

An Analysis of Consumer Response to Plant-based Meat Alternative Labelling Policy.

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By

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Abstract

Plant-based meat alternatives, defined as products made with plant-based protein that imitate the taste, texture, and appearance of real meat, have been subject to rapid market growth in recent years. These products tend to appeal to consumers who are actively reducing their meat consumption, typically due to concerns about animal welfare, environmental sustainability, or health issues. The simulant nature of these products introduces the need for regulation of labels to facilitate informed consumer decision-making when selecting meat and plant-based alternatives at the grocery store. In Canada, guidelines exist which regulate the use of meat-related terms (e.g., burger, ground, etc.) on the labels of plant-based meat alternatives, nutritional content, and other aspects of these products. While meat-related terms are permitted in Canada, provided certain disclaimers are also present, some jurisdictions abroad have banned such labels entirely. In Canada, some meat industry groups have called for the removal of such terms, and in 2020 the Canadian Food Inspection Agency (CFIA) conducted a consultation on its guidelines for plant-based meat alternative labelling. Despite a dynamic policy environment, research that investigates the consumer demand effects of plant-based meat alternative labelling policy remains elusive.

A survey of 1203 Canadian consumers was conducted to assess the consumer demand effects of different regulatory approaches to the use of meat-related terms on plant-based meat alternative labels. The survey included a discrete choice experiment, where respondents were assigned to one of three labelling treatments – unregulated labels, current Canadian regulations, and a meat-related terms ban. Choice sets featured ground beef and plant-based alternatives with varying attributes and prices. The choice experiment facilitated the investigation of two secondary research objectives: consumer response to regulated protein label claims, and an assessment of preference heterogeneity for plant-based meat alternatives under different labelling policy scenarios. The data was analyzed using multinomial logit, random parameters logit, and latent class logit models, eliciting marginal utility and willingness-to-pay estimates for the attributes and policy effects.

Results show that the labelling policy environment does impact consumer preferences for ground beef and plant-based alternatives. Ground beef is preferred by most consumers in the Canadian market under all three labelling treatments. Further, consumers prefer meat alternatives in an unregulated market relative to the current Canadian regulations and the meat-related terms ban treatments. On average, consumers exhibit similar reductions in willingness-to-pay under the two regulated treatments. However, these effects diverge when preference heterogeneity is accounted for. Five classes of consumers were identified in the latent class logit model, with varying preferences, characteristics, and responses to labelling policy. Preferences for protein claims are generally strong and positive, and there is a significant degree of heterogeneity in preferences for products, attributes, and labelling policy frameworks. The analysis reveals numerous insights into both market and policy issues of plant-based meat alternative labelling. It is in the firm's best interest to utilize meat-related terms on product labels. However, the disparity in preferences among policy treatments indicates that the provision of information in the form of label disclaimers alongside meat-related terms likely provides valuable information to consumers who may be confused or inattentive otherwise.

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Chapter 1 Introduction

1.1 Background and Problem Statement

Meat consumption habits are changing around the world. While consumption is increasing with income in developing nations (OECD-FAO, 2020), consumption growth has tapered off in many high-income countries (Malek et al, 2019). Significant swathes of Canadian consumers have begun substituting meat with other forms of dietary protein, particularly from plant-based sources. These changes tend to stem from concerns about the environmental impact of the meat industry, such as greenhouse gas emissions, land and water use, and animal welfare, or for nutritional reasons, like cholesterol avoidance. Plant-based meat alternatives, defined as products derived from plant-protein that mimic the taste, texture, appearance, and protein content of real meat, have become a vehicle of substitution away from meat in the diets of many Canadians.

According to the National Research Council of Canada, the global market for plant-based protein will be worth \$US 10.8 billion by 2022, growing at a compound annual rate of 6.7% (NRCC, 2019). Further, sales of plant-based meat alternatives in the United States increased fourfold over the course of the COVID-19 pandemic (Zhao et al, 2022). In Canada, this trend is similarly substantial. Canadian sales for plant-based protein products are experiencing a higher growth rate than meat (Burak, 2021), and 40% of consumers have expressed interest in increasing their consumption of plant-based foods (NRCC, 2019). 6.4 million Canadian consumers report adherence to dietary habits which eliminate or reduce meat consumption (Charlebois et al, 2018). These trends are indicative of substantial change in Canadian eating habits, and plant-based meat alternatives appear to be facilitating some portion of these recent developments.

While vegetarian diets have been relatively common for decades, the simulant nature of the recently developed suite of plant-based meat alternatives has allowed for market expansion beyond just meat-avoiding consumers. Traditionally meat-eating consumers can incorporate such products into their diets while maintaining dietary familiarity in terms of meal structure, meaning firms in the plant-based sector can potentially access consumer segments that would not previously consider such products.

The simulant nature of these products introduces rationale for the regulation of labelling and nutritional standards to ensure consumers can make informed choices at the grocery store. Predictably, regulatory standards have developed alongside market growth in most jurisdictions where plant-based meat alternatives are available. One persistent point of contention in this regulatory environment, both in Canada and elsewhere, is whether the use of meat-related terms and language should be permitted on the labels of plant-based meat alternatives. Bans on the use of meat-related terms have been enacted in France and certain U.S. state-level jurisdictions. Meanwhile in Canada, meat-industry advocates and organizations such as the Canadian Meat Council, Quebec Cattle Producers Federation and Canadian Cattlemen's Association have lobbied for similar legislation, claiming that meat-related terms on plant-based meat alternative labels can be misleading to consumers (Fortune, 2019).

While meat-related terms are currently permitted in Canada, other policy mechanisms are utilized to mitigate consumer confusion when purchasing plant-based meat alternatives. All plant-based meat alternative products sold in Canada must include disclaimers noting the plant-based nature of the product ("Contains no Meat") and include the word "simulated" directly adjacent to the product's common name, which often uses language associated with a meat

product (CFIA, 2021a).¹ Plant-based meat alternatives in Canada must also adhere to nutritional and protein content requirements. The goal of these regulations is to prevent consumers from being misled and ensure that plant-based meat alternatives achieve a nutritional standard such that they are appropriate dietary substitutes for meat.

In 2020, the Canadian Food Inspection Agency launched a consultation to reassess its guidelines for plant-based meat alternative labelling and nutritional standards. This initiative to re-open policy discussions implies that the policy environment remains dynamic in Canada. Despite an active regulatory environment in many jurisdictions, research that explores the consumer demand effects of plant-based meat alternative labelling policy remains limited. As this market continues to grow, the ramifications of regulatory changes become increasingly widespread. A strong understanding of the potential effects of regulatory change is necessary to inform and promote beneficial policy going forward. Given the prominence of this policy debate over the last several years, the lack of analysis on the topic is surprising.

There is a wide body of evidence to suggest that consumer perceptions of product names and label terminology influence demand for those products. In the case of plant-based meat alternatives specifically, Van Loo et al (2020) found American consumer preferences for plant-based meat changed based on the provision of information and the inclusion of brand names on product labels. Meanwhile, in the European Union, Demartini et al (2022) found that framing plant-based meat alternative labels as “meat-sounding” elicited different consumer perceptions of healthiness, tastiness, and willingness to buy plant-based meat alternatives than “vegan” framing. Label framing effects have been found in other agri-food contexts as well. Therefore, work that

¹ For example, a plant-based burger product would require the common name “Simulated Burger” on its label.

expands upon previous findings to explore the consumer demand effects of plant-based meat alternative labelling policy would provide important context to ongoing policy debates.

1.2 Research Objectives

The policy issues outlined in Section 1.1 motivate three objectives to be addressed by this research. The primary objective of this thesis is to evaluate how consumer preferences for meat and plant-based alternatives change under different labelling policy frameworks, which regulate the use of meat-related terms on the labels of plant-based meat alternatives. The comparison of preferences for meat with plant-based alternatives allows for an assessment of substitution patterns between these products, and changes to those patterns with respect to labelling policy.

Two secondary objectives emerge from the central goal of this research. The first of these complementary objectives is to assess consumer response to two regulated protein label claims – “An Excellent Source of Protein” and “A Complete Source of Protein.” Broadly, these claims represent two different aspects of protein attributes – content and quality. Since the standards for plant-based meat alternative protein content tend to overlap with the standards for these regulated protein claims (CFIA, 2021a; CFIA 2021b), this analysis provides an indirect assessment of the consumer demand effects of nutritional content policy for plant-based meat alternatives.

The second extension is an investigation of consumer preference heterogeneity for plant-based meat alternatives and their attributes – the degree to which preference heterogeneity exists in the market, and the consumer characteristics that drive it. Consumer purchasing decisions will vary based on their attitudes, beliefs, habits, and other characteristics. In the case of plant-based meat alternatives, factors such as dietary habits, food attribute values, food neophobia and many

socio-demographic characteristics are anticipated to underly preferences for plant-based meat alternatives, and changes in demand brought about by labelling policy.

1.3 Research Methods

To address the research objectives, an online survey containing a discrete choice experiment is developed and distributed in an online format to Canadian consumers. In the choice experiment, respondents choose among ground beef and plant-based alternatives, with varying prices and attributes, under different labelling policy treatments which dictate permissible terms on the label. Three labelling policy scenarios are considered – an unregulated policy environment, the current Canadian regulations, and a meat-related terms ban. These scenarios represent a continuum with respect to their restrictions on plant-based meat alternative firms' labelling activities. Upon beginning the survey, respondents are assigned to one of these three labelling policy treatments, and respond to six hypothetical purchase scenarios, with product labels adhering to their assigned treatments. The choice experiment utilizes graphically designed label images to enhance realism in the choice task. This data is then used to model consumer choice and elicit the effects of labelling policy on consumer demand for plant-based meat alternatives.

