CENTRE FOR HEALTH ECONOMICS RESEARCH AND EVALUATION

Estimating the value of irradiation food labelling in Australia and New Zealand

Final Report

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Contents

Tables

Figures

1 Executive Summary

The aim of this project is to explore the impact on consumer preferences and choices of possible changes to mandatory labelling of irradiated food.

We have used discrete choice experiment methods to explore the impact of changes to labelling of irradiated foods in Australia and New Zealand. The choice experiment was undertaken in samples of consumers drawn from on-line panels in Australia and New Zealand. Consumers were asked to consider three different food products; strawberries, bananas and chicken, that could potentially be irradiated. Before undertaking the choice tasks, respondents were provided with some information about food irradiation, instructions about how to complete the choice tasks and a sample choice task. The respondents were also asked about their previous knowledge and exposure to irradiation foods, plus a series of attitudinal and demographic questions.

The foods were described in terms of key attributes such as shelf life, price, country of origin, as well as the food labelling information about irradiation. In addition, the experiments were designed to vary the information that consumers had about the benefits of food irradiation. This allowed us to explore the effect of the way food labelling information is presented, as well as the impact of the food label itself.

Three "information conditions" were presented in the experiment before the choice sets in the experiment. These varied in terms of the amount of information given about food irradiation *(see Figure 3 for actual text used).*

- **Information condition 1** simply stated that irradiation was a preservation technique similar to pasteurisation *(control group).*
- **Information condition 2** reiterated that irradiation is a safe process and provided information about the benefits of irradiation, such as extended shelf-life and reduced spoilage *(the aim of this condition was to test the impact of education).*
- **Information condition 3**, contained the same information as information condition 2, but also stated that irradiation avoids the use of chemical treatments *(the aim of this condition was to test the impact of education and to explore different labelling options)*.

In addition to the information provided in the information conditions, the irradiation labelling attribute also varied by choice set and by information condition. The following labelling attributes were presented to respondents during the experiment:

- No label (information conditions 1, 2, and 3)
- Label 'this product was not irradiated' (information conditions 1, 2, and 3)
- Label 'this product was irradiated' (information conditions 1,2)
- Label 'this product was irradiated to kill harmful bacteria and prevent spoilage' (information condition 3 – chicken case study)
- Label 'this product was irradiated as an alternative to chemical treatment to protect against the spread of fruit fly' (information condition 3 – fruit case study)

A total of 1,502 individuals from Australia and 1521 from New Zealand completed the survey. In the Australian sample, 509 respondents were randomised to information condition 1, 545 to information condition 2 and 488 to information condition 3. The equivalent allocation for the New Zealand sample was 495, 513 and 513 (see Figure 2 and Figure 3). The characteristics of those who completed the choice experiments were representative of the wider populations in terms of age, gender, education, household income and household composition.

1.1 Findings

This report provides the latest information regarding consumers' awareness and purchasing behaviour with respect to irradiated food. Awareness of the international Radura symbol was low (between 10%-12%), but higher than previously reported in Australia and New Zealand (FSANZ report 2003). About half of the New Zealand respondents and a third of the Australian respondents reported that they had heard of food irradiation. A quarter said they had knowingly purchased irradiated foods previously. Despite mandatory labelling of irradiated food, the majority of respondents did not know whether they had purchased irradiated foods previously (63% and 65%).

A quarter of respondents said they would purchase irradiated food in the future and a quarter said they would not purchase irradiated food, with the remainder undecided. When these findings are divided across the different information conditions, we observe that respondents that received additional education (information conditions 2 and 3) are more likely to say they would purchase irradiated food in the future when compared to those respondents that received limited information (information condition 1). These results suggest that greater awareness and improved education has a role to play in wider acceptance of food irradiation.

The relative importance of the food attributes was ascertained by estimating the willingness-to-pay (WTP) derived from coefficients from a generalised multinomial logit (G-MNL) model. For chicken, country of origin was the most important attribute, with respondents clearly preferring chicken produced locally. Chicken sourced from Thailand was the least desirable option. For example, Australian respondents would rather pay $8 more for Australian chicken than accept chicken from Thailand. Indeed the findings suggest that Australian respondents would pay an extra $5 for meat that was labelled as from Australia (compared to unlabelled meat of unknown origin). Respondents also preferred free-range chicken (compared to conventionally farmed chicken), a lower risk of foodborne illness, longer shelf-life and a lower price. For example, we estimated that respondents would be prepared to pay an extra dollar for free-range chicken compared to conventionally farmed chicken. These preferences were consistent across the different information conditions provided during the experiment.

For fruit, respondents demonstrated a preference for locally produced fruit, with a longer shelf-life and lower price.

1.1.1 Irradiation labelling

In terms of the irradiation label, the results differ by information condition. For information conditions 1, respondents had a clear preference for non-irradiated chicken (or fruit). The coefficients were negative with a monotonic relationship between the probability of irradiation and the size of the coefficient. For information condition 1, the results suggest that respondents would be prepared to pay an extra $2 for non-irradiated chicken or fruit (or an extra $1 for labelled non-irradiated chicken/fruit, when the alternative is unlabelled chicken with a 50% probability that the chicken has been irradiated). These results were consistent between Australian and New Zealand respondents.

For information condition 2, the results suggest that respondents would still prefer non-irradiation food, but the level of compensation required was lower than for information condition 1.

For information condition 3, respondents were indifferent between irradiated and non-irradiated foods (i.e. under this condition, respondents are willing to accept irradiated food and no additional cost/compensation is required). These results demonstrated that education and the labelling information can influence the acceptability of irradiated foods.

The preferences of the Australian and New Zealand respondents were very similar. However, New Zealand respondents were more likely to have heard of food irradiation and for the fruit scenario, they were more price sensitive and placed less importance on country of origin.

It is worth noting that the results of the G-MNL modelling demonstrated that there is significant heterogeneity in individual preferences towards irradiated food. Therefore even with increased education and labelling, some individuals will still maintain a strong preference for non-irradiated foods.

1.2 Conclusions

About half of the New Zealand respondents and two thirds of the Australian respondents reported that they had not heard of food irradiation and most said they had never knowingly purchased irradiated foods. Given this lack of awareness, it is unsurprising that on average, consumers state that they would prefer non-irradiated food to irradiated food. This suggests that given the current information available to consumers, food irradiation labels are used by some consumers as a way of avoiding irradiated products or choosing non-irradiated food and consequently removing the mandatory irradiation labels would lead to an overall welfare loss to consumers. However, it is clear that the extent of the welfare loss is dependent upon the level of information that consumers have about irradiation.

Importantly, we demonstrate that raising awareness about the safety and benefits of food irradiation processing, combined with a greater understanding of alternative processing treatments, can ameliorate the negative impact of irradiation labelling on food choices. This suggests that education has a role to play if consumers are to accept changes to the mandatory requirement for food irradiation labelling.

2 Introduction

2.1 Overview and background to the project

The aim of this project is to explore the impact on consumer preferences and choices of possible changes to mandatory labelling of irradiated food.

In 2009, the then Australian and New Zealand Food Regulation Ministerial Council (now the Australia and New Zealand Ministerial Forum on Food Regulation) (Forum) agreed to a comprehensive independent review of food labelling law and policy. In January 2011 an expert panel, chaired by Dr Neal Blewett, AC, released a report entitled Labelling Logic: Review of Food Labelling Law and Policy, and outlined 61 recommendations. After the review of the Labelling Logic recommendations, the Forum referred a number of these recommendations to FSANZ.

Recommendation 34 was one of these recommendations; it recommended *"that the requirement for mandatory labelling of irradiated food be reviewed".*

Food irradiation is used in more than 50 countries to destroy bacteria and pests and to extend the shelf life of food. Food irradiation technology is an alternative to chemical and heat treatment of food.

At low doses, irradiation extends a product's shelf life. At higher doses, this process kills insects, moulds, bacteria and other potentially harmful micro-organisms. Most modern day irradiation processes involve passing food through a radiation field. The radiation may be an electron beam or come from X-rays. The radiation may also consist of gamma rays, which are generated from the radioactive source cobalt 60.

Current technology allows for a precise dose of radiation to be measured. The doses permitted range from a maximum of 1 kilogray (kGy) for tropical fruits and up to 30 kGy for herbs and spices[1]. No radioactive energy remains in the food after irradiation.

Research has shown that food irradiation is safe and effective. The process has been examined thoroughly by the World Health Organization; the United Nations Food and Agriculture Organization; the European Community Scientific Committee for Food; the United States Food and Drug Administration, a United Kingdom House of Lords committee and by scientists at FSANZ.

Food irradiation is permitted in Australia and New Zealand under the authority of FSANZ.[2] FSANZ grants specific permission for foods to be irradiated and requires these foods to be labelled, including food that has irradiated ingredients. Currently, Australia New Zealand Food Standards Code – Standard 1.5.3 (updated 1 March 2016) permits the irradiation of the following: herbs and spices, herbal infusions of plant materials, and fruits and vegetables (apples, apricots, bread fruit, capsicum, carambola, cherry, custard apple,

[1] Radiation is measured in kilograys (kGy). 1kGy = 1000 Gray (Gy). It indicates the absolution of 1 Joule (watt per second) of ionising radiation by one kilogram of matter (mass).

[2] http://www.foodstandards.gov.au/consumer/foodtech/irradiation/Pages/default.aspx

honeydew, litchi, longan, mango, mangosteen, nectarine, papaya, peach, persimmon, plum, rambutan, rockmelon, scaloppini, strawberry, table grape, tomato and zucchini).

FSANZ assesses each application for food irradiation by considering the following four aspects of the process and effect on the food: the technological need for the treatment; the safety of the treatment; effects on food composition; and any effects on the nutritional quality of the food.

A food that has been irradiated, or food that contains irradiated ingredients or components, must have a mandatory labelling statement that the food, ingredients or components have been treated with ionising radiation. This requirement applies to packaged and unpackaged irradiated foods. If the food is unpackaged, the mandatory labelling statement must be displayed close to the food. The international Radura symbol (Figure 1) may be used in addition to the mandatory labelling. In Australia and New Zealand it is not mandatory to include the Radura symbol, however, the statement indicating that a food has been treated with ionising radiation is mandatory.

Figure 1: Radura symbol

CHERE previously conducted a review, commissioned by FSANZ, of the available peer reviewed and grey literature on the attitudes of consumers to food irradiation labelling. The review considered a range of issues including consumer awareness and understanding towards food irradiation labelling, the purchasing impact of food irradiation labelling on consumer choice, the economic impact of food irradiation labelling on consumer choice (including costs and benefits) and the impact of removing mandatory food irradiation labelling information on consumer attitude.

This review demonstrated that consumers' understanding and awareness of food irradiation varies significantly. Consumer understanding of the food irradiation process is a key determining factor in understanding irradiation labelling. Awareness of food irradiation labelling was low. Only 1% of respondents were aware of the irradiation label element; this rose slightly to 6% once the respondents had been prompted (FSANZ 2003).

Given the low number of consumers that were aware of irradiated food labelling, it was unsurprising that only 3% of respondents indicated that they used irradiated food labels at least occasionally to make purchasing decisions (FSANZ 2003).

Consumers perceive food irradiation labels in different ways. Many consider it an assurance of quality, some view it a warning symbol. The way labelling information is presented (in terms of wording, presentation and the inclusion of the voluntary Radura symbol) may directly impact the way that consumers form general opinions about irradiated food. It also suggests that different people will perceive the same label in a different way (positive or negative) depending on their knowledge and beliefs.

No studies compared the differences in consumer responses between voluntary and mandatory food irradiation labelling requirements. The review provides some evidence with regard to the differences between consumer attitudes towards mandatory and voluntary food labelling. Removal of mandatory labelling may impact the ability of consumers to make informed choices. Consumers averse to food irradiation may use other food labelling information as a proxy for irradiation status, or avoid food types that are known to be irradiated.

The 'right to know' was a common theme raised. The cost to consumers (and therefore society) of removing irradiation labelling, is related to a number of factors; such as the resistance to irradiated food, the proportion of individuals that choose food products based on their irradiation status (whether positive or negative) and the ease to obtain product information in the absence of the label.

The review demonstrated that there is considerable uncertainty about the impact of changes to food labelling for irradiated foods on consumer preferences for food, on consumer choices and demand for different food products and on consumer wellbeing. Consideration of the impact on consumer choice needs to be incorporated in the overall costs and benefits of changes to food irradiation labelling. In previous research we have demonstrated that there is a wellbeing (or utility[3]) impact of implementation of mandatory programs[4]. Specifically the previous research used discrete choice experiment methods to investigate three case studies of mandatory health programs – fortification of bread with folate, vaccination of children and banning of trans fats. In each case the research demonstrated that some consumers experienced a reduction in wellbeing when health programs removed choice, but that this depended on the nature of the program and the health benefits that the program delivered.

