher

No comment



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## 台灣消費者之購買選擇行為研究

## 9. 您的職業?

- 軍公教人員
- 受雇於私人企業
- 自己經營企業/ 自由業
- 學生
- 家管
- 退休人員
- 待業中



0%  100%

## Survey of Taiwanese Consumers' Food Choice

## 9. Your career.

- Governmental servant
- Employed in private company
- Self employed
- Student
- Housemaker
- Retirement
- Job hunting



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台灣消費者之購買選擇行為研究

**10. 請指出您的家庭中所有成員整戶每月平均的稅後收入總合範圍。**

(請注意：若您是獨居，則只計算您本身獨自一戶的稅後收入。若是兩大一小的家庭，則是指這整戶家庭的稅後收入。)

新台幣 30,000 元以下

新台幣 30,001 - 60,000 元


新台幣 60,001 - 90,000元


新台幣 90,001 - 120,000元

新台幣 120,001 - 150,000元

新台幣 150,001 元以上

無可奉告



0%  100%

Survey of Taiwanese Consumers' Food Choice

**10. Please indicate your household monthly net income range.**

(If you live alone, you only need to consider your net income. If you live in a household with other family members, then you need to consider the household net income for the entire family)

Up to NT 30,000

NT 30,001 –NT 60,000


NT 60,001 –NT 90,000

NT 90,001 –NT 120,000

NT 120,001 –NT 150,000

NT 150,001 and over

No comment



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### 台灣消費者之購買選擇行為研究

#### 11. 請指出您的家庭每月平均在食物上的花費範圍。

(請注意，本題的食物花費指的是在您所居住的這戶裡，所有與食物開銷有關的花費(例如：水果、食材、飲料與餐廳外食的花費等)均需納入考量。)

- 新台幣 8,000 元以下
- 新台幣 8,001 - 16,000 元
- 新台幣 16,001 - 24,000元
- 新台幣 24,001 - 32,000元
- 新台幣 32,001 元以上



0%  100%

### Survey of Taiwanese Consumers' Food Choice

#### 11. Please indicate the average monthly food expenditure in your household.

(The average monthly food expenditure refers to all the expenses related to food including fruit, food ingredients, cost for dining in the restaurant etc.)

- Up to NT 8,000
- NT 8,001 – NT 16,000
- NT 16,001– NT 24,000
- NT 24,001 – NT 32,000
- NT 32,001 and over



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## 台灣消費者之購買選擇行為研究

12. 請問您每次採購食物的花費，其中有機食品平均約佔總花費多少金額比例？

- 低於 20%
- 21%- 40%
- 41%- 60%
- 61%- 80%
- 高於 80%



0%  100%

## Survey of Taiwanese Consumers' Food Choice

What is the average cost proportion of organic food on food purchase expenses usually?

- Up to 20%
- 21% - 40%
- 41% - 60%
- 61% - 80%
- 81% and over



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## 台灣消費者之購買選擇行為研究

13. 請問您每次採購食物的花費，其中進口食品平均約佔總花費多少金額比例？

- 低於 20%
- 21%- 40%
- 41%- 60%
- 61%- 80%
- 高於 80%



0%  100%

## Survey of Taiwanese Consumers' Food Choice

What is the average cost proportion of imported food on food purchase expenses usually?

- Up to 20%
- 21% - 40%
- 41% - 60%
- 61% - 80%
- 81% and over



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### 台灣消費者之購買選擇行為研究

太棒了！問卷終於完成填寫,並且成功的寄出！

最後，由衷的感謝您抽出寶貴的時間參與此線上問卷，與您的熱心幫忙，在此致上十二萬分的謝意。

敬祝您闔家身體健康，事業順利。

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### Survey of Taiwanese Consumers' Food Choice

Wonderful! You have completed the survey and your responses are successfully submitted. We deeply thank you for taking the time and appreciate your involvement in this survey. Thank you very much for your help.



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