Three different choice models are utilized to address the research objectives. A Multinomial Logit Model comprises the base model for this research, providing estimates for broad, average preferences for plant-based meat alternatives and policy effects. Then two models which incorporate preference heterogeneity, a Random Parameters Logit Model, and a Latent Class Logit Model, are utilized. These models offer a more complex analysis of preferences for plant-based meat alternatives, their attributes, and policy effects.

1.4 Thesis Organization

This thesis contains six chapters. Following the introduction, Chapter 2 provides an overview of the market for plant-based meat alternatives and a review of relevant consumer demand literature, with a focus on the drivers and barriers of plant-based meat alternative consumption. Chapter 3 describes the relationship between food labelling and consumer demand, before outlining the regulatory environment and policy debates in Canada and abroad. The empirical methods are described in Chapter 4, where the survey development, survey administration, and econometric methods are discussed. Chapter 5 presents the results of the consumer survey and choice modelling. Finally, Chapter 6 discusses the conclusions, implications, and limitations of this research, along with suggestions for future research.

Chapter 2 Plant-Based Meat Alternatives: Product, Market, and Demand

2.1 Introduction

Plant-based meat alternatives – particularly those intended to be direct substitutes for meat products – are becoming increasingly popular among consumers in Canada and abroad. The practice of meat substitution in favour of plant-based alternatives has been investigated worldwide, as consumers become increasingly conscious about the food they eat and the effects that it can have on their health, the environment, and society at-large.

The fast-growing nature of the market for plant-based meat alternatives has attracted a wide-range of studies in recent years. Onwezen et al (2021) note that consumer research on the broad topic of meat alternatives – including insect, lab-grown, and plant-based products – is growing rapidly, from three published studies in 2014 to thirty-seven in 2019. This growing body of work addresses consumer preferences for meat alternative products from differing perspectives and methodologies, and the uptick in research in this area highlights the importance of obtaining a better understanding of the market for these products. However, Onwezen et al (2021) note that studies pertaining to consumer preferences for plant-based meat alternatives trails the work on insects, cultured meat, and other vegetarian options, meaning that more work is necessary to obtain a comprehensive grasp on consumer preferences and demand for such products. This chapter reviews the current body of literature on plant-based meat alternatives, including the product composition and attributes, the drivers of consumer demand, and the barriers preventing more widespread consumption.

2.2 Plant-Based “Meat”: Product Composition and Market Overview

Plant-based meat alternatives are defined by the Canadian Food Inspection Agency (CFIA) as products that do not contain any meat or poultry ingredients, but are produced such that they simulate the taste, texture, and nutritional qualities of traditional meat products (CFIA, 2021a). These products utilize novel food production technology that incorporates various plant-based ingredients into products that can serve as direct replacements for meat. Plant-based meat alternatives are available to Canadian consumers in a variety of different forms, including as burger patties, sausages, and ground “beef.” Although these products make suitable substitutes for processed meat products, attempts to imitate muscle meat from vegetable sources have been less successful (Elzerman et al, 2013). Plant-based meat alternatives can be found in both grocery stores and restaurants. Popular fast-food chains in Canada, such as Burger King and A&W, have promoted products containing plant-based meat substitutes extensively, creating an opportunity to draw in customers that they may not have had access to previously with meat-centric menu items.

Meat substitutes have existed on the market for quite some time. For example, tofu has been readily available to North American consumers since the 1960s, and veggie burgers were soon to follow (Elzerman et al, 2013). However, the more recent product offerings from new market entrants have become increasingly adept at simulating the taste and texture of meat, eclipsing vegetarian meat substitutes of the past in terms of broad appeal amongst consumers. Plant-based meat simulant companies developed and created these products by extracting protein and other key ingredients from plant-based sources and combining these inputs into a finished good that is structurally similar to meat, which is then used in a number of product lines. For example, Beyond Meat uses pea protein isolate to form the basis of its plant-based “meat,” and

beet juice to mimic the “bleeding” and juiciness of beef (Van Loo et al, 2020). Meanwhile, Impossible Foods utilizes soy protein, along with a yeast-extracted heme protein, coconut oil, and other plant-based additives to create a meaty taste and texture (Impossible Foods, 2021).

Start-ups such as Beyond Meat and Impossible Foods are not the only players in this rapidly growing market. Large meat packing companies such as Tyson, Smithfield, and Perdue began investing in plant-based protein products in 2019, citing market opportunities as the reason to do so (Yaffe-Bellany, 2019).² While firms in the plant-based meat market heavily communicate the societal benefits of their products (environment, health, animal welfare, etc.), there are clear market incentives for such firms as well. As consumers become increasingly conscious of their food purchases, and firms continue to invest in new technology and product lines, the market for plant-based meat alternatives is expected to experience continued growth.

Currently, market shares for simulated meat remain low relative to traditional meat products. In Canada, the hypothetical market share of plant-based burgers was found to be between 14%-25%, while beef burgers remained dominant at 65%-75% (Slade 2018). Van Loo et al (2020) found similar results in their American study, with beef maintaining a hypothetical market share anywhere from 60%-80%,³ while plant-based options ranged from 15%-25%. In terms of raw sales, the plant-based industry is dwarfed by traditional meat products (NRCC, 2019; AAFC, 2021). Using Nielsen scanner data, Cuffey et al (2022) found only 25% of their sample to have purchased plant-based meat alternatives between 2015 and 2019, while 43% of those who did purchase those products were one-time consumers. Meanwhile, Zhao et al (2022) estimated that prior to the COVID-19 pandemic, American plant-based meat alternatives made

² It should be noted that in fall of 2022, some of these traditional meat firms have scaled back (Smithfield) or divested entirely (JBS) of plant-based meat alternative product lines in North America, citing reduced sales linked with food price inflation in the latter half of 2022 (Watson, 2022).

³ Market share variation dependent on information treatments.

up only 0.1% of fresh meat sales. However, this proportion increased fourfold by July 2020, exhibiting the fastest growth rate among fresh meat categories. Continued growth for the market of plant-based alternatives and other “clean meat” products is widely expected, with the National Research council of Canada predicting 20% market share in 25 years (NRCC, 2019). Further, Malek et al (2019) note that as many as 50% of Australian consumers are willing to shift some of their protein consumption from meat to plant-based options, while more than 40% of Canadian consumers express similar sentiments (NRCC, 2019).

Plant-based meat alternatives may not function solely as a substitute to meat. There is evidence to suggest that some consumers perceive plant-based meat alternatives as complementary to traditional meat products, implying that these products may not erode the market share of meat products, instead growing the market for protein-rich food products in general (Siegrist and Hartmann, 2019; Taylor et al, 2022). Zhao et al (2022) found plant-based meat alternatives to be a price complement to beef products, implying that they are likely purchased together rather than as substitutes.⁴ Further, when a household purchases plant-based meat alternative products for the first time, meat expenditures remain constant, implying that these products are not necessarily substitutes (Cuffey et al, 2022). Tonsor et al (2022) also found a weak degree of substitutability between meat and plant-based alternatives. Relatedly, some work has also assessed consumer preferences for hybrid burgers, which contain a combination of beef and plant-based ingredients (Profeta et al, 2021a; Profeta et al, 2021b). While substitutability seems to be a clear intention for many plant-based meat alternative firms, consumers are heterogeneous in their perceptions and intentions for such products, and plant-

⁴ The authors posit that this could be due to flexitarian consumers that consume both products regularly, or that early adopters purchase both meat and plant-based products at the same time for purposes of comparison. Another potential motivator for purchasing meat and plant-based alternatives as complements could be the case where only certain members of a household adhere to a meat-avoiding diet, while the rest prefer to eat meat.

based meat alternatives may ultimately expand the total market for protein consumption, rather than cannibalize traditional sources of protein.

The expansion of the plant-based meat alternatives sector has numerous implications for Canadian consumers, firms, and policymakers. First, the growing number of companies entering the sector will ensure that consumers are able to choose from many different products to find those that suit their preferences. Consumer satisfaction with meat alternatives on the market increased by 6% from 2019 to 2020 (Bryant and Sanctorum, 2021), illustrating significant positive change in a short period of time, and this trend should continue as firms refine their product offerings. However, plant-based meat alternatives remain more expensive than traditional meat products, and exhibit more elastic demand than the meat products they simulate (Tonsor et al, 2022). As prices decrease (Sozzi, 2020), plant-based meat alternatives may become more appealing to a wider group of consumers.

Second, while plant-based meat alternatives could pose a threat to the Canadian meat industry in the future, these products also provide opportunities for Canadian farmers that grow some of the key inputs for plant-based meat alternatives, particularly peas. Van Loo et al (2020) found pea-based products to generally capture a greater market share than soy-heme products. While soy remains the market leader as a protein source for plant-based meat alternatives (Grand View Research, 2020), pea protein is exhibiting the fastest growth among plant-based protein sources, due to positive attributes such as amino acid content and a lack of allergenicity (Grand View Research, 2020; Markets and Markets, 2020). Canada is among the world's leaders in field pea production, and domestic production of pea-based protein isolates could soon be a reality given recent investments in processing facilities (Laychuk, 2021). Finally, plant-based meat products, and the associated labelling and promotional activities by firms and stakeholders, have

come under increased scrutiny from both meat producer groups and government, prompting policy discussions and regulations regarding permissible product descriptions and nutritional content.

2.3 Drivers and Barriers of Demand and Meat Substitution

The body of literature examining consumer preferences for plant-based meat alternatives is growing rapidly and provides a strong foundation for new research to fill in existing gaps. There are numerous factors that can influence food purchasing, consumption, and aversion. Renner et al (2012) found as many as 78 separate items and factors that influence food choice. According to numerous consumer studies, as many as half of consumers have expressed some intent to change their meat consumption habits, for a myriad of reasons (Latvala et al, 2012; Charlebois et al, 2018, Malek et al, 2019; Profeta et al, 2021b). Determining the drivers of consumer substitution from meat to plant-based alternatives has motivated much of the existing literature, and further insights are necessary to gain a stronger understanding of these products and their potential market.