In this project, we have used discrete choice experiment methods to explore the impact of changes to labelling of irradiated foods on Australia and New Zealand consumers. Discrete choice experiments are a stated preference technique widely used in economics and marketing to investigate how the characteristics of products affect choices. They are particularly useful for new products, or to explore the effect of characteristics that are not commonly seen in the market. Respondents are presented with hypothetical but realistic situations (called choice sets) in which products or programs are described in terms of their attributes, and options are offered. The respondent is asked to choose their preferred option (this may be the product they would choose, or the one they like best or worst. Respondents see a number of the choice sets, and in each choice set the attributes are varied across a series of levels (or values) that allow the analyst to explore what is most valued. The experiment is designed to choose the choice sets that are presented to each respondent to ensure the attribute levels are varied in a way that allows the effect of each attribute and level to be estimated independently from the responses to each choice set. Multinomial choice statistical analysis methods are used to estimate these effects.

[3] Utility is the total satisfaction received from consuming a good or service. The economic utility of a good or service is important because it will directly influence the demand, and therefore price, of that good or service.

[4] Parkinson, B. T., Goodall, S., Norman, R. Measuring the loss of consumer choice in mandatory health programs using discrete choice experiments. Applied Health Economics and Health Policy, 11(2), 139-150. 2013

In the experiment, consumers are presented with a series of choice sets representing potential food shopping choices for a range of different foods. The foods are described in terms of relevant attributes such as shelf life, price, country of origin, as well as the food labelling information about irradiation. In addition, the experiments were designed to vary the information (and label) that consumers had about the benefits of food irradiation (Figure 3). This allows us to explore the effect of the way food labelling information is presented, as well as the impact of the food label itself.

3 Methods

3.1 Overview of the experiment

The choice experiment was undertaken in samples of consumers drawn from on-line panels in Australia and New Zealand. In the choice experiment undertaken, consumers were asked to consider three different food products, specifically two fruits (strawberries and bananas) and chicken that could potentially be irradiated. Respondents were asked to imagine that they were undertaking their grocery shopping and choosing between different options for each of these food products. In each case they were presented with two options for the product, described in terms of a range of product attributes. Respondents were asked to state which of the two products they preferred, and then asked whether, if their preferred product was available, they would choose to buy it or not. Before undertaking the choice tasks, respondents were provided with some information about food irradiation, instructions about how to complete the choice tasks and a sample choice task. The respondents were also asked a series of attitudinal and demographic questions.

Based on consultation with FSANZ, the experiment was designed to investigate the impact of information provided to consumers about food irradiation. Specifically three "information conditions" were presented in the experiment, and respondents were randomly assigned to one of the information conditions (or vignettes), that varied in terms of the amount of information were given about food irradiation. Figure 1 provides a schematic representation of the choice experiments.

- **Information condition 1** simply stated that irradiation was a preservation technique similar to pasteurisation *(control group - representing the current situation in which respondents have only basic information about food irradiation).*
- **Information condition 2** reiterated that irradiation is a safe process and provided information about the benefits of irradiation, such as extended shelf-life and reduced spoilage *(the aim of this condition was to test the impact of education).*
- **Information condition 3**, contained the same information as information condition 2, but also stated that irradiation avoids the use of chemical treatments *(the aim of this condition was to test the impact of education and to explore different labelling options)*.

Figure 3 provides details of the text used in each of the information conditions.

Figure 2: Flow of respondents in the DCE

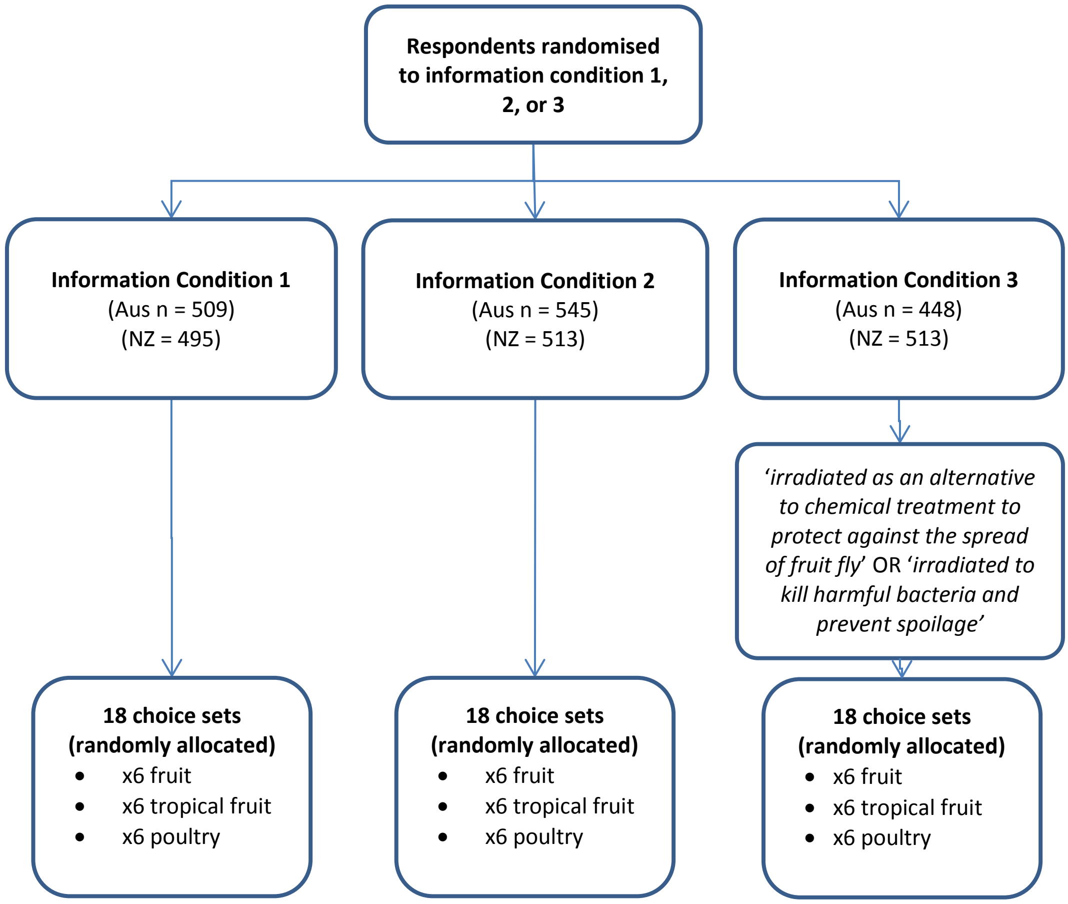

Figure 3: Information conditions

Information condition 1

The food available in shops may have labels about how it has been treated or processed, including about food irradiation. Food irradiation is a processing and preservation technique with similar results to freezing or pasteurisation.
Some of the food has labels that include: "This product was irradiated".

Information condition 2

The food available in shops may have labels about how it has been treated or processed, including about food irradiation. Food irradiation is a processing and preservation technique with similar results to freezing or pasteurisation.
Some of the food has labels that include: "This product was irradiated".

Food irradiation is a form of food processing that extends shelf life and reduces spoilage of food. During this procedure, foods (such as fruits and poultry) are exposed to doses of ionising energy, or radiation, to kill insects, moulds and micro-organisms.

There is a common misconception that irradiated food is radioactive. The radiation used to process foods is very different from the radioactive fallout that occurs after, for example, a nuclear accident. In food processing, the radioactive sources permitted do not generate gamma, electrons or x-rays of sufficient high energy to make food radioactive. There are no detectable levels of radiation left behind in the products.

The World Health Organization (WHO), the American Dietetic Association and the Scientific Committee of the European Union are three internationally recognised bodies that support food irradiation.

Information condition 3

The food available in shops may have labels about how it has been treated or processed, including about food irradiation. Food irradiation is a processing and preservation technique with similar results to freezing or pasteurisation.
Some of the food has labels that include: "This product was irradiated".

Food irradiation is a form of food processing that extends shelf life and reduces spoilage of food. During this procedure, foods (such as fruits and poultry) are exposed to doses of ionising energy, or radiation, to kill insects, moulds and micro-organisms.

There is a common misconception that irradiated food is radioactive. The radiation used to process foods is very different from the radioactive fallout that occurs after, for example, a nuclear accident. In food processing, the radioactive sources permitted do not generate gamma, electrons or x-rays of sufficient high energy to make food radioactive. There are no detectable levels of radiation left behind in the products.

The World Health Organization (WHO), the American Dietetic Association and the Scientific Committee of the European Union are three internationally recognised bodies that support food irradiation.

Many fresh foods are treated with chemicals to control for pests during storage and transportation. Chemicals used in agriculture include insecticides, fungicides and herbicides. Some previously used chemicals may no longer be available for these purposes. Food irradiation is an alternative to chemical treatment, particularly in cases where there are no chemicals available to protect the food during storage.

Note: Information condition 3 also includes additional text within the label attribute. Fruit; *"This product was irradiated as an alternative to chemical treatment to protect against the spread of fruit fly"* and chicken; *"This product was irradiated to kill harmful bacteria and prevent spoilage".*

3.2 Design of the experiment

The previous literature review informed the candidate set of possible attributes. These were then presented in a stakeholder consultation with FSANZ, to ensure that the attributes were both realistic and relevant to the key policy questions and variables. In consultation with FSANZ, and based on products that could potentially be irradiated in the Australian and New Zealand context, three food products were presented to each consumer – strawberries (representing an "everyday" fruit), bananas (representing a tropical fruit) and chicken (a standard meat product). A draft set of attributes and levels were then developed and tested in a focus group with a convenience sample of consumers, to confirm the appropriateness of wording and whether the most relevant factors they consider when shopping were included in the choice sets. The choice experiment was then piloted in a sample of 100 consumers, and further refined based on the responses to this pilot.

The final set of attributes and levels for the experiment are presented in Table 1 and Table 2. There were some differences between the attributes for the two fruits compared with the chicken, reflecting the different nature of the products, but otherwise and to facilitate comparison, the attributes and levels were common across all three food products. The attributes which were common across all three products were the shelf life of the product (three levels), the price of the product (three levels, with the prices expressed in terms of a realistic quantity of the food for the prices presented), a country of origin label (four levels, including Australia and New Zealand). The chicken choice sets included two additional attributes: risk of foodborne illness (two levels) and farming methods (two levels). The farming methods attribute (conventional or free range) was added after the pilot phase because it was evident that consumers were potentially using price as a proxy for quality.

Table 1: Attributes and Levels - Chicken

Attribute	Level text
Food Process Label*	
Information condition 1 & 2	1) *"This product was irradiated"* 2) *"This product was not irradiated"* 3) No label
Information condition 3	1) *"The product was irradiated to kill harmful bacteria and prevent spoilage"* 2) *"This product was not irradiated"* 3) No label
Probability of irradiation treatment*	1) 0% 2) 10% 3) 50% 4) 80% 5) 100%
Farming methods	1) Conventional 2) free range
Shelf life (eat within)	1) 2 days 2) 5 days 3) 10 days
Price	1) $2.99 2) $4.99 3) $6.99
Country of origin label	1) Australia 2) New Zealand 3) Thailand 4) No label
Risk of foodborne illness	1) 1 in 10,000 2) 10 in 10,000

* The "food process label" and "probability of irradiation treatment" were present as two attributes in the choice sets, but these attributes were actually combined into a five level attribute in the experimental design. These levels were:

- "The product was irradiated", 100% probability of irradiation treatment**
- "The product was not irradiated", 0% probability of irradiation treatment
- "No Label", 80% probability of irradiation treatment
- "No Label", 50% probability of irradiation treatment
- "No Label", 10% probability of irradiation treatment

** Applies to information conditions 1 and 2 only. For information condition 3 the food process label reads "The product was irradiated to kill harmful bacteria and prevent spoilage"

Table 2: Attributes and Levels - Fruit

Attribute	Level text
Food Process Label*	
Information condition 1 & 2	1) *"This product was irradiated"* 2) *"This product was not irradiated"* 3) No label
Information condition 3	1) *"This product was irradiated as an alternative to chemical treatment to protect against the spread of fruit fly"* 2) *"This product was not irradiated"* 3) No label
Probability of irradiation treatment*	1) 0% 2) 10% 3) 50% 4) 80% 5) 100%
Shelf life (eat within)	1) 2 days 2) 5 days 3) 10 days
Price	1) $2.99 2) $4.99 3) $6.99
Country of origin label	1) Australia 2) New Zealand 3) Thailand 4) No label

* The "food process label" and "probability of irradiation treatment" were present as two attributes in the choice sets, but these attributes were actually combined into a five level attribute in the experimental design. These levels were:

- "The product was irradiated, 100% probability of irradiation treatment**
- "The product was not irradiated, 0% probability of irradiation treatment
- "No Label", 80% probability of irradiation treatment
- "No Label", 50% probability of irradiation treatment
- "No Label", 10% probability of irradiation treatment

** Applies to information conditions 1 and 2 only. For information condition 3 the food process label reads "This product was irradiated as an alternative to chemical treatment to protect against the spread of fruit fly"

The food irradiation label attribute was presented in the experiment as two attributes, the food label and the probability of irradiation, but in the design of the experiment was constructed as single five level attribute. Respondents were presented with three different levels of food label, either "irradiated", "not irradiated" or no label. For the "irradiated" label, the probability of irradiation was always 100%, and for the "not irradiated" label, the probability of irradiation was always 0%. If there was no food label, three levels of probability of irradiation were presented (10%, 50% and 80%).