Broadly, the literature pertaining to consumer demand for plant-based meat alternatives has identified and examined four predominant drivers of demand for plant-based meat products. First, consumer preferences for the product attributes of plant-based meat alternatives are dependent upon consumer-specific factors such as food neophobia, meat attachment, dietary habits, and socio-demographic characteristics. To gain a strong understanding of how consumers value the product attributes of plant-based meat alternatives, a comprehensive analysis of these factors is needed. These characteristics then influence the consumer response to the remaining three drivers of demand for plant-based meat alternatives – the physical attributes of the product

such as taste and texture, environmental sustainability,⁵ and health (Charlebois et al, 2018). Further, certain aspects of these motivators, particularly regarding the physical product, and behavioural/attitudinal factors such as food neophobia and meat attachment, can pose barriers to consumption for various consumer groups. Ultimately, for the consumption of plant-based meat alternatives to maintain its growth in the coming years, the benefits of consumption must outweigh the barriers, which will require continued communication and product improvement from firms and industry stakeholders (Hoek et al, 2011). The following sub-sections review, compare, and contrast the findings of the research regarding each of these influencers of demand and substitution.

2.3.1 Behavioural, Attitudinal and Socio-Demographic Factors

Behavioural, attitudinal, and socio-demographic factors influence how consumers value the attributes of meat and plant-based alternatives and form the basis for food consumption decisions. There is a plethora of consumer-specific characteristics that can influence food choice, often forming underlying motivations for more tangible preferences such as those pertaining to physical attributes, ethical concerns, and human health. The following sections outline the consumer-specific factors found to be prominent in the case of plant-based meat alternatives.

2.3.1.1 Consumption Habits: Meat-avoiders, Meat-reducers, and Omnivores

Veganism, vegetarianism, and other meat-avoiding diets have been commonplace in Western cultures for decades. Studies have found approximately 5-10% of Western consumers identify themselves as vegan or vegetarian (Apostolidis and McLeay, 2016; Slade, 2018; Malek et al, 2019).⁶ The remaining population generally consumes some sort of omnivorous diet

⁵ Inclusive of animal welfare and other ethical factors for purposes of this analysis.

⁶ Studies from the United Kingdom, Canada, and Australia, respectively.

inclusive of both meat and plant-derived products. Dietary habits and familiarity are among the most prominent factors influencing food choice (Hoek et al, 2011; Schosler et al, 2012).

Predictably, meat-avoiders tend to strongly prefer plant-based meat alternatives to traditional meat products (Tonsor et al, 2022). While the similarities between meat and plant-based alternatives have driven market expansion beyond meat-avoiding consumers, dietary habits may also pose a barrier for more widespread consumption, by both wary omnivores that ordinarily would not consume such products, and meat-avoiders who may not be enticed by products that closely mimic meat.

Some studies have found vegetarian consumers to be averse to plant-based meat alternatives that closely resemble meat (Hoek et al, 2011; Michel et al, 2021), due to feelings of disgust that they may associate with those products. Motivations for adhering to a vegetarian diet vary, and often include health-related reasons, animal welfare, concerns about the environmental impacts of the meat industry, and psychological characteristics such as empowerment and identity (Simons et al, 2021). It is thus understandable that many vegetarian consumers would prefer plant-based protein options that are dissimilar to meat. This dichotomy in preferences for meat-like attributes in plant-based meat alternatives between meat-eaters and avoiders, combined with advertising strategies which appeal to aspects of taste and similarity to meat (Ye and Mattila, 2021), indicates that plant-based meat alternative firms are marketing to a growing demographic of “flexitarians” – consumers that incorporate plant-based protein into their diet to replace meat, while not eschewing meat completely. However, vegetarians are still more likely to choose plant-based meat alternatives than omnivores (Slade, 2018; Van Loo et al, 2020; Tonsor et al, 2022).

Flexitarianism can describe a wide variety of dietary patterns where meat is intentionally avoided under certain circumstances, but not eschewed completely (Capper, 2021). The proportion of consumers that adhere to a flexitarian diet is somewhat uncertain. In Canada, Charlebois et al (2018) found 10.2% of their sample to identify as flexitarian. Meanwhile, Bryant and Sanctorem (2021) found that 34.6% of Belgian consumers identified as flexitarian in 2020, up from 31.4% in 2019, making flexitarians the second-largest group of protein consumers after traditional omnivores. Further, this segment of self-identified flexitarians appears to be smaller than the group of consumers that state a general willingness to reduce meat consumption (Latvala et al, 2012; Malek et al, 2019; NRCC 2019), potentially indicating a sizeable target market for plant-based meat alternatives.

This ambiguity in definition makes the actual proportion of flexitarian consumers difficult to identify. In a review of the literature regarding flexitarian consumers, Dagevos (2021) found that anywhere from 16%-66% of consumers engage in some sort of flexitarianism, dependent on geographic location, intent, and definition of flexitarianism used in the reviewed studies. Despite uncertainty regarding the size of this segment, it still presents a promising opportunity for firms in the plant-based meat alternative industry, and it appears that firms have realized this, employing marketing strategies that focus on meat-reducing consumers.

2.3.1.2 Familiarity, Food Neophobia, and Food Disgust

A lack of familiarity is a prominent barrier to widespread consumption of plant-based meat alternatives. Familiarity with meat substitutes plays an important role in the selection of such products, and consumers may not deem plant-based meat alternatives to be suitable substitutes to meat in traditional dietary contexts (Schosler et al, 2012). In Western cultures,

meat is typically viewed as a staple in a meal, and replacing it with plant-based alternatives may not be amenable to all consumers in terms of both sensory qualities and meal structure.

A lack of familiarity with plant-based meal preparation and products can be associated with meat attachment, a phenomenon where consumers form a bond to the meat products with which they are familiar. Those with higher levels of meat attachment are less willing to change their consumption habits than consumers without this trait (Graca et al, 2015). Several studies have found a large portion of consumers exhibit meat attachment (Malek et al, 2019; Possidonio et al, 2021).⁷ Ultimately, a lack of familiarity with plant-based meat alternatives and meat attachment characteristics combine to form significant hurdles for the widespread consumption of plant-based meat alternatives and will be important barriers to overcome for the industry.

Relatedly, food neophobia has also been found to present a significant barrier in the consumer acceptance of plant-based meat alternatives (Hoek et al, 2011; Apostolidis and McLeay, 2016; Onwezen et al, 2021). Food neophobia is defined as a fear of or reluctance to try novel foods and is likely an adaptive human trait developed to protect from potentially dangerous foods (Pliner and Hobden, 1992). Consumers may be wary to try plant-based meat alternatives due to a fear that they will not enjoy them, even if the product is nearly indistinguishable from meat in terms of its physical properties. Consumer feelings of food neophobia toward plant-based meat alternatives likely stem from a combination of unfamiliarity (Hoek et al, 2011) and novel production technology (Slade, 2018), among other factors.

Food neophobia in the context of plant-based meat alternatives also displays linkages with consumer consumption habits. According to Hoek et al (2011), both non-consumers and

⁷ Malek et al (2019) found 46% of Australian consumers to be “committed meat eaters,” while Possidonio et al (2021) found this segment to represent 55.8% of Portuguese consumers.

heavy users⁸ of meat alternatives expressed high levels of food neophobia, while light-to-medium consumers displayed lower levels. This indicates that certain subsets of consumers are food neophobic to different protein sources depending on their entrenched consumption habits. In addition, 40% of participants were found to be food neophilic, adventurous eaters that love to try new foods. Thus, there appears to be significant heterogeneity among consumers regarding the presence, expression, and outcomes of food neophobic behaviours in the case of plant-based meat alternatives.

Despite clear linkages expressed in the literature, the impacts of food neophobia on demand for plant-based meat alternatives are yet to be explicitly assessed in an economic context. However, insights regarding the effects of food neophobia on consumer demand can be gleaned from other contexts. Yang et al (2020) examined the impact of food neophobia on preferences for Arctic food products in Canada, finding that food neophobic consumers are unlikely to be embracers traditional Arctic food products. Food neophobia has also been found to contribute to reduced acceptance of functional foods in North America and France (Labrecque et al, 2006) and novel cheese products in Finland (Arvola et al, 1999). La Barbera et al (2018) found food neophobia to play a role in the aversion to eating insects in Western culture, though less so than the related but separate factor of food disgust. Interestingly, food neophobia was not found to be an important determinant of choice for meat hybrids⁹ (Profeta et al, 2021a). The relevance of food neophobia in various contexts implies that an investigation into the effects of food neophobia on demand for plant-based meat alternatives is a useful addition to this assessment.

⁸ Consumers were stratified into three consumption groups based on consumption frequency of plant-based meat alternatives: non-users, light/medium users, and heavy users.

⁹ Where meat and plant-based protein are combined into a single processed protein product.

Finally, a third related factor that has been found to affect consumer perceptions of plant-based meat alternatives is food disgust sensitivity (Siegrist and Hartmann, 2019; Michel et al, 2021; Possidonio et al, 2021). Disgust sensitivity refers to the likelihood a consumer feels disgusted when presented with the opportunity to consume different foods and can be measured using a scale developed by Hartmann and Siegrist (2018). Siegrist and Hartmann (2019) found food disgust sensitivity to be negatively correlated with consumption of plant-based meat alternatives, while Michel et al (2021) found “disgust” to be one of the terms most associated with the concept of plant-based meat alternatives. In their Portuguese study, Possidonio et al (2021) found 55.8% of consumers to express disgust toward plant-based meat substitutes.

2.3.1.3 Other Notable Attitudinal and Socio-demographic Factors

While an innumerable amount of consumer-specific factors may have some impact on consumer preferences for plant-based meat alternatives, there are several more worth mentioning for this research. Slade (2018) produced a comprehensive assessment of how various behavioural, attitudinal, and socio-demographic characteristics affect demand for plant-based meat alternatives, finding that consumers with positive views toward food technology and those who claim to be conscious food purchasers are more likely to buy plant-based meat alternatives. The role of socio-demographics in driving demand for plant-based meat alternatives has been widely debated, but Slade (2018) notes that younger, more educated consumers are more likely to purchase plant-based meat alternatives, consistent with the findings of Van Loo et al (2020). Female consumers were also found to be more likely to purchase plant-based meat alternatives, consistent with Bryant and Sanctorem (2021).

Finally, politically liberal consumers are more inclined to purchase meat alternatives. These consumers tend to share several key attitudinal characteristics (environmental

consciousness, importance of science, higher rates of vegetarianism, etc.) that correlate and converge toward a consistent worldview (Slade, 2018). The importance of socio-demographic characteristics in determining meat consumption habits stokes some disagreement in the literature, with proponents (Latvala et al, 2012) and skeptics (Malek et al, 2019), but are nonetheless important in practicality as a straightforward manner in developing consumer profiles and segments for marketing efforts.

2.3.2 Taste, Texture, and Physical Properties of Plant-based Meat Alternatives

The taste and texture of plant-based meat alternatives have become increasingly similar to real meat. These product developments aim to make plant-based meat alternatives more amenable to the broad population, but barriers to consumption persist. Taste and appearance are paramount in driving adoption of plant-based meat alternatives, (Latvala et al, 2012; Weinrich, 2019), and must be considered when assessing demand for these products. There appears to be a significant degree of heterogeneity in how consumers perceive the taste, texture, appearance, and other physical properties of plant-based meat alternatives, and these perceptions can often be associated with the consumer-specific characteristics mentioned previously.

The taste attributes of plant-based meat alternatives, and associated perceptions, are a key component of plant-based meat alternative demand. While the increasing similarities between meat and plant-based alternatives in terms of taste, texture, and appearance have played an important part in recent market growth, these attributes can also pose a barrier to consumption for meat-eating consumers who do not perceive the taste of plant-based products as adequate relative to meat. Using latent class analysis, Apostolidis and McLeay (2016) found that a taste-driven consumer segment represents around 15% of meat and plant-based meat alternative consumers, a larger group than those driven primarily by healthy eating, organic food, or a

vegetarian diet, but smaller in number than the price-conscious and green consumer groups. These taste-driven consumers tend to prefer meat to plant-based meat alternatives (Apostolidis and McLeay, 2016; Possidonio et al, 2021), indicating that these attributes may not be sufficient in stimulating demand for plant-based meat alternatives among these consumers. Continued product development is a necessary step to mitigate taste-related barriers to consumption and reach a broader body of consumers.

Past consumption behaviour is a key determinant in the effectiveness of nudging consumers toward plant-based meat alternative acceptance (Bacon and Krpan, 2018). The importance of meat-like taste and texture in driving substitution towards plant-based analogues among consumption groups is further confirmed by Hoek et al (2011), who found that those who consume relatively few meat alternative products place an outsized importance on the product's sensory appeal and similarity to meat. Further, they found that the most important barriers for non-users of plant-based meat alternatives are often product-related (sensory appeal, unfamiliarity, etc.). These taste-related barriers for non-users are likely linked to behavioural characteristics such as food neophobia and disgust sensitivity. Further, consumers tend to rate meat products as tastier than plant-based alternatives across product categories (Michel et al, 2021). Ye and Mattila (2021) and Profeta et al (2021a) echo these findings, noting that while consumers may believe plant-based options to be healthier and better for the environment than meat, they prefer the taste of meat products.

Elzerman et al (2013) conducted a taste test experiment of plant-based meat alternatives to gauge consumers' experiences and expectations of plant-based meat alternatives in the Netherlands. While the study took place before the newer suite of plant-based meat simulants entered the market, it does provide insight into consumers' preconceived notions for plant-based

meat products and their reactions to trying such products. The participants generally expressed negative views of plant-based meat alternatives, both in terms of sensory appeal and appropriateness in the meals that they cook. However, a taste-test of a pasta dish containing meat substitutes in place of ground beef generally elicited positive reactions from participants, implying that their low expectations for the sensory appeal of plant-based meat alternatives were exceeded when given the opportunity to try such products. This disparity between expectation and reality could be influenced in part by food neophobia, which is highly correlated with expectations associated with novel foods (Pliner and Hobden, 1992).

While rapidly improving taste and texture attributes of plant-based meat alternative have vaulted such products into the mainstream, these physical attributes can still pose significant barriers for consumption. Meat eating consumers generally prefer the taste and texture of meat to plant-based alternatives. Characteristics such as food neophobia and disgust sensitivity could play a role in enforcing this barrier for omnivorous consumers. While expectations and preconceived notions of taste-related attributes appear to inhibit consumption of plant-based meat alternatives, Elzerman et al (2013) demonstrate that perceptions can change after consumption. The onus of overcoming this barrier thus falls to firms, tasked with encouraging consumers to try plant-based meat alternatives to boost market demand, and continued product development. Alternatively, Ye and Mattila (2021) suggest that taste-based marketing appeals are ineffective, claiming that firms should focus on promoting other product attributes such as those pertaining to health and sustainability to increase consumption.

2.3.3 Ethical Motivations, Environmental Sustainability, and Animal Welfare

Ethical and social motivations have long been associated with vegetarianism and other meat-avoiding diets. Concerns regarding animal welfare have driven consumption of plant-based

meat alternatives for some time, particularly after the BSE outbreak and other food safety issues in the early 2000s (Hoek et al, 2011). Animal welfare concerns continue to be a strong motivator today, with moral reasons consistently being cited as the dominant driver of vegetarianism (Ruby, 2012). While animal welfare has long motivated certain subsets of consumers to consider plant-based protein options, the negative impacts of the meat industry on the environment, in the form of greenhouse gas emissions, water use, and habitat destruction, have come to the forefront more recently. Self-reported consciousness about food and the environment both lead to increased consumption of plant-based meat alternatives, and correlate with vegetarian diets (Slade, 2018). Nevertheless, the importance of sustainability concerns relative to taste and health motivations on demand for plant-based meat alternatives remains unclear.

Much of the consumer literature on plant-based meat alternatives refers to the environmental harm caused by the meat industry, citing those concerns as a driver for market growth (Siegrist and Hartmann, 2019; Possidonio et al, 2021; Bryant and Sanctorem, 2021; Onwezen et al, 2021). According to the FAO (2013), 14.5% of all human-related greenhouse gas emissions stem from the livestock industry, contributing to environmental issues such as climate change and habitat loss. Plant-based meat alternative firms extensively mention the environmental toll of the meat industry in their marketing efforts, highlighting reductions in greenhouse gases, water, and land use in their production processes relative to conventional meat production (Beyond Meat, 2021; Impossible Foods, 2021). Although these claims become debateable when sustainable meat production practices are adopted (Van Vliet et al, 2020), plant-based meat alternatives likely have a role to play in the development of more environmentally sustainable supply chains.

Increasingly concerned consumers may shift dietary habits toward meat reduction or avoidance to mitigate their carbon footprint. Bryant and Sanctorem (2021) found that 54.1% of Belgian consumers indicated that a product's environmental impact is an important factor in food choice, a statistically significant increase from the year previous. This growing trend of environmentally driven consumption of plant-based meat alternatives has been widely acknowledged and investigated in the literature, and along with concerns for animal welfare, provide a strong purchasing motivator for ethically motivated consumers. However, due to the mostly hypothetical nature of this work, the degree to which consumers truly act on these attitudes is uncertain.

Macdiarmid et al (2016) investigated Scottish consumer awareness of the environmental impacts of meat-eating and whether that awareness translated into a stated reduction in meat consumption. The researchers note three key results from this assessment. First, they found a significant lack of awareness regarding the link between meat consumption, greenhouse gas emissions, and climate change, with participants showing more concern for the environmental effects of packaging, transportation, and processing in the food industry than livestock greenhouse gas emissions. Second, participants tended to believe that their personal meat consumption is inconsequential when it comes to solving the issue of climate change, often citing the presence of bigger environmental issues to rationalize their stance. Finally, there was a general resistance among participants to the notion of eating less meat, even in those who recognized the environmental impacts of meat consumption, with few differences in this opinion along socio-demographic lines.

Meat is generally perceived as pleasurable, traditional, and familiar (Hoek et al, 2011; Schosler et al, 2012; Michel et al, 2020), and Macdiarmid et al (2016) assert that these values

likely outweigh environmental concerns for most consumers. Further, those who expressed some willingness to eat less meat seemed more interested in health-related motivators. Respondents were often skeptical of scientific evidence pointing to the meat industry's role in climate change, and it is unclear what evidence would be necessary to convince them of such issues. Ultimately, while the study by Macdiarmid et al (2016) was qualitative in nature, it lends key insights into the information and awareness consumers possess regarding the environmental impacts of meat consumption, highlighting significant resistance to the idea of eating less meat to remedy these issues.

Beyond the study by Macdiarmid et al (2016), findings indicate that on average, consumers seem to express a neutral view as to whether the meat industry is detrimental to the environment (Slade, 2018), though some disagreement exists (Hartmann and Siegrist, 2017; Siegrist and Hartmann, 2019).¹⁰ Apostolidis and McLeay (2016) posit that consumer awareness about environmental issues is not strong enough to overcome the perceived lack of sensory appeal associated with plant-based meat alternatives. Like perceptions of taste-related attributes, there appears to be significant heterogeneity in consumer awareness and attitudes regarding the environmental impacts of their purchasing, and how their knowledge translates into food purchasing decisions.