The food labelling attribute also varied across the information conditions and the fruit and chicken product types. For information conditions 1 and 2, the food label was as described above. For the third condition, for fruit choice sets the wording of the irradiation label level was changed to *"This product was irradiated as an alternative to chemical treatment to protect against the spread of fruit fly"* – this wording was developed in consultation with FSANZ, and was designed to provide consumers with the additional information that food which is not irradiated may be treated with chemicals. For the third condition for the chicken choice sets the wording of the irradiation label was changed to *"This product was irradiated to kill harmful bacteria and prevent spoilage"* – this wording was developed to provide additional information about the benefits to consumers of irradiation.

The final design therefore included one five level attribute, two three level attributes and a four level attribute for the fruit options, and two additional two level attributes for the chicken options, giving 720 possible combinations of chicken products and 180 possible combinations of fruit products. These options are then combined in choice sets of size two (two options in each choice set), giving 518,400 candidate choice sets for chicken and 32,400 candidate choice sets for fruit options. The choice sets included in each experiment were selected using a d-optimal procedure within the experimental design software NGene (NGene, 2014). Ngene uses optimisation to select choice sets via a swapping algorithm that increases the efficiency of the design until a user specified stopping point (e.g. no improvement in X iterations) is reached. In this case a WTP efficiency design (this minimises the variance of the ratio of two parameters, and can account for multiple ratios within a design) was specified. This necessitates the use of coefficient values, or priors, in order to generate the design. The priors were generated from the pilot study. In constructing the design the five level irradiation level was constrained so that the two extreme levels (not irradiated, 0% probability of irradiation and irradiated, 100% probability of irradiation) appeared more often in the design than the other three levels. All other attributes were selected to be balanced in terms of presentation of levels but there were no restrictions on overlap of attribute levels across the options in the choice sets. Therefore all theoretical combinations of attribute levels were possible[5].

Therefore the design was constructed using 300 rows for the chicken experiment and 180 rows for the fruit experiments. Each respondent was presented with 6 choice sets for each food product type. The experiment was then repeated over the three information conditions with each respondent randomised to one of the information conditions, as described above. Figure 3 provides the details of the wording of the different information conditions.

All choice sets were designed as being unlabelled forced choices; respondents had to make a choice between either option A or option B for each question. Choice options (Option A or Option B) were presented in a set order in each choice set; Option A on the left and Option B on the right. This was not anticipated to affect preference valuation given that this is an unlabelled design[6].

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[5] It was considered necessary to allow all combinations of attribute levels, rather than nest particular attribute levels. Although one could argue that irradiated foods should have an extended shelf life, it is possible that the actual benefit of the extended shelf life go to the producer, who may be able to transport their produce further or store for longer.

[6] It is assumed (and tested in the analysis) that respondents are indifferent between choosing the label "Option A" or "Option B". In that context, the DCE is considered to be an unlabeled design. Since respondents are likely to only trade-off between the product attributes presented in the experiment.

Example choices sets are presented in Figure 4, Figure 5 and Figure 6

Figure 4 depicts an example choice set for information conditions 1 and 2 for chicken, and Figure 5 depicts an example choice set for information condition 3 for chicken. Figure 6 depicts an example choice set for information condition 3 for fruit. As discussed previously, the information provided in the vignettes differs between the information conditions. But in terms of the attributes and levels, the only difference between information conditions 1 and 2 and information condition 3 is the wording of the irradiation label. For example, for fruit the label reads *"This product was irradiated as an alternative to chemical treatment to protect against the spread of fruit fly"* (information condition 3), and for chicken the label reads *"The product was irradiated to kill harmful bacteria and prevent spoilage"* (information condition 3)

Figure 4: Example choice set – Chicken scenario (information condition 1 and 2)

Imagine that you are shopping for your family and you need to buy a packet of chicken portions. Please consider the following options.

	Option A	Option B
Food process label	"This product was irradiated"	No label
Probability of irradiation treatment	100%	80%
Farming methods	Free range	Free range
Shelf life (eat within)	5 days	5 days
Price (per 500g pack)	$2.99	$2.99
Country of origin label	Australia	No label
Risk of foodborne illness	1 in 10,000	10 in 10,000
Which would you choose?	Option A	Option B

If the product you have just chosen was available in the shop, would you buy it?
Select only one answer

- Yes
- No

Figure 5: Example choice set – Chicken scenario (information condition 3)

Imagine that you are shopping for your family and you need to buy a packet of chicken portions. Please consider the following options.

	Option A	Option B
Food process label	"This product was irradiated to kill harmful bacteria and prevent spoilage"	"This product was not irradiated"
Probability of irradiation treatment	100%	0%
Farming methods	Conventional	Conventional
Shelf life (eat within)	2 days	10 days
Price (per 500g pack)	$6.99	$6.99
Country of origin label	No label	New Zealand
Risk of foodborne illness	1 in 10,000	10 in 10,000
Which would you choose?	Option A	Option B

If the product you have just chosen was available in the shop, would you buy it?
Select only one answer

- Yes
- No

Figure 6: Example choice set – Fruit scenario (information condition 3)

Imagine that you are shopping for your family and you need to buy a punnet of strawberries. Please consider the following options.

	Option A	Option B
Food process label	No label	"This product was irradiated as an alternative to chemical treatment to protect against the spread of fruit fly"
Probability of irradiation treatment	50%	100%
Shelf-life (eat within)	10 days	2 days
Price (per 250g punnet)	$6.99	$6.99
Country of origin label	Thailand	No label
Which would you choose?	Option A	Option B

If the product you have just chosen was available in the shop, would you buy it?
Select only one answer

- Yes
- No

3.3 Recruitment and data collection

The DCE was completed on-line, in samples in Australia and New Zealand. Respondents were recruited from the on-line panel Toluna. The final sample comprised 1521 respondents from New Zealand, of whom 495 were allocated to Information Condition 1, and 513 to each of Information Conditions 2 and 3, and 1502 respondents from Australia, of whom 509 were allocated to Information Condition 1, 545 to Information Condition 2 and 448 to Information Condition 3. These slight differences in the number of respondents to each information condition arise because of the random allocation procedure and the specification of a quota of respondents.

3.4 Analysis

The analysis presented in this draft report was undertaken using Stata software, using a conditional logit model. Further analysis will be undertaken using more sophisticated econometric modelling methods to account for preference heterogeneity.

Broadly, the analysis is based on the random utility framework. The utility of an alternative *i* in a choice set C_n to an individual *n* is given by

$$U_{in} = V(X_{in}, \beta) + \varepsilon_{in} \text{ . } \quad (1)$$

The $V(X_{in}, \beta)$ term is the explainable (or systematic) component of utility which is determined by characteristics of the choice or the individual *n*. However, there is also an error term which differs over alternatives and individuals and makes prediction of choice uncertain. This error term does not relate to the respondent incorrectly ranking as per their utility function, rather that the investigator can only identify a proportion of the reason for the respondent making a particular decision. It is assumed that the individual will choose the option if the utility associated with that option is higher than any alternative option. If we assumed there are *I* items in C_n, the choice y_{in} is defined as

$$y_{in} = f(U_{in}) = 1\_iff\_U_{in} = \max\{U_{in}\} \text{ . } \quad (2)$$

Alternative *i* is chosen over all other options *j* if and only if

$$(V_{in} + \varepsilon_{in}) > (V_{jn} + \varepsilon_{jn}) \cdot \forall j \neq i \in C_n \text{ , } \quad (3)$$

which can be rearranged to yield

$$(V_{in} - V_{jn}) > (\varepsilon_{jn} - \varepsilon_{in}) \cdot \forall j \neq i \in C_n \text{ . } \quad (4)$$

Neither the systematic utility nor the error terms are directly observed. Therefore, analysis is reliant on observing choices and inferring the terms from that. Random Utility Theory (RUT) is the dominant approach to doing this. In RUT, it is assumed that the difference in utility between two options (in this case *i* and *j*) is proportional to the frequency that one is chosen over the other.

4 Results

4.1 Data

A total of 1,502 individuals from Australia and 1,521 from New Zealand completed the survey. In the Australian sample, 509 respondents were randomised to information condition 1, 545 to information condition 2 and 448 to information condition 3. The equivalent allocation for the New Zealand sample was 495, 513 and 513.

The characteristics of those who completed the task are outlined in Table 3. The demographic data for the Australian and New Zealand respondents are similar in terms of age, gender, education, household income and household composition. Half of responders were female and a third had a university degree. There was an even age distribution and 80% of the Australia sample were born in Australia and 77% of the New Zealand sample were born in New Zealand.

Table 3: Demographic information for the Australian and New Zealand respondents

	Australia n=1,502	**New Zealand** n=1,521
	n (%)	n (%)
Age		
<18	6 (0%)	33 (2%)
18- 24	155 (10%)	152 (10%)
25-34	275 (18%)	223 (15%)
35-44	285 (19%)	195 (13%)
45-54	240 (16%)	221 (15%)
55-64	255 (17%)	260 (17%)
≥ 65	286 (19%)	437 (29%)
Sex (male)	749 (50%)	771 (51%)
Education		
Primary school only	23 (2%)	19 (1%)
Up to Year 10 only	204 (14%)	83 (5%)
Up to Year 12 only	258 (17%)	311 (20%)
Post high school qualification	475 (32%)	471 (31%)
Bachelor Degree	357 (24%)	352 (23%)
Post Graduate Degree or Higher	161 (11%)	172 (11%)
Prefer not to answer/other	24 (2%)	113 (8%)
Country of birth		
Australia	1199 (80%)	27 (2%)
New Zealand	29 (2%)	1165 (77%)
Other	274 (18%)	329 (22%)
Language in household (English)	1461 (97%)	1451 (95%)
Income (household)		
< $39K	392 (26%)	407 (27%)
$40K -$79K	450 (30%)	438 (29%)
$80K- $119K	249 (17%)	277 (18%)
$120K-$199K	179 (12%)	125 (8%)
>$200K	57 (4%)	44 (3%)
Prefer not to answer/ not sure	175 (12%)	230 (15%)
Household type		
Single	306 (20%)	260 (17%)
With children	402 (27%)	424 (28%)

Between 5-6% of respondents described themselves as vegetarian and 19% stated that they, or someone in the household, had a food allergy. About 69% of Australian respondents and 60% of the New Zealand respondents stated they were mostly responsible for the household grocery shopping. Respondents were also asked about their buying habits, 59% said they bought bananas weekly, 27% bought strawberries weekly and 52% bought chicken weekly. The equivalent values for New Zealand responders were 66%, 24% and 45%, respectively (Table 4).

Table 4: Food specific questions

	Australia	New Zealand
	n=1,502 n (%)	n=1,521 n (%)
Vegetarian	87 (6%)	79 (5%)
Food allergy (within the household)	287 (19%)	291 (19%)
Responsible for grocery shopping		
All groceries	1,037 (69%)	912 (60%)
Half of groceries	331 (22%)	449 (30%)
Less than half of groceries	93 (6%)	130(8%)
None	41 (3%)	30(2%)
Buying habits (at least once a week)		
Bananas	890 (59%)	1,001 (66%)
Strawberries	407 (27%)	372 (24%)
Chicken	786 (52%)	685 (45%)

4.2 Food Label Awareness

Before starting the choice tasks, each respondent was asked if they recognised a selection of food labels (Table 5). For the Australian respondents, the 'Paw of approval' RSPCA farming label was the most recognisable label (66%), followed by the 'smart choices' label (32%). Gluten-free 'crossed grain' and Radura labels were recognised by 16% and 12% of respondents, respectively. Very few respondents recognised the ecolabel (6%) or kosher standards label (4%).

In the New Zealand sample, the awareness of food labels was similar to the Australian sample, with the Radura label recognised by 10% of responders. The only difference related to the awareness of the RSPCA approved farming label, (31% versus 66%). This difference is probably due to New Zealand using a different RSPCA label than the one used on the survey (which was the Australian specific label).

Table 5: Awareness of different food labels

Logo	Description	Australia n=1,502 n (%)	New Zealand n=1,521 n (%)
	Gluten-free 'crossed grain'	244 (16%)	217 (14%)
	"OU kosher label" meets kosher standards	64 (4%)	31 (2%)
	"Radura" the international symbol indicating a food product has been irradiated	185 (12%)	156 (10%)
	"ecolabel" promoting sustainable energy use in production	89 (6%)	75 (5%)
	"Smart choices" Products must contain at least 10 percent of the Daily Value of a targeted nutrient	462 (31%)	394 (26%)
	"Paw of Approval" RSPCA approved farming scheme	986 (66%)	478 (31%)*

*** New Zealand has a different logo for RSPCA approved farming, which may explain the differences between awareness in the two countries**

Table 6 provides a summary of the respondents' awareness of food irradiation and whether they have previously purchased irradiated foods or would purchase irradiated foods in the future. New Zealand respondents were more likely than Australian respondents to have heard of irradiated foods (51% versus 38%), but of those who stated they had heard of food irradiation, approximately the same proportion of Australian and New Zealand respondents said they had previously purchased irradiated food (26% and 25%, respectively). Despite mandatory labelling of irradiated food, the majority of respondents did not know whether they had purchased irradiated foods previously (63% and 65%).