Counter to Macdiarmid et al (2016) and Apostolidis and McLeay (2016), some studies indicate that information and knowledge of the environmental effects of meat consumption does lead to increased acceptance of plant-based meat alternatives. Siegrist and Hartmann (2019) found that Swiss consumers with a stronger understanding of the environmental impacts of meat

¹⁰ Indicating comparatively less (Hartmann and Siegrist, 2017) and more (Siegrist and Hartmann, 2019) consumer concern toward the environmental impacts of the meat industry than reported by Slade (2018), respectively.

consumption are more likely to choose meat alternatives.¹¹ Other studies have also found self-reported knowledge of the environmental impacts of the meat industry to be predictive of increased meat alternative consumption, to varying degrees (Slade, 2018; Profeta et al, 2021b). Moreover, Van Loo et al (2020) found that a sustainability information treatment resulted in the highest willingness-to-pay estimates for plant-based meat alternatives in their choice experiment.¹² While the extent of its impact remains ambiguous, sustainability-related information does seem to influence consumer perceptions of plant-based meat alternatives to some degree.

While the effects of external information provision on demand for plant-based meat alternatives remain murky, firm-level promotion of sustainability attributes is common and may be more convincing for consumers. In their choice experiment study of British consumers, Apostolidis and McLeay (2016) included a five -level carbon footprint attribute to observe whether an explicit environmental sustainability attribute on product labels influenced preferences and willingness to pay for meat and plant-based alternatives. Their results show that consumers have significant positive preferences for products with a low carbon footprint and obtain disutility for products with a carbon footprint above the median attribute value (6kg CO₂ per 500g of product). Apostolidis and McLeay (2016) then expand on their analysis by incorporating a latent class model, finding that 17% of consumers can be characterized as ‘green consumers,’ whose purchases are primarily driven by environmental sustainability. These consumers tend to be higher income and express a willingness to reduce their meat consumption, consistent with findings from other studies such as Latvala et al (2012), Slade (2018), and Malek

¹¹ Notably, these sentiments are somewhat muddled by the fact that participants generally perceived the environmental impact of plant-based products to be similar to meat.

¹² Relative to branding, technology, and control treatments.

et al (2020). The size of this segment aligns with findings from Portugal, where 18.1% of consumers fit the description of ‘ethically conscious meat avoiders’ (Possidonio et al, 2021).

Ye and Mattila (2021) investigated the effects of various advertising appeals and messaging strategies on American consumer preferences for plant-based meat alternatives in a restaurant setting. They hypothesize that environmental advertising messages are more effective than those focused on health and taste due to the ambivalence consumers may feel toward eating meat. Moreover, they argue that employing a social appeal will result in pleasurable feelings as the consumers’ choice is perceived as societally beneficial, and this encouragement could help to overcome individual and product related barriers that have been discussed at length in the literature (Hoek et al, 2011; Schosler et al, 2012; Slade, 2018). After investigating the effects of push and pull marketing efforts in separate experiments, their hypotheses are largely confirmed: consumers exhibited the greatest positive response to environmental advertising appeals, relative to taste-and health-focused communication.

To summarize, the effect of ethical motivations on demand for plant-based meat alternatives remains unclear. Ye and Mattila present the most bullish case, indicating that promoting the sustainability attributes of plant-based meat alternatives can be extremely effective. However, disagreement persists, and consumer skepticism of information provision may pose a barrier in the acceptance of plant-based meat alternatives, at least if that acceptance is contingent on prior concern for animal welfare and greenhouse gas emissions. Consumer skepticism may be justified; Lusk et al (2022) found that even a steep decline in prices for plant-based meat alternatives are unlikely to have significant impact on American cattle inventories and associated greenhouse gas emissions. Regardless, firms in the industry are already heavily

promoting the sustainability-related attributes of their products, indicating that there is likely sufficient internal evidence to support those strategies.

2.3.4 Health-related Motivations

The final driver of demand for plant-based meat alternatives to be discussed in this chapter is human health. Meat consumption per capita continues to rise worldwide (Godfray et al, 2018), which is somewhat of a double-edged sword in terms of the implications for human health. While relatively low-income consumers are increasingly able to access nutritious and protein-rich meat products, overconsumption of meat can result in a variety of health issues (Godfray et al, 2018). Reducing meat consumption to mitigate those health risks could be beneficial for public health, since although plant-based meat alternatives are similar to meat in terms of calories and fat content, they contain no cholesterol and are high in fiber (Ye and Mattila, 2021). Health focused consumers may be encouraged to shift some of their meat consumption to plant-based options because of these potential benefits. In Canada and many other jurisdictions, plant-based meat alternatives are subject to minimum protein content regulations – for example, a minimum protein rating of 40 for beef simulants in Canada (CFIA, 2020a) – and the current suite of plant-based products are comparable to beef in terms of their macro-nutrient content (Van Loo et al, 2020). So, health-motivated consumers in Canada can substitute from meat to plant-based alternatives knowing that the protein content is adequate, while avoiding unwanted cholesterol.

Consumer perceptions of health-related attributes in plant-based meat alternative products have been found to positively influence demand. Slade’s 2018 Canadian study reported health to be the second most important factor in general food purchasing decisions, though these values were not strong predictors of choice for plant-based meat alternatives. In their study of

consumer preferences for meat hybrid products, Profeta et al (2021b) found perceptions of healthiness to have the strongest impact on choice, roughly double the effects of environmental and animal welfare factors in magnitude. The authors note that this implies consumers may be more concerned about their own well-being than that of the environment. This concept of self-interest runs counter to the conclusions of Ye and Mattila (2021), who assert that consumers experience feelings of ambivalence when consuming meat and will thus obtain utility from making an environmentally or societally conscious choice. Further, Latvala et al (2012) found health to be the predominant reason for Finnish consumers to change their meat consumption habits.

Consumers are heterogeneous in their perceptions and attitudes for health-related product attributes of plant-based meat alternatives. In their latent class analysis of British consumers, Apostolidis and McLeay (2016) found 10.5% of consumers to be characterized as ‘healthy eaters,’ who were deterred by high fat content. This cluster was found to be the least price-sensitive of the six groups analyzed in the study, meaning these consumers may be willing to pay significantly more than others for food they perceive to be healthy. Possidonio et al (2021) observed a subset of 26.1% of Portuguese consumers to be characterized as health-oriented meat eaters that would consider plant-based meat alternatives. Meanwhile, Neff et al (2018) found fifty percent of American meat reducers to cite health-related reasons as an important factor in their consumption decisions, surpassed only by price. Further, higher income Americans were more likely to express the importance of health-related reasons for meat reduction. These findings are indicative of a motivated consumer segment with a high willingness-to-pay for healthy food.

However, debate persists as to whether health-attributes are a strong motivator for consumption of plant-based meat alternatives relative to physical and sustainability attributes. Many popular plant-based meat alternative products imitate processed meats such as burgers, sausages, and chicken nuggets, which may be perceived as unhealthy choices. Therefore, health-related messaging may not be particularly effective for these products (Ye and Mattila, 2021). Weinrich (2019) argues that although health-related arguments can be effective in the long-run adoption of plant-based meat alternatives, they typically are not decisive arguments in the initial decision stage, relative to the product's physical attributes. Plant-based meat alternatives are generally perceived to be healthier than the processed meat products they imitate, but not animal-derived muscle meat (Michel et al, 2021). However, plant-based analogues of muscle meat products remain largely uncompetitive on the market. Processed foods in general may be perceived as relatively unhealthy compared to more natural or wholesome foods, and this could be the case for plant-based meat alternatives as well, which undergo significant processing in their production.

Overall, the health-based purchase motivators for plant-based meat alternatives seem to be strong for certain subsets of consumers. Health attributes are multifaceted and can be expressed as additional nutritional benefit or a reduction in potentially harmful substances, and consumers may perceive these two dimensions differently. As noted by Weinrich (2019), health appeals are likely to be most effective in encouraging long-term adoption of plant-based meat alternatives, rather than one-off purchases, so effective messaging from firms will be crucial in reaching consumers that value the health attributes of plant-based meat alternatives.

2.4 Conclusions

The consumer demand literature pertaining to plant-based meat alternatives is characterized by ongoing debate as to how consumers value these products and their attributes, and which factors are most influential in the purchasing decision. Many uncertainties persist, providing ample space for continued research on this rapidly developing market. However, there are consistencies within the literature worth noting and are important to consider when engaging in research in this area. First, the market for plant-based meat alternatives is rapidly growing, spurred by product offerings that are increasingly similar to meat in both taste and texture, with a nutritional profile that facilitates direct substitution. What remains unclear is the degree to which these products will directly replace meat in the diets of omnivorous consumers. An emerging group of meat-reducing flexitarians provides market opportunity, but meat products remain a staple in Western diets. Further, there is evidence to suggest that plant-based meat alternatives are purchased as complements to meat products, rather than substitutes (Zhao et al, 2022).

Secondly, while product attributes pertaining to taste, sustainability, and health are all prominent motivators for demand, their relative importance in the consumer's purchase decision is uncertain. The physical attributes of plant-based meat alternatives still pose barriers to consumption, despite rapid product development. The valuation of these attributes is at least partially bound to several consumer-specific behavioural and attitudinal characteristics. This relationship fosters a significant degree of preference heterogeneity among consumers, both in their broad perceptions of plant-based meat alternatives and the valuation of certain attributes.

Finally, there is evidence that consumers perceive information heterogeneously, meaning that the ways in which firms and other stakeholders communicate about plant-based meat alternatives can have different demand effects for different consumer segments. This

phenomenon seems to be particularly important in the case of sustainability-related attributes but is likely influential for other attributes as well. An understanding of consumer demand and the market for plant-based meat alternatives provides a strong foundation for the investigation of labelling policy effects on demand for plant-based meat alternatives.