In the total sample approximately a quarter (19%-29%) said they would purchase irradiated food in the future, a quarter (17%-27%) said they would not and half (50%-60%) said maybe. There were no differences between the Australian and New Zealand respondents or by food types. When these findings are considered across the different information conditions, we observe that respondents that received information condition 3 are more likely to say they will purchase irradiated food in the future when compared to those respondents that received information condition 1 (20-32% compared to 17%-28%). This suggests that product information and education reduces consumer suspicion of irradiation foods.

Table 6: Awareness of irradiated foods and previous purchasing behaviour

	Australia (n=1,502)			New Zealand (n=1,521)		
	Yes	No	Maybe[1]	Yes	No	Maybe[1]
Heard of food irradiation	38%	62%	-	51%	50%	-
Previously purchased irradiated food [2]	26%	10%	63%	25%	9%	65%
Would you purchase the following irradiated foods						
Total sample						
Bananas	27%	21%	52%	29%	17%	54%
Strawberries	25%	23%	52%	25%	24%	51%
Poultry	23%	27%	51%	23%	27%	50%
Other products	20%	21%	59%	19%	19%	60%
Information Condition 1						
Bananas	23%	24%	53%	28%	19%	53%
Strawberries	22%	26%	52%	26%	26%	48%
Poultry	20%	30%	50%	25%	28%	47%
Other products	17%	24%	59%	20%	21%	59%
Information Condition 2						
Bananas	28%	19%	53%	27%	20%	54%
Strawberries	24%	23%	52%	20%	27%	53%
Poultry	23%	26%	51%	20%	30%	50%
Other products	20%	20%	60%	16%	20%	64%
Information Condition 3						
Bananas	31%	19%	50%	32%	14%	54%
Strawberries	29%	19%	51%	28%	19%	52%
Poultry	24%	24%	52%	25%	22%	53%
Other products	22%	19%	60%	20%	16%	64%

[1] Maybe or don't know [2] Only relates to respondents who stated they had heard of food irradiation (Aus n=575 and NZ n=768)

4.3 G-MNL modelling by information conditions – Chicken

The following tables provide the results of the G-MNL models for the chicken (Table 7 and Table 8) and fruit (Table 9 and Table 10) scenarios for the Australian and New Zealand respondents. For each scenario, the results for each information condition are provided separately. In general, the coefficients are well ordered and as expected.

For the chicken scenario, the coefficients demonstrate that Australian respondents prefer Australian produce (New Zealand produce in the New Zealand sample) followed by New Zealand produce (Australian produce in the New Zealand sample). Chicken supplied from Thailand was least preferred, even when compared to the no country of origin label option.

Respondents also preferred free-range chicken to conventionally farmed chicken, a lower risk of foodborne illness (1/10,000 compared to 10/10,000), longer shelf-life and a lower price. These preferences are consistent across the different information conditions.

In terms of the irradiation label, the results differ by information condition. For information conditions 1 and 2, respondents had a clear preference for non-irradiated chicken. The coefficients are negative with a monotonic relationship between the probability of irradiation and the size of the coefficient, such that the 100% probability of irradiation coefficients were larger than the 50% irradiated coefficients, and 50% coefficients were larger than the 10% coefficients.

For information condition 3, the additional label (*This product was irradiated to kill harmful bacteria and prevent spoilage)* reduced the size of the 100% irradiated coefficient, such that it was not statistically different from the no irradiation option.

The results for the New Zealand sample are similar to the Australian sample, with the exceptions highlighted above in brackets.

The relative importance of the attributes is explored further when WTP estimates are calculated (section 4.6).

Table 7: G-MNL model by information condition for Australia – Chicken scenario

Dimension		**Information condition 1 (N=509)**		**Information condition 2 (N=545)**		**Information condition 3 (N=448)**	
		Coef	**(SE)**	**Coef**	**(SE)**	**Coef**	**(SE)**
Label (Probability of Irradiation) [1]							
No label (10%)		-0.390**	(0.172)	-0.282*	(0.165)	-1.075	(0.737)
	SD	0.737**	(0.365)	0.000	(0.000)	1.875*	(0.978)
No Label (50%)		-641***	(0.171)	-0.295*	(0.168)	-1.791	(1.112)
	SD	0.590	(0.438)	0.000	(0.000)	0.010	(0.620)
No Label (80%)		-0.886***	(0.169)	-0.619***	(0.166)	--1.728	(1.056)
	SD	0.139	(0.502)	0.000	(0.000)	0.923	(0.612)
"This product was irradiated" (100%)		-1.197***	(0.206)	-0.647***	(0.171)		
	SD	1.285***	(0.301)	0.000	(0.000)		
"This product was irradiated to kill harmful bacteria and prevent spoilage" (100%)						-0.462	(0.669)
	SD					4.051*	(2.223)
Farming method [2]							
Free range		0.867***	(0.150)	1.036***	(0.148)	4.022*	(2.360)
	SD	1.471***	(0.237)	0.000	(0.001)	3.326*	(1.810)
Shelf life [3]							
5 days		0.553***	(0.144)	0.208	(0.142)	0.399	(0.487)
	SD	0.802**	(0.341)	0.000	(0.000)	2.490*	(1.335)
10 days		0.774***	(0.138)	0.493**	(0.145)	1.981	(1.221)
	SD	0.228	(0.339)	0.000	(0.000)	3.308*	(1.821)
Price		-0.476***	(0.062)	-0.802***	(0.100)	-2.047*	(1.196)
	SD	0.578***	(0.083)	0.000	(0.000)	1.665*	(0.865)
Country of Origin [4]							
NZ or Australia [5]		-1.152***	(0.180)	-1.644***	(0.222)	-5.545*	(3.353)
	SD	1.010**	(0.300)	0.000	(0.000)	2.918*	(1.622)
Thailand		-3.643***	(0.372)	-4.202***	(0.398)	-15.576*	(9.175)
	SD	1.439***	(0.372)	0.000	(0.000)	4.966*	(2.710)
No label		-2.368***	(0.267)	-3.063***	(0.326)	-10.288*	(6.129)
	SD	1.372***	(0.318)	0.000	(0.000)	2.894*	(1.712)
Probability of illness [6]							
10 in 10,000		-0.878***	(0.142)	-0.888***	(0.133)	-2.950*	(1.706)
	SD	1.178***	(0.231)	0.000	(0.000)	1.303	(0.828)

[1] Base = "This product was not irradiated (0%), [2] base = farming methods, [3], base = 2 days, [4] base = Australian in the Australian sample or New Zealand in the New Zealand sample, [5] Australia in the New Zealand sample and New Zealand in the Australia sample, [6] base = 1 in 10,000. SD = standard deviation.
Significance test: p-value < *** 0.01; ** 0.05; * 0.1

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Table 8: G-MNL model by information condition for New Zealand – Chicken scenario

Dimension		Information condition 1 (N=495)		Information condition 2 (N=513)		Information condition 3 (N=513)	
		Coef	(SE)	Coef	(SE)	Coef	(SE)
Label (Probability of Irradiation) [1]							
No label (10%)		-1.709**	(0.751)	-0.060	(0.249)	-0.296*	(0.158)
	SD	1.872**	(0.662)	1.138	(0.744)	0.612	(0.377)
No Label (50%)		-1.802**	(0.750)	-0.595**	(0.302)	-0.305**	(0.153)
	SD	2.000**	(0.730)	0.300	(0.553)	0.165	(0.658)
No Label (80%)		-2.865**	(0.937)	-1.120**	(0.498)	-0.605***	(0.158)
	SD	0.333	(0.262)	0.135	(0.618)	-0.833**	(0.300)
"This product was irradiated" (100%)		-2.878**	(0.980)	-0.984**	(0.471)		
	SD	7.389**	(2.519)	1.249**	(0.512)		
"This product was irradiated to kill harmful bacteria and prevent spoilage" (100%)						-0.206	(0.178)
	SD					1.741***	(0.285)
Farming method [2]							
Free range		2.930**	(0.887)	1.461**	(0.650)	1.115***	(0.142)
	SD	2.858**	(1.018)	1.755*	(0.920)	1.303***	(0.217)
Shelf life [3]							
5 days		0.472	(0.351)	0.294	(0.244)	0.396**	(0.129)
	SD	1.702**	(0.662)	0.136	(0.475)	-0.118	(0.325)
10 days		1.082**	(0.389)	0.086	(0.184)	0.384**	(0.122)
	SD	0.090	(0.250)	0.959**	(0.431)	0.546*	(0.303)
Price		-1.437**	(0.434)	-1.369**	(0.650)	-0.394***	(0.049)
	SD	1.710**	(0.554)	1.277**	(0.568)	0.470***	(0.073)
Country of Origin [4]							
NZ or Australia [5]		-2.843**	(0.923)	-1.888**	(0.901)	-1.105***	(0.158)
	SD	0.319	(0.303)	0.621	(0.479)	0.114	(0.419)
Thailand		-8.496**	(2.453)	-5.070**	(2.364)	-3.407***	(0.317)
	SD	3.838**	(1.289)	2.831**	(1.283)	1.444***	(0.311)
No label		-4.674**	(1.424)	-3.086**	(1.371)	-2.239***	(0.237)
	SD	0.967**	(0.370)	1.162*	(0.648)	1.166***	(0.302)
Probability of illness [6]							
10 in 10,000		-2.889**	(0.935)	-1.093**	(0.485)	-0.911***	(0.135)
	SD	2.629**	(0.856)	0.833*	(0.458)	1.333***	(0.223)

[1] Base = "This product was not irradiated (0%), [2] base = farming methods, [3], base = 2 days, [4] base = Australian in the Australian sample or New Zealand in the New Zealand sample, [5] Australia in the New Zealand sample and New Zealand in the Australia sample, [6] base = 1 in 10,000. SD = standard deviation.
Significance test: p-value < *** 0.01; ** 0.05; * 0.1

4.4 G-MNL modelling by information conditions - Fruit

For the fruit scenario, the coefficients demonstrate that Australian respondents prefer Australian produce (New Zealand produce in the New Zealand sample) followed by New Zealand produce (Australian in the New Zealand sample). Fruit supplied from Thailand was least preferred, even when compared to the no country of origin label option. Respondents also preferred longer shelf-life and a lower price. These preferences are consistent across the different information conditions.

In terms of the irradiation label, and as with the chicken scenario, the results differ by information condition. For information conditions 1 and 2, respondents had a clear preference for non-irradiated fruit. The coefficients are negative with a monotonic relationship between the probability of irradiation and the size of the coefficient, such that the 100% irradiated coefficients were larger than the 50% irradiated coefficients, and 50% coefficients were larger than the 10% coefficients.

For information condition 3, the additional label (*This product was irradiated as an alternative to chemical Treatment to protect against the spread of fruit fly)* reduced the size of the 100% irradiated coefficient.