Chapter 3 Labelling Issues and the Plant-based Meat Alternative Policy Environment

3.1 Food Labelling and Consumer Demand: A Brief Overview

The labelling and communication efforts of agri-food firms can have profound effects on consumer demand for their products. Labels, affixed to product packaging, convey information to consumers at the point of purchase. Firms utilize labels to encourage purchasing, highlighting favourable product attributes in a salient format. Food labels and their effects on consumer demand have been widely assessed in the literature, though limited work has been performed in the context of plant-based meat alternatives. Apostolidis and McLeay (2016) used product labels to convey information about product attributes to consumers in their choice experiment. Edenbrandt and Lagerkvist (2021) assessed the efficacy of carbon emission traffic light labels in stimulating demand for plant-based meat alternatives, while Van Loo et al (2020) examined how brand labels impact choice of plant-based and cultured meat products. Asioli et al (2021) assessed naming effects in the case of in-vitro meat, finding that the terminology used to describe cultured meat products has a significant effect on demand. A review of the broader food labelling literature provides insight into the effects of labels on consumer demand and a foundation for the examination of labelling policy and issues in the context of plant-based meat alternatives. The following will analyze consumer response to label information, regulatory rationale in the case of plant-based meat alternatives, and describe the current labelling policy environment in Canada and abroad. Finally, research objectives to be assessed empirically based on this review are outlined.

3.1.1 Label Information, Prior Knowledge, and Consumer Response

Among the most prominent findings in the food labelling literature is the relationship between label information and prior knowledge of consumers, and the effect of this relationship on purchasing. Labels often used to communicate a product's adherence to certain standards that may be perceived as a positive attribute by consumers. Consumers' objective knowledge and subjective perceptions about products and standards can combine with label information to influence preferences (Drugova et al, 2020). Food product labels are inherently limited in terms of space, which necessitates consumers to incorporate their own knowledge and ideas into their valuation of the product attributes highlighted by label information (Prinsloo et al, 2012). Predictably then, consumers that are not knowledgeable or interested in certain product attributes will not be willing to pay a premium when the presence of those attributes are indicated on a label (Drugova et al, 2020). Therefore, labels do not encourage purchasing on their own, but are dependent on prior knowledge, opinions, and expectations of consumers to some extent in influencing preferences and decision-making. Consumer expectations and prior experience with a product and its quality attributes can form reference points, from which changes in utility are assessed (McFadden, 1999), and these reference point effects have been shown to influence choice (Hu et al, 2006).

The tone and perspective of consumer knowledge acquired prior to purchase can often shape consumer response to label information. The source of such knowledge, and trust therein, is relevant as well (Huffman, 2003). Biased information can also influence preferences, implying that misinformation can contribute to market outcomes by influencing consumer perceptions (Wilson and Lusk, 2020). Costanigro et al (2014) further affirm the relationship between labels, knowledge, and beliefs, finding that American consumers tend to reassess their beliefs about a

product after being provided with additional information. Despite the significant impacts of information and prior knowledge on food choice, these effects may wane in the long run. Using experimental auctions, Liaukonyte et al (2015) assessed how positive and negative information impacted agricultural biotechnology-related label perceptions and food choice in both the short and long run. They found that while negative information had a considerable impact on willingness-to-pay, the effects of that information did not persist in the long run. Meanwhile, positive information exposure had limited impact on willingness-to-pay immediately after provision but was not subject to the wear-out effects like the provision of negative information. In combination, these findings regarding the interactions between label information, consumer knowledge, and beliefs in affecting choice indicate a complex process in how consumers utilize label information in their purchasing decisions.

While information is valuable for consumers in agri-food markets, complex labels containing too much information can result in information overload, influencing purchase behaviour. Information is processed in combination (Larceneaux et al, 2012), meaning the presence of multiple label components can impact how consumers perceive and evaluate separate label components. Drugova et al (2020) examined American consumer response to multiple sustainability and health claims on the labels of wheat products. They found that adding redundant or overlapping labels to products often provides little-to-no additional benefit to the consumer. Further, some label combinations elicited a lower willingness-to-pay than each claim on its own. Gao and Schroeder (2009) also found willingness-to-pay estimates for beef products in the United States to change with additional attribute information included on labels, though the changes were dependent on the other labels present and the perceived relationships between product attributes. While these changes in willingness-to-pay are dependent on other attributes

included on the label, the relative ranking of the importance of the various beef attributes investigated remained constant.

Villas-Boas et al (2020) found that American consumers respond differently to nutrition label claims depending on how many are displayed on the package, indicating that increased complexity can alter purchase behaviour. Hu et al (2006) further observed this concept, finding that when there are many products on the market with a variety of labels, choice becomes more volatile due to the added complexity in the decision-making process – an issue that could be alleviated through strong labelling policy. Bonroy and Constantatos (2014) echo these sentiments, noting that message complexity and closely related labels are key sources of consumer misperceptions. While full provision of information is often thought to be beneficial, the effects of information overload may have unintended behavioural consequences, increasing the complexity of the purchase decision and potentially influencing the values consumers place on various product attributes.

3.1.2 Information Asymmetry, Firm Incentives, and Regulatory Rationale

The information provided by labels signals the presence of quality attributes to consumers, allowing for informed choice. Many of the attributes that drive demand for meat and plant-based alternatives, such as those pertaining to nutritional content, sustainability, and production processes, are not tangibly noticeable at the point of purchase or consumption. These attributes are known as credence attributes, and are often valued by consumers. The presence of credence attributes is often communicated to consumers through label claims. However, since the consumer cannot know for certain whether the attributes highlighted by label claims are present, they must trust that the label information is accurate. Credence attributes can create issues of information asymmetry, where one party in the transaction, typically the seller, has

access to more information about the exchange than the other. In the absence of oversight, information asymmetry can lead to consumer confusion, and in some cases, deceptive practices by firms. These issues posed by information asymmetry often necessitate government regulation of labelling and product standards to promote efficient market outcomes (McCluskey, 2000).

While the meatless nature of plant-based meat alternatives likely does not qualify as a credence attribute at this point in time due to subtle differences that persist between meat and plant-based alternatives, the simulant nature of these products poses similar issues to the case of credence attributes.¹ For example, an unlabelled package of plant-based ground beef may look indistinguishable from real ground beef. Therefore, consumers rely on label information provision to understand the nature of these products and make informed choices at the grocery store. The simulant nature of these products provides rationale for regulation and oversight of information provision to protect both consumers and firms.

Government regulation of information provision is a demand-led policy that can alleviate issues of information asymmetry, reduce search costs, and ensure more efficient market outcomes in the presence of credence attributes (Caswell and Mojduszka, 1996). Caswell and Mojduszka (1996) suggest mandatory information disclosure and controls on voluntary claims as policy tools to protect consumers from misperceptions and misinformation. These concepts have become widely adopted across jurisdictions to alleviate these issues. Under a control on voluntary claims labelling policy structure, there are incentives for firms to only communicate the presence of attributes that will be perceived as positive. However, the product must adhere to

¹ If consumers perceive a difference in taste between meat and plant-based meat alternatives, taste-related attributes could then be considered experience attributes – discernable at the point of consumption but not at the point of purchase. These attributes pose similar issues to credence attributes at the point of purchase, but consumers can self-verify these attributes at consumption. In the future, it is possible that taste attributes shift from experience to credence attributes as product development continues.

certain standards to utilize those label claims. Meanwhile, mandatory information disclosure labelling policies can force firms to disclose the presence of certain product attributes, some of which may be perceived as undesirable (Hu et al, 2005). The implementation of regulations for information disclosure will therefore be highly dependent on the goal of government and the nature of the market. If not carefully considered, the welfare effects of such policies have the potential to become problematic. For example, in the United States, front-of-package health claims are regulated but voluntary, and while full information about negative health attributes would benefit consumers, a strategic firm has no incentive to provide such information (Villas-Boas et al, 2020).

Mandatory information disclosure and regulated voluntary claims labelling policies have been found to produce different results in terms of purchasing behaviour due to the way consumers perceive the label information presented to them. For example, Hu et al (2005) found a loss in Canadian consumer welfare from the labelled presence of GMO ingredients² to be less than the welfare gain associated with a non-GMO attribute.³ This finding can be attributed to Prospect theory (Kahneman and Tversky, 1979), where consumers value gains and losses in utility differently (Hu et al, 2005). The consumer welfare outcomes of these two regulatory frameworks need to be considered when developing policy to regulate labelling and reduce information asymmetry.

The information-providing function of labels is often seen as beneficial to consumers, reducing issues arising from information asymmetry. However, some researchers posit that under certain circumstances, label information may not be welfare enhancing. When labels are present without sufficient monitoring and certification, incentives for firms to commit food fraud arise

² An outcome of mandatory information disclosure.

³ An outcome of control on voluntary claims.

(Caswell and Mojduzska, 1996; McCluskey, 2000), which could mitigate the benefits consumers receive from label information and quality standards. Monitoring and enforcement of adherence to labelling policy is key in ensuring such policy functions in a beneficial manner.

Beyond the issue of food fraud, Bonroy and Constantatos (2014) outline additional negative welfare effects that can arise from labels. They theorize that labels can differentiate goods into high- and low-quality markets, resulting in increased concentration in high quality markets, higher prices, new market inefficiencies, and a loss in consumer welfare. Villas-Boas et al (2020) also mention this possibility, stating that strategic firms in concentrated markets can take advantage of consumer preferences and substitution patterns for nutrition labels. With little incentive to deviate from voluntary label claims that maximize profit, firms will not disclose full information, reducing consumer welfare. Increased prices for high-quality goods could also increase prices for lower-quality goods, to the point that they could exceed expected prices of average quality in competitive equilibrium (Bonroy and Constantatos, 2014).