Table 9: G-MNL model by information condition for Australia – Fruit scenario

Dimension		Information condition 1 (N=509)		Information condition 2 (N=545)		Information condition 3 (N=448)	
		Coef	(SE)	Coef	(SE)	Coef	(SE)
Label (Probability of Irradiation) [1]							
No label (10%)		-0.929***	(0.178)	-0.697***	(0.173)	-0.627**	(0.246)
	SD	1.002***	(0.240)	0.729***	(0.250)	0.782**	(0.331)
No Label (50%)		-1.017***	(0.166)	-1.338***	(0.256)	-0.979**	(0.336)
	SD	0.574**	(0.253)	0.763***	(0.199)	0.459	(0.375)
No Label (80%)		-1.666***	(0.226)	-1.489***	(0.261)	-1.190**	(0.385)
	SD	1.019***	(0.231)	1.357***	(0.250)	0.393	(0.394)
"This product was irradiated" (100%)		-2.263***	(0.300)	-2.060***	(0.351)		
	SD	2.046***	(0.351)	2.589***	(0.397)		
"This product was irradiated as an alternative to chemical Treatment to protect against the spread of fruit fly'" (100%)						-0.488	(0.348)
	SD					2.827***	(0.797)
Shelf life [2]							
5 days		0.532***	(0.120)	0.899***	(0.181)	0.462**	(0.156)
	SD	0.303	(0.209)	0.191	(0.200)	0.642*	(0.374)
10 days		0.737***	(0.131)	1.161***	(0.204)	1.068***	(0.302)
	SD	0.516***	(0.247)	1.503***	(0.225)	1.437**	(0.502)
Price		-0.945***	(0.125)	-0.976***	(0.158)	-1.220**	(0.366)
	SD	0.852***	(0.102)	0.949***	(0.132)	1.130**	(0.328)
Country of Origin [3]							
NZ or Australia [4]		-2.031***	(0.270)	-2.224***	(0.365)	-2.271***	(0.609)
	SD	0.414	(0.270)	0.915***	(0.239)	0.342	(0.308)
Thailand		-5.164***	(0.630)	-6.128***	(0.928)	-6.126***	(1.472)
	SD	2.539***	(0.410)	2.771***	(0.493)	2.218**	(0.642)
No label		-3.280***	(0.408)	-3.868***	(0.570)	-3.942***	(0.977)
	SD	1.592***	(0.310)	1.341***	(0.247)	1.393**	(0.455)

[1] Base = "This product was not irradiated (0%), [2] base = 2 days, [3] base = Australian in the Australian sample or New Zealand in the New Zealand sample, [4] Australia in the New Zealand sample and New Zealand in the Australia sample; SD = standard deviation.
Significance test: p-value < *** 0.01; ** 0.05; * 0.1

Table 10: G-MNL model by information condition for New Zealand – Fruit scenario

Dimension		Information condition 1 (N=495)		Information condition 2 (N=513)		Information condition 3 (N=513)	
		Coef	(SE)	Coef	(SE)	Coef	(SE)
Label (Probability of Irradiation) [1]							
No label (10%)		-0.581***	(0.158)	-0.592***	(0.147)	-0.564***	(0.151)
	SD	0.775**	(0.231)	0.378	(0.314)	0.590**	(0.265)
No Label (50%)		-1.094***	(0.173)	-1.170***	(0.173)	-0.840***	(0.158)
	SD	0.638**	(0.233)	0.628**	(0.200)	0.379	(0.320)
No Label (80%)		-1.587***	(0.257)	-1.715***	(0.238)	-0.921***	(0.185)
	SD	1.137***	(0.252)	1.259***	(0.196)	0.870***	(0.211)
"This product was irradiated" (100%)		-2.016***	(0.299)	-1.825***	(0.245)		
	SD	2.817***	(0.398)	2.176***	(0.259)		
"This product was irradiated as an alternative to chemical Treatment to protect against the spread of fruit fly"' (100%)						-0.526**	(0.203)
	SD					2.639***	(0.386)
Shelf life [2]							
5 days		0.502***	(0.140)	0.497***	(0.106)	0.457***	(0.111)
	SD	0.390	(0.248)	-0.304	(0.312)	0.146***	(0.214)
10 days		0.767***	(0.151)	0.766***	(0.129)	0.898***	(0.145)
	SD	1.122***	(0.188)	1.029***	(0.150)	0.795***	(0.200)
Price		-2.294***	(0.311)	-1.737***	(0.199)	-1.816***	(0.244)
	SD	1.785***	(0.217)	1.371***	(0.143)	1.796***	(0.271)
Country of Origin [3]							
NZ or Australia [4]		-1.626***	(0.264)	-1.436***	(0.197)	-1.590**	(0.245)
	SD	0.784**	(0.260)	1.127***	(0.197)	0.533*	(0.284)
Thailand		-4.465***	(0.629)	-3.630***	(0.385)	-3.744***	(0.482)
	SD	1.731***	(0.336)	1.488***	(0.245)	1.548***	(0.281)
No label		-3.311***	(0.471)	-2.901***	(0.319)	-2.906***	(0.412)
	SD	1.356***	(0.262)	-0.913***	(0.231)	1.426***	(0.295)

[1] Base = "This product was not irradiated (0%), [2] base = 2 days, [3] base = Australian in the Australian sample or New Zealand in the New Zealand sample, [4] Australia in the New Zealand sample and New Zealand in the Australia sample; SD = standard deviation.
Significance test: p-value < *** 0.01; ** 0.05; * 0.1

4.5 G-MNL modelling by information conditions allowing for country interactions

To examine whether there are any statistically significant difference in preference between Australia and New Zealand residents, we introduced interaction terms between product attributes and a country indictor variable. The results are shown in Table 11 (chicken) and Table 12 (fruit). For the chicken scenario, there are no obvious differences between Australian and New Zealand residents.

For the fruit scenario, New Zealand respondents were more price sensitive (as suggested by the negative and significant interaction coefficients) and placed less importance on country of origin. The results also suggest that there were no differences between Australian and New Zealand residents in terms of their preferences for non-irradiation products.

Table 11: G-MNL model allowing for country interactions – Chicken scenario

Dimension		Information condition 1 (N=1,004)		Information condition 2 (N=1,058)		Information condition 3 (N=961)	
		Coef	(SE)	Coef	(SE)	Coef	(SE)
Label (Probability of Irradiation) [1]							
No label (10%)		-0.367**	(0.164)	-0.468	(0.339)	-1.005	(0.672)
	SD	0.674**	(0.282)	1.070**	(0.529)	3.465**	(1.514)
No label (10%) * NZ		-0.126	(0.230)	0.447	(0.460)	-0.510	(0.816)
No Label (50%)		-0.614***	(0.158)	-0.723**	(0.351)	-1.791*	(0.979)
	SD	0.210	(0.572)	0.700	(0.733)	0.106	(0.359)
No Label (50%) * NZ		0.118	(0.224)	0.070	(0.428)	0.702	(0.972)
No Label (80%)		-0.856***	(0.157)	-1.013**	(0.370)	-1.203*	(0.720)
	SD	0.238	(0.331)	0.187	(1.116)	1.074*	(0.609)
No Label (80%) * NZ		-0.138	(0.216)	-0.313	(0.416)	-1.454	(0.949)
"This product was irradiated" (100%)		-1.182***	(0.191)	-1.212**	(0.419)		
	SD	1.668***	(0.212)	2.033**	(0.590)		
"This product was irradiated" (100%) * NZ		0.228	(0.251)	-0.155	(0.466)		
"This product was irradiated to kill harmful bacteria and prevent spoilage" (100%)						-0.480	(1.321)
	SD					6.747**	(2.809)
"This product was irradiated to kill harmful bacteria and prevent spoilage" (100%) * NZ						-0.067	(1.324)
Farming method [2]							
Free range		0.859***	(0.128)	1.906**	(0.567)	4.263**	(1.824)
	SD	1.268***	(0.164)	2.155***	(0.551)	4.691**	(1.840)
Free range * NZ		0.277*	(0.165)	0.096	(0.326)	1.068	(0.697)
Shelf life [3]							
5 days		0.510***	(0.132)	0.340	(0.243)	0.337	(0.421)
	SD	0.648**	(0.252)	0.344	(0.531)	1.893**	(0.865)
5 days * NZ		-0.217	(0.188)	0.153	(0.343)	1.480	(0.906)
10 days		0.755***	(0.130)	0.864**	(0.328)	2.416**	(1.084)
	SD	0.474*	(0.255)	1.303***	(0.371)	1.988**	(0.927)
10 days * NZ		-0.331*	(0.175)	-0.665*	(0.386)	-0.546	(0.671)
Price							
Price		-0.464***	(0.051)	-0.771***	(0.217)	-2.156**	(0.911)
	SD	0.578***	(0.058)	0.819***	(0.195)	2.048**	(0.831)
Price * NZ		-0.083	(0.061)	-0.097	(0.114)	0.290	(0.226)
Country of Origin [4]							
NZ or Australia [5]		-1.145***	(0.158)	-2.675***	(0.758)	-5.434**	(2.269)
	SD	0.612*	(0.321)	0.058	(0.369)	-2.337**	(1.016)
NZ or Australia [5] * NZ		0.068	(0.211)	0.133	(0.425)	0.182	(0.928)
Thailand		-3.644***	(0.280)	-7.349***	(2.024)	-16.170**	(6.632)
	SD	1.608***	(0.228)	2.758***	(0.683)	5.348**	(2.116)
Thailand * NZ		0.247	(0.257)	0.688	(0.622)	-0.225	(0.962)
No label		-2.322***	(0.209)	-5.088***	(1.425)	-10.646**	(4.487)
	SD	1.215***	(0.220)	1.408**	(0.528)	4.283**	(1.748)
No label * NZ		0.426*	(0.235)	0.866	(0.562)	-0.206	(1.028)
Probability of illness [6]							
10 in 10,000		-0.850***	(0.124)	-1.460**	(0.427)	-3.286**	(1.523)
	SD	1.152***	(0.160)	1.137**	(0.395)	2.806**	(1.281)
10 in 10,000 * NZ		-0.276*	(0.165)	-0.055	(0.292)	-0.959	(0.910)

[1] Base = "This product was not irradiated (0%), [2] base = farming methods, [3], base = 2 days, [4] base = Australian in the Australian sample or New Zealand in the New Zealand sample, [5] Australia in the New Zealand sample and New Zealand in the Australia sample, [6] base = 1 in 10,000; SD = standard deviation.
Significance test: p-value < *** 0.01; ** 0.05; * 0.1

Table 12: G-MNL model allowing for country interactions – Fruit scenario

Dimension		Information condition 1 (N=1,004)		Information condition 2 (N=1,058)		Information condition 3 (N=961)	
		Coef	(SE)	Coef	(SE)	Coef	(SE)
Label (Probability of Irradiation) [1]							
No label (10%)		-1.166***	(0.213)	-0.830***	(0.191)	-1.119**	(0.336)
	SD	0.370	(0.237)	0.451**	(0.163)	1.263***	(0.292)
No label (10%) * NZ		0.437*	(0.243)	0.080	(0.225)	0.040	(0.350)
No Label (50%)		-1.365***	(0.229)	-1.330***	(0.231)	-1.376***	(0.354)
	SD	0.494**	(0.206)	0.539**	(0.197)	0.989**	(0.289)
No Label (50%) * NZ		0.053	(0.229)	-0.220	(0.225)	-0.001	(0.335)
No Label (80%)		-2.098***	(0.312)	-1.626***	(0.277)	-2.038***	(0.475)
	SD	0.985***	(0.254)	1.185***	(0.290)	1.437***	(0.348)
No Label (80%) * NZ		0.289	(0.263)	-0.466*	(0.264)	0.272	(0.391)
"This product was irradiated" (100%)		-2.738***	(0.408)	-1.973***	(0.326)		
	SD	2.943***	(0.467)	2.473***	(0.593)		
"This product was irradiated" (100%) * NZ		0.614*	(0.347)	-0.323	(0.320)		
"This product was irradiated to kill harmful bacteria and prevent spoilage" (100%)						-0.988**	(0.376)
	SD					4.934***	(1.005)
"This product was irradiated to kill harmful bacteria and prevent spoilage" (100%) * NZ						0.521	(0.454)
Shelf life [3]							
5 days		0.676***	(0.154)	0.814***	(0.155)	0.563**	(0.198)
	SD	0.076	(0.197)	0.223*	(0.128)	0.441**	(0.201)
5 days * NZ		-0.229	(0.180)	-0.242	(0.181)	0.170	(0.271)
10 days		0.898***	(0.162)	1.168***	(0.198)	1.483***	(0.310)
	SD	1.124***	(0.270)	1.348***	(0.350)	1.316***	(0.291)
10 days * NZ		0.006	(0.183)	-0.166	(0.209)	0.047	(0.256)
Price							
Price		-1.001***	(0.138)	-0.867***	(0.118)	-1.567***	(0.249)
	SD	1.055***	(0.183)	0.872***	(0.208)	1.669***	(0.325)
Price * NZ		-0.175**	(0.064)	-0.143**	(0.067)	-0.035	(0.083)
Country of Origin [4]							
NZ or Australia [5]		-2.394***	(0.309)	-2.448***	(0.395)	-3.187***	(0.581)
	SD	0.733***	(0.196)	0.710**	(0.222)	0.433**	(0.173)
NZ or Australia [5] * NZ		0.579**	(0.281)	0.627**	(0.285)	0.430	(0.353)
Thailand		-6.051***	(0.716)	-6.522***	(0.947)	-8.810***	(1.457)
	SD	2.431***	(0.447)	1.383***	(0.351)	3.338***	(0.676)
Thailand * NZ		0.951**	(0.379)	1.877	(0.514)	1.861**	(0.593)
No label		-3.864***	(0.458)	-4.371***	(0.664)	-5.640***	(0.934)
	SD	1.497***	(0.354)	1.011***	(0.280)	2.499***	(0.524)
No label * NZ		0.123	(0.289)	0.648*	(0.351)	0.452	(0.398)

[1] Base = "This product was not irradiated (0%), [2] base = farming methods, [3], base = 2 days, [4] base = Australian in the Australian sample or New Zealand in the New Zealand sample, [5] Australia in the New Zealand sample and New Zealand in the Australia sample, [6] base = 1 in 10,000; SD = standard deviation.
Significance test: p-value < *** 0.01; ** 0.05; * 0.1

4.6 Estimating the marginal willingness-to-pay

An alternative approach to facilitate interpretation of the estimates is to calculate the marginal WTP. The WTP is the change in cost that would keep utility constant when one attribute is shifted to another level and all other attributes remain unchanged. Then we can easily compare the effect of different attributes through the amount individuals are willing to trade-off for different attribute levels relative to the base level. Marginal WTP is calculated as a ratio of the attribute coefficient estimate to the estimated monetary attribute coefficient, in our case the price of the chicken or fruit.

The mean and 95% confidence intervals of the marginal WTP estimates for the three information conditions are presented in Figure 7 and Table 9 for Australia and Table 8 and Table 10 for New Zealand respondents, respectively. The values indicates the amount of money that respondents are willing to pay to attain a higher level of an attribute (more preferred levels) rather than the reference category (all attributes set to the first level).

The relative importance of the attributes is consistent with the regression coefficients. Country of origin is given greater importance, such that Australian consumers would require compensation (lower price) to accept chicken from Thailand, New Zealand and no country of origin label. For example, chicken from Thailand would need to be $8 cheaper than the equivalent Australian product for an Australian consumer to be indifference between to two products. Indeed the findings suggest that Australian respondents would pay an extra $5 for labelled Australia meat (compared to unlabelled meat of unknown origin).

Respondents also preferred a lower risk of foodborne illness, longer shelf life and free range chicken. For example, respondents would be prepared to pay an extra dollar for free-range chicken compared to conventionally farmed chicken.

As before, the results show a preference for non-irradiated food under information condition 1 and 2. There appears to be a linear negative relationship between WTP for chicken and the probability of irradiation (shown by the blue points; irr10 – irr 100).

Information condition 3 demonstrates the impact of education and additional labelling information on acceptability of irradiated foods (green points). Figure 7 illustrates that when consumers are fully educated their aversion of (or willingness to avoid) irradiated food is non-significant. These results demonstrate that on average respondents would accept irradiated foods (without labelling) if sufficient education was provided.

Similar patterns were observed for the fruit scenario and in the New Zealand population.

Figure 7: Marginal willingness-to-pay for chicken – Australia

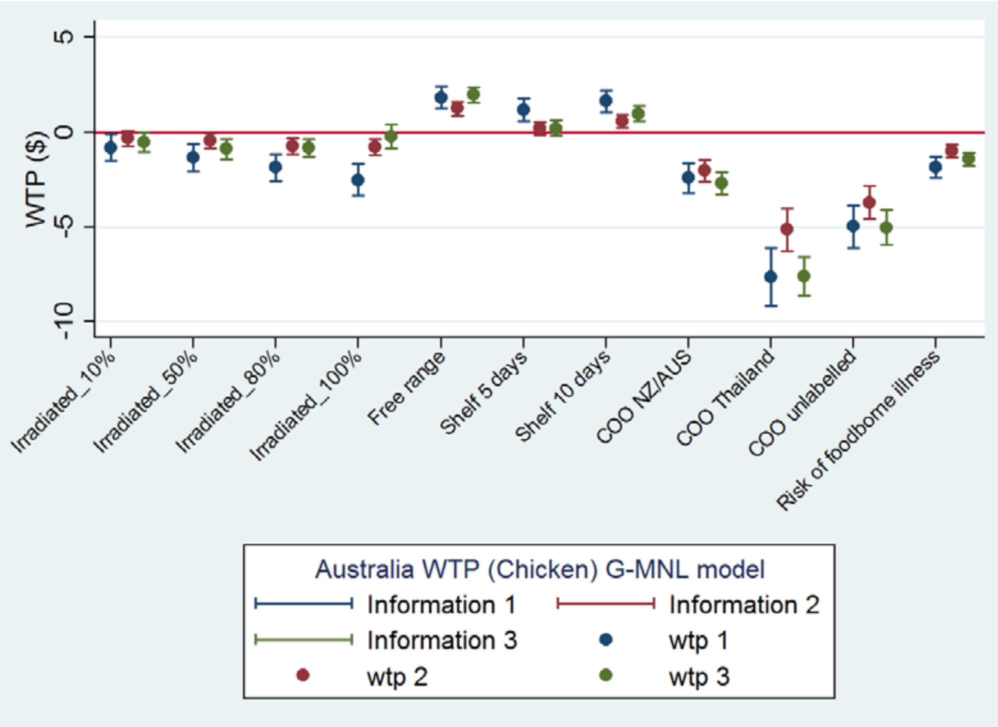


Figure 8: Marginal willingness-to-pay for chicken – New Zealand

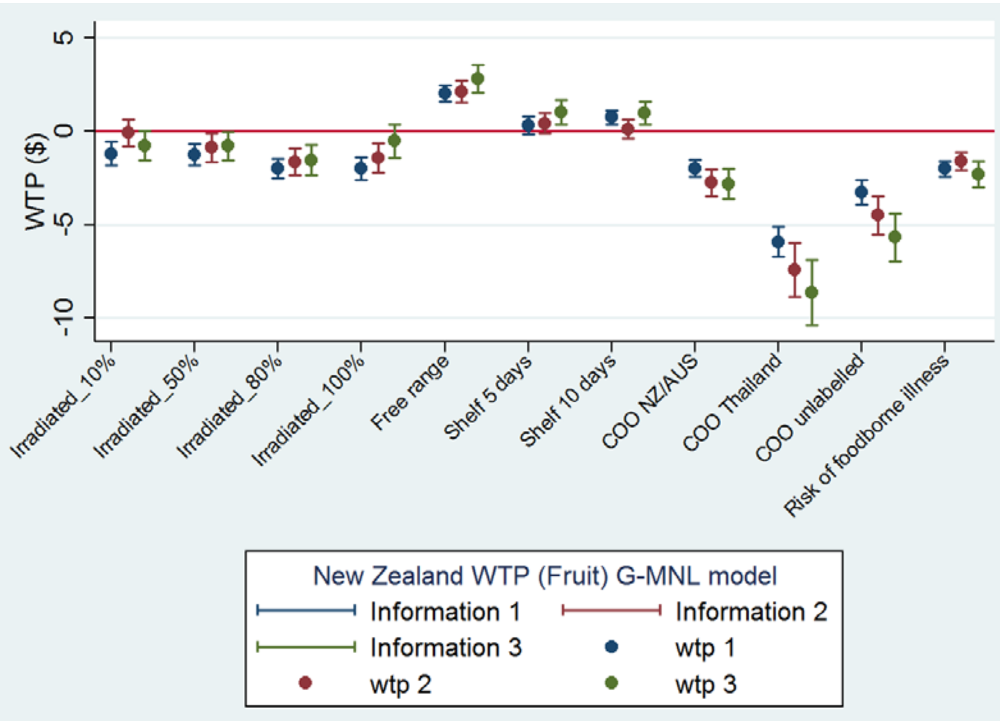


Figure 9: Marginal willingness-to-pay for fruit – Australia

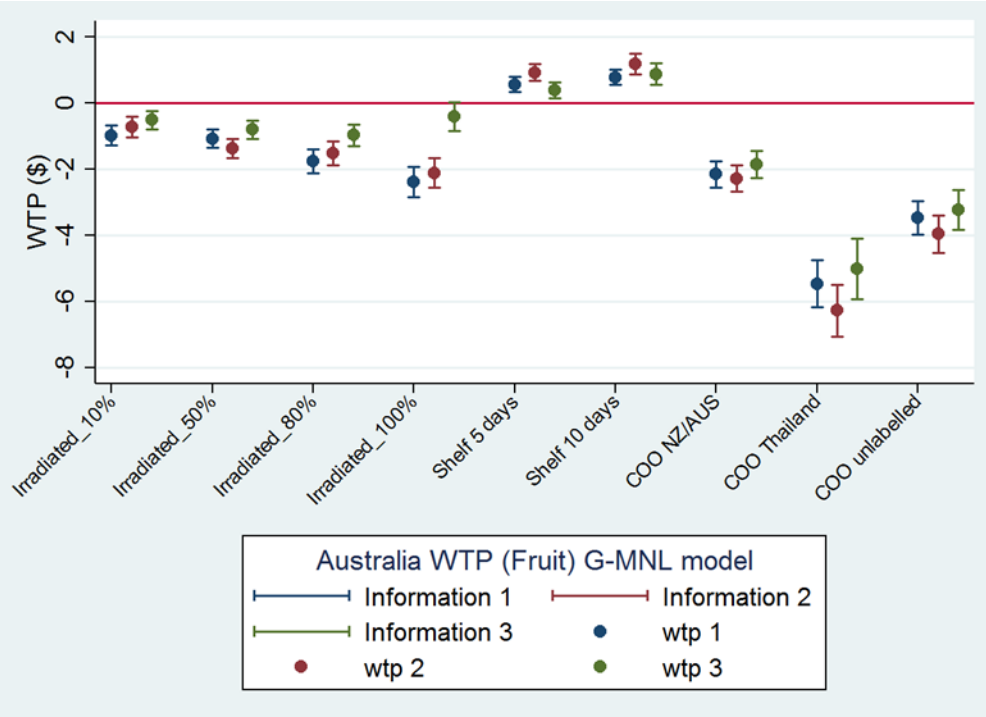


Figure 10: Marginal willingness-to-pay for fruit – New Zealand

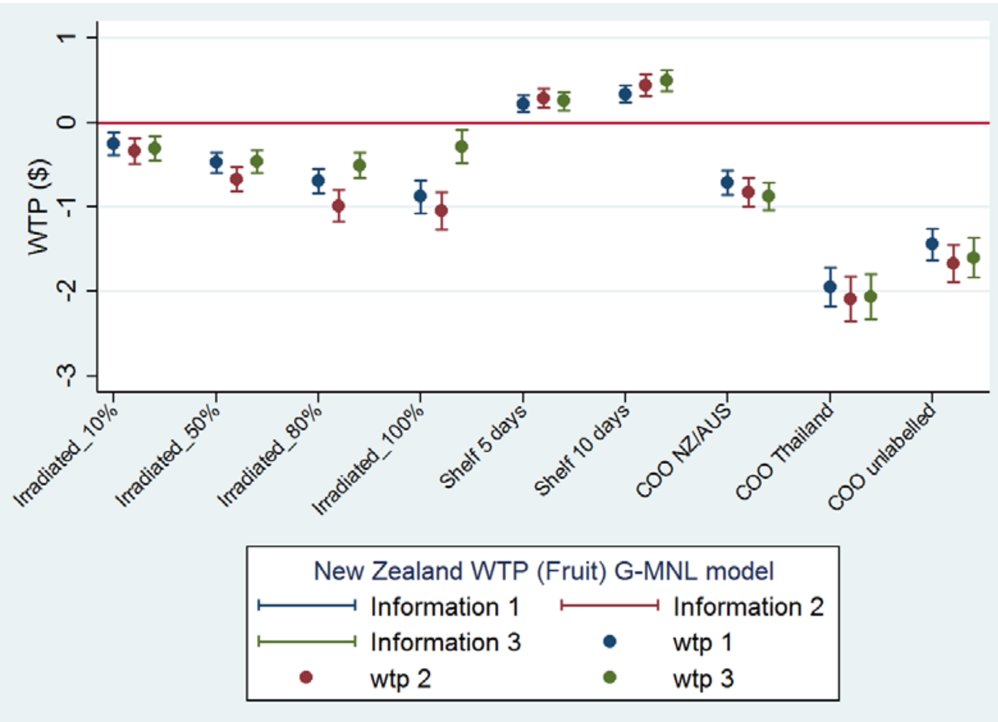


Figure 11: Marginal willingness-to-pay for chicken – allowing for country interaction