3.2 Policy Environment for the Labelling of Plant-Based Meat Alternatives

The labelling of plant-based meat alternatives has become regulated in many jurisdictions due to the issues mentioned in previous sections. Demand for these products is driven by credence attributes, particularly those pertaining to nutrition and environmental sustainability. Further, according to meat industry advocates, the simulant nature of plant-based meat alternatives could cause confusion among consumers if they are unable to differentiate the product from meat based on label information. To ensure market efficiency and reduce uncertainty, governments have taken steps to regulate several label aspects of plant-based meat alternatives. Despite these regulatory actions, the policy debate continues, particularly regarding the use of meat-related terms and framing on labels of plant-based meat alternatives. The effects

of these labelling policies and proposed changes are yet to be examined from the consumer's perspective, and the following overview of the policy environment sheds light on several issues worth investigating.

3.2.1 Canadian Labelling Regulations for Plant-Based Meat Alternatives

The Canadian Food Inspection Agency (CFIA) is the government body responsible for overseeing the labelling of plant-based meat alternatives. Several aspects of plant-based meat alternative composition and labelling are regulated by the CFIA, including the common name, protein content, nutritional requirements and labelling, and meat-free declarations (CFIA, 2021a).⁴ While Canada's composition and labelling regulations for plant-based meat alternatives are quite comprehensive, substantial policy debate in this area persists. The similarities between plant-based meat alternatives and the meat products they imitate have led meat industry advocates such as the Canadian Meat Council, Quebec Cattle Producers Federation and Canadian Cattlemen's Association to lobby for legislation restricting the use of meat-related terms on labels and in promotional efforts. In an article for CTV News, Slaughter (2019) reports that these meat industry groups consider the language used by plant-based meat alternative firms in labelling and promotion as misleading to consumers. Further, meat industry groups contend that products not containing animal protein should be prohibited from using meat-related terminology, as such products do not comply with the Canadian regulatory definition of meat.

At the end of 2020, the Canadian Food Inspection Agency launched a consultation to provide insight into potential changes for simulated meat labelling and composition guidelines (CFIA, 2020b). This consultation included stakeholders in the meat and plant-based industries, farmers, health experts and the public, among others. The goals of this consultation were

⁴ A full description of standards and labelling regulations can be found in CFIA, 2021a.

twofold: first, to ensure that the labelling policies for such products were clear, and second, to identify issues or challenges in distinguishing between meat and meat alternatives (CFIA, 2020c). The most consequential change from the consultation was to segregate meat simulants and “other products” such as tofu burgers, which are not considered direct substitutes for meat and poultry, into separate regulatory categories (Loney and Stucken, 2021).⁵

The consultation did not result in any sweeping changes to labelling or nutritional regulations. However, the CFIA has maintained a commitment to ensure clarity in the regulations for composition, labelling, and advertising of meat alternatives, indicative of a dynamic sector in the broader food policy debate in Canada. If issues persist, regulatory changes could be necessary to alleviate them.

3.2.1.1 Meat-Related Terms and Plant-Based Disclaimers

Among the most rigorously regulated aspects of plant-based meat alternative labelling policy is the use of meat-related terms and the common name for such products. Clear guidelines for these issues have been delineated by the CFIA to protect Canadian consumers from potentially misleading labels and deliver information about the composition and nature of plant-based meat products. According to the CFIA (2021a), the common name of plant-based meat alternative products in Canada must be immediately preceded by the term “simulated.” In addition to the common name, the disclaimer “Contains no meat/poultry” is required near the product’s common name. If these conditions are met, meat-related terms such as “burger” or “ground beef” are permissible on the labels of plant-based meat alternatives in Canada. This

⁵ The proposed guidelines classify three categories of food products with different requirements with respect to appearance, common name, composition, Contains no meat/poultry declarations, fortification, nutritional labelling, and advertisement. Category 1 is composed of meat and poultry products. Category 2 contains simulated meat and poultry products, inclusive of plant-based meat alternatives. Category 3 comprises other products which do not contain meat and do not attempt to imitate meat. Therefore, they are not subject to the same regulatory standards of Category 2 products. Comparisons of the regulations for each product category can be found in CFIA, 2020d.

allows firms in the plant-based meat industry to utilize such terms in appealing to aspects of taste and familiarity, implicitly or explicitly comparing their plant-based options to the meat products they imitate.

The CFIA has opted for a policy of mandatory information disclosure to mitigate issues of information asymmetry in the plant-based meat alternative market, one of the two regulatory strategies highlighted by Caswell and Mojdzuska (1996). In theory, the clear disclosure of the meatless nature of plant-based meat alternatives allows consumers to make informed choices when purchasing meat and meat alternatives. Firms in the plant-based meat market will naturally attempt to communicate the similarities between their products and meat by using meat-related terminology on labels and in advertisements to stimulate demand among omnivorous consumers. So, although plant-based firms are permitted to liken their products to meat by using terms such as “burger” and “sausage,” mandatory plant-based disclaimers on product packaging ensure that consumers have the necessary information to avoid mistakenly buying plant-based products, while maintaining the firm’s ability to market their products as direct meat substitutes. Information disclosure policies can serve as a ‘happy medium’ between unregulated labelling and outright banning terms that function as important product descriptors. Though referring to genetically modified foods, Carlsson et al (2007) note that issues regarding food products can be internalized through regulated labelling, rather than outright bans, and Canada’s plant-based meat alternative regulations reflect this idea.

As noted previously, many meat industry supporters have advocated for limiting the use of meat-related terms in the plant-based meat alternative market, to protect both consumers and their own brand equity. However, according to the CFIA (2021c) consultation report, most Canadian consumers (79%) indicated that they can conclude whether a product is plant-based

with ease. Additionally, the consultation found 66% of respondents to support the use of meat-related terms by plant-based firms in their labelling strategies. Further, 62% of respondents found the Canadian government regulations to be clear and understandable. The majority of Canadians are mostly satisfied with the CFIA regulations that differentiate meat from plant-based alternatives, though the degree to which their preferences for plant-based meat alternatives are affected by these policies is unclear.

3.2.1.2 Protein Content, Claims, and Nutritional Requirements

The second regulated aspect of plant-based meat alternative labelling in Canada pertains to protein and nutritional content, and associated claims. According to the CFIA (2021a), plant-based meat alternatives are required to be fortified with a number of vitamins and minerals, the contents of which must be declared on the product's nutrition facts panel. In addition, simulated meat products must adhere to minimum protein standards. For example, a plant-based product imitating beef requires a protein rating of at least 40 (CFIA, 2020a). This level of protein content qualifies plant-based meat alternatives for “an excellent source of protein” front-of-package label (CFIA, 2021c). Further, if a product contains all essential amino acids while qualifying for a “source of protein” – a minimum protein rating of 20 – it qualifies for “a complete source of protein” label claim (CFIA, 2021c). Plant-based protein products tend to contain all nine essential amino acids (De Marchi et al, 2021), thus qualifying many of them for this claim. These product standards are in place to ensure that consumers obtain ample protein intake when substituting the meat in their diet with plant-based options. The Canadian policy governing protein and health claims is an example of a control on voluntary claims, described by Caswell and Mojduzka (1996) as an effective form of government mandated information disclosure.

Nutrition-related product attributes can be considered credence attributes, since consumers cannot gauge how healthy a product is at the point of purchase or consumption. This provides rationale for rigorous government regulation of nutrition standards and associated labels, ensuring that consumers have ample access to nutritional information and facilitating healthy food choices. Nutrition facts panels are mandatory for nearly all packaged food products in Canada, and voluntary front-of-package health claims are also closely regulated. Strong regulation of these label aspects is relevant for plant-based meat alternatives given the importance health-related purchase motivators for many consumers (Apostolidis and McLeay, 2016; Possidonio et al, 2021). While health attributes are clearly a purchase motivator for plant-based meat alternatives, the relative importance of these attributes, and the impacts that labelled health claims can have on consumer preferences for plant-based meat alternatives remains unclear.

In other contexts, consumer response to nutrition labels has been found to be substantial. Gregori et al (2014) found that 71.8% of European consumers regularly read nutrition information when purchasing food. Consumers that self-identify as health-focused pay additional attention to nutrition labels (Van Herpen and Van Trijp, 2011). However, detailed nutrition fact panel information and simpler front-of-package claims can elicit different responses from consumers. While a comprehensive nutrition panel contains more information than a simple front-of-package health claim, many consumers may be limited by time or cognition, reducing the usefulness of this information. To account for this, front-of-package nutrition claims can highlight key attributes that consumers may be particularly interested in. These claims can pertain to the presence (an excellent source of protein, for example) or absence (low in saturated fat) of nutritional attributes, and both can provide utility to consumers depending on the context.

Consumers tend to value nutrition facts panels positively, but they are not as influential in stimulating healthy purchasing as simpler alternatives like traffic light labels and logos (Van Herpen and Van Trijp, 2011). Villas-Boas et al (2020) concur, finding that consumers tend to exhibit stronger comprehension front-of-package labels than nutrition facts panels.

Front-of-package nutrition labels not only have an information-providing function, but can also serve as promotional material, catching the consumer's eye when perusing grocery store shelves. Labels may be designed persuade rather than inform, so while they offer genuine product information, the methods in which they are employed could potentially mislead consumers (Costanigro et al, 2014). Costanigro et al (2014) emphasize further that broader front-of-package nutrition labels tend to be understood in more subjective terms than back-label nutrition tables, highlighting the impact that consumer beliefs can have on label interpretation. These subjective consumer interpretations of labels can influence the formation of preferences. For example, Drugova et al (2020) found that the inclusion of health-related label claims to organic products surprisingly elicited reduced willingness-to-pay for the products in some circumstances, implying that consumers may be obtaining health-related utility from the organic product attribute, which pertains to production practices rather than nutrition. Therefore, the effectiveness of health-related labels in generating demand can be hampered by consumer misperceptions and unfamiliarity with product standards and associated labels.