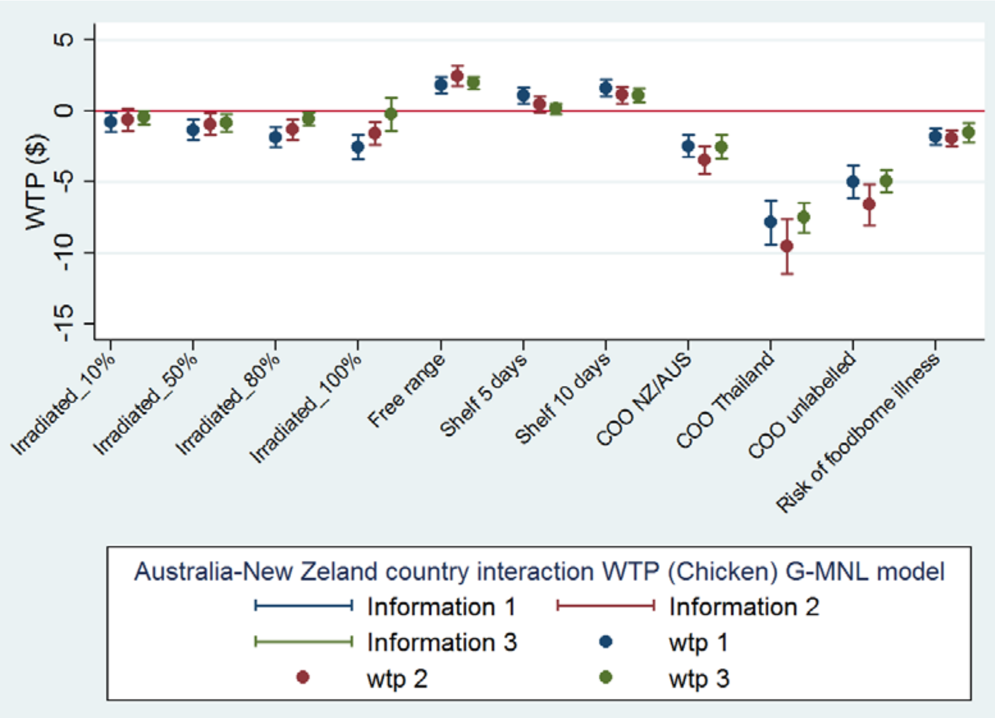
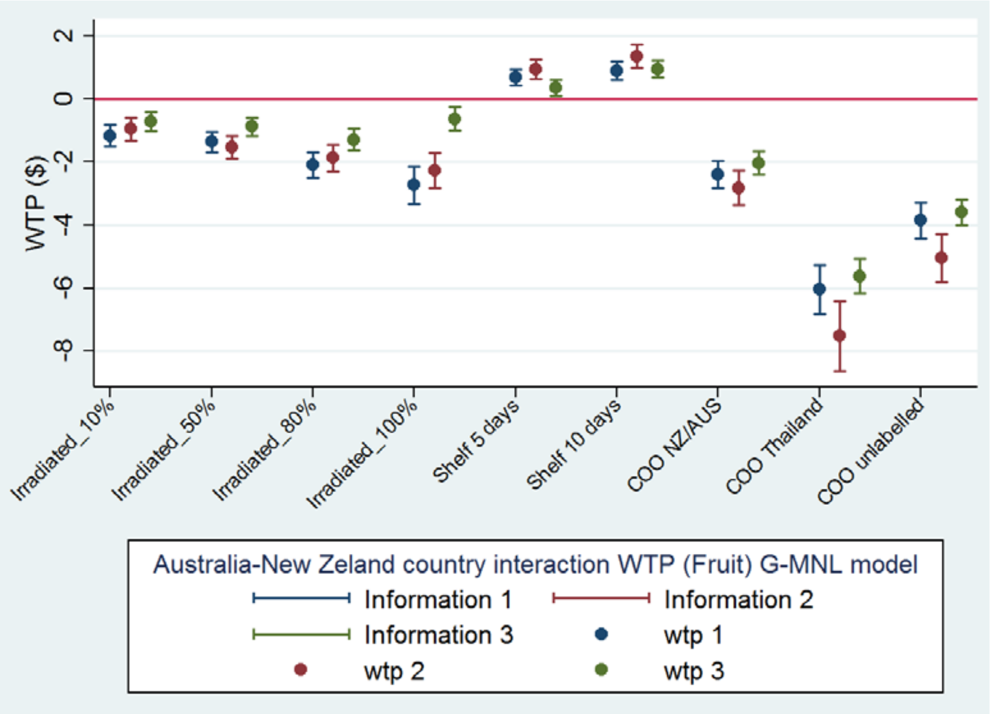


Figure 12: Marginal willingness-to-pay for fruit – allowing for country interaction



5 Conclusions & Discussion

This report provides the latest information regarding consumers' awareness and purchasing behaviour with respect to irradiated food. Awareness of the Radura symbol was low, but higher than previously reported in Australia and New Zealand (FSANZ report 2003). About half of the New Zealand respondents and a third of the Australian respondents reported that they had heard of food irradiation. Of these, a quarter said they had knowingly purchased irradiated foods previously. Despite mandatory labelling of irradiated food, the majority of respondents from Australia and New Zealand did not know whether they had purchased irradiated foods previously (63% and 65%).

A quarter of respondents Australia and New Zealand said they would purchase irradiated food in the future and a quarter said they would not purchase irradiated food, with the remainder undecided. When these findings are divided across the different information conditions, we observe that respondents that received additional education and a different label are more likely to say they will purchase irradiated food in the future when compared to those respondents that received limited information. These results suggest that greater awareness and improved education has a role to play in wider acceptance of food irradiation.

The relative importance of the food attributes was ascertained by estimating the WTP derived from the G-MNL model. For chicken, country of origin was the most important attribute, with respondents clearly preferring chicken produced locally. Chicken sourced from Thailand was the least desirable option. For example, Australian respondents would rather pay $8 more for Australian chicken than accepting chicken sourced from Thailand. Respondents also preferred free-range chicken to conventionally farmed chicken, a lower risk of foodborne illness longer shelf-life and a lower price. For example, we estimated that respondents would be prepared to pay an extra dollar for free-range chicken compared to conventionally farmed chicken. These preferences were consistent across the different information conditions provided during the experiment.

For fruit, respondents demonstrated a preference for locally produced fruit, with a longer shelf-life and lower price.

In terms of the irradiation label, the results differ by information condition. For information conditions 1, respondents had a clear preference for non-irradiated chicken (or fruit). The coefficients were negative with a monotonic relationship between the probability of irradiation and the size of the coefficient.

For information condition 1, the results suggest that respondents would be prepared to pay an extra $2 for non-irradiated chicken or fruit (or an extra $1 for labelled non-irradiated chicken/fruit, when the alternative is unlabelled chicken with a 50% probability that the chicken has been irradiated). These results were consistent between Australian and New Zealand respondents.

For information condition 2, the results suggest that respondents would still prefer non-irradiation food, but the level of compensation required was lower than for information condition 1. This demonstrates that education may have a role to play.

For information condition 3, respondents were indifferent between irradiated and non-irradiated foods (i.e. under this condition, respondents are willing to accept irradiated food and no additional cost/compensation is require). These results demonstrated that education and the labelling information can influence the acceptability of irradiated foods.

The preferences of the Australian and New Zealand respondents were very similar. Although New Zealand respondents were more likely to have heard of food irradiation and for the fruit scenario, they were more price sensitive and placed less importance on country of origin.

It is worth noting that the results of the G-MNL modelling demonstrated that there is significant heterogeneity in individual preferences towards irradiated food. Therefore even with increased education and labelling, some individuals will still prefer non-irradiated foods.

5.1 Conclusions

About half of the New Zealand respondents and two thirds of the Australian respondents reported that they had not heard of food irradiation and most said they had never knowingly purchased irradiated foods. Given this lack of awareness, it is unsurprising that on average, consumers state that they would prefer non-irradiated food to irradiated food. This suggests that given the current information available to consumers, food irradiation labels are used by some consumers as a way of avoiding irradiated products or choosing non-irradiated food and consequently removing the mandatory irradiation labels would lead to an overall welfare loss to consumers. However, it is clear that the extent of the welfare loss is dependent upon the level of information that consumers have about irradiation.

Importantly, we demonstrate that raising awareness about the safety and benefits of food irradiation processing, combined with a greater understanding of alternative processing treatments, can ameliorate the negative impact of irradiation labelling on food choices. This suggests that education has a role to play if consumers are to accept changes to the mandatory requirement for food irradiation labelling.

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6 Appendices

6.1 Pooled results

Table 13: C-Logit model – Chicken scenario (pooled)

Dimension	Australia		New Zealand	
	Coefficient (SE)	Odds ratio	Coefficient (SE)	Odds ratio
Label (Probability of Irradiation) [1]				
No label (10%)	-0.150 (0.054) ***	0.861	-0.168 (0.054) ***	0.845
No Label (50%)	-0.264 (0.055) ***	0.768	-0.249 (0.055) ***	0.780
No Label (80%)	-0.328 (0.057) ***	0.720	-0.441 (0.057) ***	0.644
"This product was irradiated" (100%)	-0.372 (0.059)***	0.690	-0.347 (0.062)***	0.707
Farming method [2]				
Free range	0.478 (0.039)***	1.612	0.584 (0.038)***	1.793
Shelf life [3]				
5 days	0.131 (0.047)***	1.140	0.145 (0.046)***	1.156
10 days	0.333 (0.044)***	1.395	0.177 (0.043)***	1.194
Price	-0.463 (0.027)***	0.629	-0.489 (0.026)***	0.613
Country of Origin [4]				
NZ or Australia [5]	-0.692 (0.053)***	0.501	-0.674 (0.051)***	0.510
Thailand	-1.892 (0.067)***	0.151	-1.820 (0.064)***	0.162
No label	-1.326 (0.059)***	0.266	-1.167 (0.057)***	0.311
Probability of illness [6]				
10 in 10,000	-0.443 (0.037)***	0.642	-0.531 (0.038)***	0.588

[1] Base = "This product was not irradiated (0%), [2] base = farming methods, [3], base = 2 days, [4] base = Australian in the Australian sample or New Zealand in the New Zealand sample, [5] Australia in the New Zealand sample and New Zealand in the Australia sample, [6] base = 1 in 10,000
Significance test: p-value < *** 0.01; ** 0.05; * 0.1

Table 14: C-Logit model – fruit scenario (pooled)

Dimension	Australia		New Zealand	
	Coefficient (SE)	Odds ratio	Coefficient (SE)	Odds ratio
Label (Probability of Irradiation) [1]				
No label (10%)	-0.290 (0.041)***	0.748	-0.268 (0.040)***	0.765
No Label (50%)	-0.379 (0.041)***	0.685	-0.454 (0.041)***	0.635
No Label (80%)	-0.591 (0.046)***	0.554	-0.599 (0.048)***	0.549
"This product was irradiated" (100%)	-0.626 (0.053)***	0.535	-0.601 (0.054)***	0.548
Shelf life [2]				
5 days	0.201 (0.031)***	1.222	0.192 (0.032)***	1.212
10 days	0.342 (0.032)***	1.407	0.342 (0.033)***	1.408
Price	-0.669 (0.023)***	0.512	-0.785 (0.024)***	0.456
Country of Origin [3]				
NZ or Australia [4]	-0.751 (0.041)***	0.472	-0.657 (0.041)***	0.519
Thailand	-1.945 (0.058)***	0.008	-1.677 (0.049)***	0.187
No label	-1.336 (0.048)***	0.13	-1.336 (0.048)***	0.263

[1] Base 0%, [2], base = 2 days, [3] base = Australian in the Australian sample or New Zealand in the New Zealand sample, [4] Australia in the New Zealand sample and New Zealand in the Australia sample
Significance test: p-value < *** 0.01; ** 0.05; * 0.1

Table 15: C-Logit model by information condition for Australia – Chicken scenario

Dimension	Information condition 1 (N=509)		Information condition 2 (N=545)		Information condition 3 (N=448)	
	Coef	(SE)	Coef	(SE)	Coef	(SE)
Label (Probability of Irradiation) [1]						
No label (10%)	-0.174*	(0.096)	-0.128	(0.088)	-0.145	(0.099)
No Label (50%)	-0.364***	(0.098)	-0.197**	(0.092)	-0.229**	(0.099)
No Label (80%)	-0.511***	(0.100)	-0.297***	(0.092)	-0.176*	(0.103)
"This product was irradiated" (100%)	-0.609***	(0.104)	-0.401***	(0.094)	-	-
"This product was irradiated to kill harmful bacteria and prevent spoilage" (100%)					-0.076	(0.111)
Farming method [2]						
Free range	0.418***	(0.068)	0.538***	(0.066)	0.484***	(0.070)
Shelf life [3]						
5 days	0.276***	(0.083)	0.048	(0.078)	0.072	(0.085)
10 days	0.426***	(0.076)	0.262***	(0.073)	0.325***	(0.081)
Price	-0.485***	(0.047)	-0.424***	(0.044)	-0.487***	(-0.049)
Country of Origin [4]						
NZ or Australia [5]	-0.676***	(0.091)	-0.731***	(0.087)	-0.679***	(0.099)
Thailand	-2.013***	(0.109)	-1.877***	(0.114)	-1.809***	(0.127)
No label	-1.337***	(0.100)	-1.394***	(0.100)	-1.238***	(0.105)
Probability of illness [6]						
10 in 10,000	-0.484***	(0.067)	-0.427***	(0.062)	-0.422***	(0.065)

[1] Base = "This product was not irradiated (0%), [2] base = farming methods, [3], base = 2 days, [4] base = Australian in the Australian sample or New Zealand in the New Zealand sample, [5] Australia in the New Zealand sample and New Zealand in the Australia sample, [6] base = 1 in 10,000
Significance test: p-value < *** 0.01; ** 0.05; * 0.1

Table 16: C-Logit model by information condition for New Zealand – Chicken scenario

Dimension	Information condition 1 (N=495)		Information condition 2 (N=513)		Information condition 3 (N=513)	
	Coef	(SE)	Coef	(SE)	Coef	(SE)
Label (Probability of Irradiation) [1]						
No label (10%)	-0.266***	(0.095)	-0.075	(0.095)	-0.164*	(0.092)
No Label (50%)	-0.268***	(0.094)	-0.299***	(0.097)	-0.174*	(0.094)
No Label (80%)	-0.521***	(0.098)	-0.447***	(0.100)	-0.361***	(0.097)
"This product was irradiated" (100%)	-0.510***	(0.111)	-0.393***	(0.108)	-	-
"This product was irradiated to kill harmful bacteria and prevent spoilage" (100%)					-0.123	(0.108)
Farming method [2]						
Free range	0.587***	(0.065)	0.567***	(0.066)	0.608***	(0.066)
Shelf life [3]						
5 days	0.174**	(0.082)	0.086	(0.076)	0.182**	(0.080)
10 days	0.259***	(0.076)	0.076	(0.076)	0.204***	(0.072)
Price	-0.556***	(0.049)	-0.483***	(0.045)	-0.440***	(0.045)
Country of Origin [4]						
NZ or Australia [5]	-0.605***	(0.092)	-0.769***	(0.087)	-0.640***	(0.087)
Thailand	-1.873***	(0.109)	-1.756***	(0.113)	-1.858***	(0.109)
No label	-1.076***	(0.100)	-1.175***	(0.095)	-1.258***	(0.102)
Probability of illness [6]						
10 in 10,000	-0.619***	(0.071)	-0.462***	(0.059)	-0.532***	(0.069)

[1] Base = "This product was not irradiated (0%), [2] base = farming methods, [3], base = 2 days, [4] base = Australian in the Australian sample or New Zealand in the New Zealand sample, [5] Australia in the New Zealand sample and New Zealand in the Australia sample, [6] base = 1 in 10,000

Significance test: p-value < *** 0.01; ** 0.05; * 0.1

Table 17: C-Logit model by information condition for Australia – Fruit scenario

Dimension	Information condition 1 (N=509)		Information condition 2 (N=545)		Information condition 3 (N=448)	
	Coef	(SE)	Coef	(SE)	Coef	(SE)
Label (Probability of Irradiation) [1]						
No label (10%)	-0.387***	0.069	-0.234***	0.067	-0.236***	0.078
No Label (50%)	-0.468***	0.071	-0.351***	0.067	-0.306***	0.074
No Label (80%)	-0.756***	0.080	-0.550***	0.074	-0.456***	0.085
"This product was irradiated" (100%)	-0.974***	0.092	-0.647***	0.088	-	-
"This product was irradiated as an alternative to chemical Treatment to protect against the spread of fruit fly"' (100%)					-0.221**	0.095
Shelf life [2]						
5 days	0.197***	0.052	0.265***	0.050	0.132**	0.058
10 days	0.297***	0.053	0.386***	0.056	0.341***	0.060
Price	-0.713***	0.043	-0.632***	0.041	-0.680***	0.046
Country of Origin [3]						
NZ or Australia [4]	-0.859***	0.072	-0.719***	0.071	-0.692***	0.073
Thailand	-2.024***	0.101	-1.908***	0.099	-1.946***	0.102
No label	-1.431***	0.081	-1.339***	0.080	-1.257***	0.089

[1] Base = "This product was not irradiated (0%), [2] base = 2 days, [3] base = Australian in the Australian sample or New Zealand in the New Zealand sample, [4] Australia in the New Zealand sample and New Zealand in the Australia sample.

Significance test: p-value < *** 0.01; ** 0.05; * 0.1

Table 18: C-Logit model by information condition for New Zealand – Fruit scenario

Dimension	Information condition 1 (N=495)		Information condition 2 (N=513)		Information condition 3 (N=513)	
	Coef	(SE)	Coef	(SE)	Coef	(SE)
Label (Probability of Irradiation) [1]						
No label (10%)	-0.309***	(0.070)	-0.249***	(0.069)	-0.254***	(0.068)
No Label (50%)	-0.522***	(0.073)	-0.500***	(0.070)	-0.371***	(0.070)
No Label (80%)	-0.695***	(0.083)	-0.732***	(0.084)	-0.397***	(0.082)
"This product was irradiated" (100%)	-0.819***	(0.097)	-0.823***	(0.093)	-	-
"This product was irradiated as an alternative to chemical Treatment to protect against the spread of fruit fly"' (100%)					-0.194**	(0.091)
Shelf life [2]						
5 days	0.147***	(0.056)	0.245***	(0.055)	0.191**	(0.053)
10 days	0.305***	(0.057)	0.340***	(0.058)	0.387***	(0.055)
Price	-0.869***	(0.045)	-0.739***	(0.040)	-0.761***	(0.042)
Country of Origin [3]						
NZ or Australia [4]	-0.637***	(0.072)	-0.645***	(0.074)	-0.723***	(0.067)
Thailand	-1.737***	(0.090)	-1.670***	(0.088)	-1.671***	(0.081)
No label	-1.362***	(0.085)	-1.381***	(0.082)	-1.317***	(0.082)

[1] Base = "This product was not irradiated (0%), [2] base = 2 days, [3] base = Australian in the Australian sample or New Zealand in the New Zealand sample, [4] Australia in the New Zealand sample and New Zealand in the Australia sample.
Significance test: p-value < *** 0.01; ** 0.05; * 0.1

Table 19: C-Logit model allowing for country interactions – Chicken scenario

Dimension	Information condition 1 (N=1,004)		Information condition 2 (N=1,058)		Information condition 3 (N=961)	
	Coef	(SE)	Coef	(SE)	Coef	(SE)
Label (Probability of Irradiation) [1]						
No label (10%)	-0.186*	(0.096)	-0.128	(0.088)	-0.152	(0.099)
No label (10%) * NZ	-0.083	0.135	0.036	0.130	-0.019	0.135
No Label (50%)	-0.379***	(0.098)	-0.196**	(0.093)	-0.239**	(0.099)
No Label (50%) * NZ	0.105	0.136	-0.122	0.135	0.057	0.136
No Label (80%)	-0.505***	(0.100)	-0.297***	(0.092)	-0.175*	(0.103)
No Label (80%) * NZ	-0.014	0.140	-0.148	0.136	-0.185	0.142
"This product was irradiated" (100%)	-0.611***	(0.104)	-0.401***	(0.094)		
"This product was irradiated" (100%) * NZ	0.100	0.152	0.009	0.143		
"This product was irradiated to kill harmful bacteria and prevent spoilage" (100%)					-0.075	(0.111)
"This product was irradiated to kill harmful bacteria and prevent spoilage" (100%) * NZ					-0.047	0.155
Farming method [2]						
Free range	0.418***	(0.068)	0.538***	(0.066)	0.486***	(0.07)
Free range * NZ	0.170*	0.094	0.033	0.094	0.123	0.096
Shelf life [3]						
5 days	0.279***	(0.083)	0.047	(0.077)	0.074	(0.085)
5 days * NZ	-0.103	0.117	0.048	0.109	0.110	0.117
10 days	0.431***	(0.076)	0.261***	(0.073)	0.329***	(0.081)
10 days * NZ	-0.168	0.108	-0.178*	0.106	-0.122	0.108
Price						
Price	-0.483***	(0.047)	-0.424***	(0.044)	-0.487***	(0.049)
Price ($4.99) * NZ	0.009	0.117	-0.171	0.110	0.065	0.115
Price ($6.99) * NZ	-0.145	0.137	-0.112	0.125	0.093	0.132
Country of Origin [4]						
NZ or Australia [5]	-0.693***	(0.092)	-0.730***	(0.087)	-0.691***	(0.100)
NZ or Australia [5] * NZ	0.094	0.130	-0.024	0.123	0.057	0.133
Thailand	-2.023***	(0.109)	-1.877***	(0.11)	-1.816***	(0.127)
Thailand * NZ	0.153	0.154	0.126	0.160	-0.039	0.168
No label	-1.347***	(0.100)	-1.394***	(0.100)	-1.243***	(0.105)
No label * NZ	0.274*	0.142	0.229*	0.138	-0.012	0.147
Probability of illness [6]						
10 in 10,000	-0.481***	(0.067)	-0.427***	(0.062)	-0.420***	(0.066)
10 in 10,000 * NZ	-0.136	0.098	-0.031	0.086	-0.110	0.095

[1] Base = "This product was not irradiated (0%), [2] base = farming methods, [3], base = 2 days, [4] base = Australian in the Australian sample or New Zealand in the New Zealand sample, [5] Australia in the New Zealand sample and New Zealand in the Australia sample, [6] base = 1 in 10,000

Significance test: p-value < *** 0.01; ** 0.05; * 0.1

Table 20: C-Logit model allowing for country interactions – Fruit scenario

Dimension	Information condition 1 (N=1,004)		Information condition 2 (N=1,058)		Information condition 3 (N=961)	
	Coef	(SE)	Coef	(SE)	Coef	(SE)
Label (Probability of Irradiation) [1]						
No label (10%)	-0.404***	(0.07)	-0.244***	(0.068)	-0.248***	(0.078)
No label (10%) * NZ	0.099	0.099	-0.002	0.096	-0.021	0.104
No Label (50%)	-0.459***	(0.071)	-0.348***	(0.067)	-0.303***	(0.074)
No Label (50%) * NZ	-0.063	0.102	-0.152	0.097	-0.063	0.102
No Label (80%)	-0.750***	(0.08)	-0.545***	(0.074)	-0.449***	(0.085)
No Label (80%) * NZ	0.054	0.116	-0.191*	0.112	0.059	0.117
"This product was irradiated" (100%)	-0.982***	(0.092)	-0.650***	(0.088)		
"This product was irradiated" (100%) * NZ	0.165	0.133	-0.172	0.128		
"This product was irradiated as an alternative to chemical Treatment to protect against the spread of fruit fly"' (100%)					-0.229**	(0.096)
"This product was irradiated as an alternative to chemical Treatment to protect against the spread of fruit fly"' (100%) * NZ					0.030	0.132
Shelf life [2]						
5 days	0.194***	(0.052)	0.264***	(0.05)	0.133**	(0.058)
5 days * NZ	-0.047	0.076	-0.019	0.074	0.058	0.079
10 days	0.302***	(0.053)	0.391***	(0.057)	0.352***	(0.06)
10 days * NZ	0.002**	0.078	-0.052	0.081	0.040	0.082
Price						
Price	-0.705***	(0.043)	-0.628***	(0.041)	-0.674***	(0.046)
Price ($4.99) * NZ	-0.310***	0.090	-0.216**	0.085	-0.082	0.092
Price ($6.99) * NZ	-0.329***	0.124	-0.225*	0.115	-0.165	0.125
Country of Origin [3]						
NZ or Australia [4]	-0.869***	(0.073)	-0.726***	(0.071)	-0.704***	(0.073)
NZ or Australia [4] * NZ	0.230**	0.102	0.078	0.102	-0.006	0.099
Thailand	-2.022***	(0.100)	-1.905***	(0.099)	-1.938***	(0.101)
Thailand * NZ	0.283**	0.135	0.232*	0.132	0.282**	0.129
No label	-1.440***	(0.081)	-1.343***	(0.08)	-1.264***	(0.088)
No label * NZ	0.077	0.118	-0.040	0.114	-0.048	0.120

[1] Base = "This product was not irradiated (0%), [2] base = 2 days, [3] base = Australian in the Australian sample or New Zealand in the New Zealand sample, [4] Australia in the New Zealand sample and New Zealand in the Australia sample.
Significance test: p-value < *** 0.01; ** 0.05; * 0.1

6.2 Factors considered important when purchasing food

Table 21: Factors considered important when purchasing food

	Australia (n=1502)		New Zealand (n=1521)	
	n	(%)	n	(%)
Food appearance				
Very important	622	(41%)	625	(41%)
Important	692	(46%)	729	(48%)
Neither important or unimportant	153	(10%)	143	(9%)
Unimportant	30	(2%)	17	(1%)
Very unimportant	5	(0%)	7	(0%)
Support local farmers				
Very important	611	(41%)	351	(23%)
Important	630	(42%)	708	(47%)
Neither important or unimportant	220	(15%)	382	(25%)
Unimportant	29	(2%)	58	(4%)
Very unimportant	12	(1%)	22	(1%)
Support Australian Economy*				
Very important	663	(44%)	-	-
Important	579	(39%)	-	-
Neither important or unimportant	216	(14%)	-	-
Unimportant	31	(2%)	-	-
Very unimportant	13	(1%)	-	-
Avoid imported products				
Very important	419	(28%)	146	(10%)
Important	495	(33%)	419	(28%)
Neither important or unimportant	411	(27%)	666	(44%)
Unimportant	133	(9%)	221	(15%)
Very unimportant	44	(3%)	69	(5%)
Reduce food miles				
Very important	322	(21%)	139	(9%)
Important	509	(34%)	442	(29%)
Neither important or unimportant	532	(35%)	689	(45%)
Unimportant	102	(7%)	175	(12%)
Very unimportant	37	(2%)	76	(5%)
Product health claims				
Very important	381	(25%)	312	(21%)
Important	631	(42%)	688	(45%)
Neither important or unimportant	383	(26%)	425	(28%)
Unimportant	75	(5%)	75	(5%)
Very unimportant	32	(2%)	21	(1%)
Quality certification				
Very important	538	(36%)	520	(34%)
Important	641	(43%)	716	(47%)
Neither important or unimportant	262	(17%)	243	(16%)
Unimportant	40	(3%)	31	(2%)
Very unimportant	21	(1%)	11	(1%)

* question not asked in New Zealand sample