While health-related attributes are generally considered as positive factors of demand for food products, nutrition labels can reduce willingness-to-pay for certain types of products. Several studies have found reduced, or even negative willingness-to-pay values for certain health attributes when affixed to the labels of indulgent or hedonic products (Berning et al, 2010; Drugova et al, 2020; Villas-Boas et al, 2020). Whether this phenomenon could apply to plant-

based meat alternatives seems dependent on how consumers perceive such products. For example, if a consumer views a plant-based burger as a direct substitute for a relatively unhealthy food choice, they may not respond to a health claim label, as they intended to make an unhealthy choice regardless. Conversely, a significant subset of consumers may consider plant-based meat alternatives as a healthier option than meat due to favourable attributes such as lower levels of cholesterol, and those motivated by health may respond favourably to a nutrition claim. The plant-based meat alternative literature is often in disagreement regarding the importance of health-related attributes in driving consumption of such products, and it is anticipated that health perceptions may be dependent on the product the meat alternative imitates – a burger versus ground meat, for example. The effect of this trend on plant-based meat alternatives will be dependent upon whether consumers view plant-based meat alternatives as indulgent or staple products.

Nutrition and associated label components represent an important aspect of plant-based meat alternative regulations in Canada. Despite the oft-mentioned importance of nutrition standards and claims in consumer choice, the value consumers place on these nutritional standards and associated labels in the context of plant-based meat alternatives is yet to be assessed in the literature, outside of Apostolidis and McLeay (2016). A robust assessment of the impact protein claims can have on consumer preferences for plant-based meat alternatives remains elusive, but it is anticipated that clear standards and labels for protein content will have a positive effect on consumer demand for both meat and plant-based meat alternatives.

3.2.2 Issues Abroad – Bans and Permissible Language

Outside of the Canadian market, the issues surrounding meat-related terms have translated into actionable policy proposals in many jurisdictions. Meat industry advocates in the

United States and Europe have expressed similar sentiments to such groups in Canada, claiming that labels and advertisements that make use of meat-related terms are misleading to consumers. However, regulatory action in response to these lobbying efforts has gone a step further than in Canada, with policy proposals that would ban plant-based meat firms from using meat-related terms brought to legislative votes in the European Union and several American state-level jurisdictions. Though these policy proposals have mostly either been rejected or amended to avoid full-scale bans in most cases, an examination of the potential effects of such policy on consumer preferences and welfare is highly relevant and could help inform future regulatory discussions.

In the United States, the regulatory discussion concerning the labelling of plant-based meat alternatives has produced some controversial legislation, resulting in subsequent pushback from plant-based meat alternative stakeholders, at both state and federal levels. In 2018, the United States Cattlemen's Association filed a petition with the United States Department of Agriculture (USDA) over the use of terms relating to "beef" and "meat" on the labels of plant-based meat alternatives (USCA, 2018). Since then, several states began banning the use of such language by plant-based meat alternative firms in labelling and marketing efforts (Van Loo et al, 2020). For example, the state legislatures of Mississippi and Arkansas passed bills prohibiting the use of any labelling language likening plant-based meat alternatives to meat (Silverman, 2020). In other states, newly legislated plant-based labelling policy is less restrictive; in Oklahoma, plant-based meat firms must include a disclaimer noting the meat-free nature of their product that is the same size as the product's name (Watson, 2020). At the federal level, the REAL Meat Act was introduced in 2019, which would require plant-based meat products to include the term "imitation" immediately preceding or following the product name on the label

(REAL Meat Act, 2019), though this piece of legislation has not yet been voted on. Similar legislation was also introduced, though voted down, in the European Union, allowing meat-related terms to remain on plant-based meat alternative labels (Berger, 2020; Epp, 2020). However, in France, a full-scale ban on meat-related terms was implemented in 2018, to mitigate “false claims” on labels (BBC, 2018).

In response to these policies, particularly in the United States, plant-based meat alternative firms have launched defensive legal actions, claiming that such legislation restricts their First Amendment Rights (Silverman, 2020). These legal challenges were successful in Mississippi and Arkansas, resulting in amendments that make such terms permissible if labels also indicate that the product contains no meat (Silverman, 2020). In Arkansas, these disclaimers are permitted to be rather subtle, unlike in Oklahoma, where legal challenges by plant-based meat advocates failed, maintaining the mandate of large plant-based modifiers on product packaging (Molen, 2021). A vehement defence against such legislation likely implies that plant-based meat alternative firms believe that the inability to use meat-related language on packaging will negatively impact demand for their products, especially among traditional meat-eating consumers. The patchwork of legislation across state-level jurisdictions poses costly issues for plant-based meat companies in ensuring correct labelling is present for each individual market they are involved in (Ikigai Law, 2021). Additionally, the consumer demand effects of a ban on meat-related terms in the plant-based market are unknown and need to be considered in the broader policy debate.

3.2.3 Implications and Research Propositions

It is anticipated that regulatory changes to plant-based meat alternative labelling and composition will elicit differing responses from consumers. Product framing has been found to

influence consumer attitudes for in-vitro meat products (Bryant and Barnett, 2019). More tangibly, label terminology significantly impacts willingness-to-pay for cultured meat products (Asioli et al, 2021), and it is anticipated that similar effects will occur for plant-based meat alternatives. Changes to permissible label language regarding meat-related terms could have profound effects on the preferences of taste-driven, omnivorous consumers, as firms would be barred from using comparisons to meat in their promotional activities. This segment of consumers are primarily meat-eaters (Apostolidis and McLeay, 2016; Possidonio et al, 2021) and may be more willing to purchase plant-based meat alternatives if they believe that these products closely resemble meat. Despite these anticipated consumer demand effects, to my knowledge, no work has assessed the differences in consumer preferences for plant-based meat alternatives under various labelling policy frameworks. Given the prominent policy debate on the topic, an assessment of consumer preferences for plant-based meat alternatives under different regulatory structures would add valuable insight to the policy debate and growing body of literature regarding consumer demand for plant-based meat alternatives.

Legislation that dictates the use of meat-related terms on the labels of plant-based meat alternatives is generally based upon conflicting evidence. Meat industry advocates argue that consumers are misled by the labels on plant-based meat alternative products, thus providing rationale for legislation that would ban meat-related terms on meat-free products. The National Cattlemen’s Beef Association reports that less than half of American consumers understand that plant-based meat alternatives are meat-free (NCBA, 2020). Further, Van Loo et al (2020) found that most American consumers are opposed to the term “beef” on the labels of plant-based meat alternatives. Conversely, 79% of Canadian respondents to the recent CFIA consultation reported no issues in differentiating plant-based products from real meat (CFIA, 2021c). These results are

supported empirically by Gleckel (2020), who found that American consumers are not confused by meat-related terms on the labels of plant-based meat alternatives. These conflicting findings indicate the importance of gaining a stronger understanding of consumer preferences for meat-related labelling of meat substitutes, to provide more concrete insight to legislators and stakeholders.

Ultimately, an analysis of plant-based meat alternative policy, both in Canada and abroad, raises two important questions that provide avenues for future research. First, despite dynamic policy discussions regarding the use of meat-related terms, the consumer demand effects of various policy proposals remain unknown. Investigating consumer preferences for plant-based meat alternatives under different regulatory frameworks could add needed context to the discussion of whether consumers are being misled by plant-based firms' use of meat-related terms on labels, an issue that remains inconclusive. If preferences do not differ between regulatory environments, then the idea that consumers are misled is likely a non-issue, providing insight to regulators and industry groups. The methods in which plant-based meat firms are permitted to communicate product information is inherently dependent on the regulatory environment of the markets they participate in. Information framing can alter consumer perceptions of the products they buy (McFadden, 1999), so an assessment of permissible information language and framing under various policy frameworks is relevant as regulations continue to evolve.

The second important question raised by this policy overview is the value that consumers place in regulated nutrition content and claims for plant-based meat alternatives. In Canada, the nutritional content of plant-based meat alternatives is regulated. These nutritional content regulations hold plant-based meat firms to high standards, ensuring that consumers who choose

plant-based meat alternatives instead of meat obtain similar nutritional benefits, and mitigating the risk of food fraud. While health related attributes have been established as a driver of demand for plant-based meat alternatives, the consumer response to regulated nutritional label claims is yet to be assessed. The degree to which consumers differentiate between “excellent” or “complete” sources of protein – regulated health claims in Canada – is unknown in the context of plant-based meat alternatives, and findings on the topic could be valuable information for both regulators and industry.

The review of plant-based meat alternative labelling policy, and associated research gaps, provide rationale for the following research propositions, and inform the experimental design and conceptual framework of this thesis:

- How do meat-related terms and framing, permissible under different regulatory structures, impact consumer choice and preferences for plant-based meat alternatives?
 - In extension, are consumers misled by meat-related terms on labels in an unregulated market? Is there rationale for implementing bans of such labels?
- How do consumers value protein content, quality, and associated claims for plant-based meat alternatives?
 - Do consumers differentiate between protein content and protein quality claims?⁶
 - How might preferences for these health-related claims compare with those pertaining other drivers of demand for plant-based meat alternatives, such as environmental sustainability?

⁶ The importance of this research objective was established further by industry representatives at the 2021 Pea Protein Omics Determination (PPOD) project annual meeting, of which this research is part of. In particular, there was significant interest as to whether consumers value the amino acid profile in the case of plant-based meat alternatives, and how those preferences compare to protein content in general.

- Does significant heterogeneity exist amongst consumers with respect to preferences for meat-related terms and protein claims?
 - Which consumer characteristics drive preference heterogeneity?

Chapter 4 Survey Design and Estimation Methods

4.1 Introduction

The preceding review of consumer demand and food labelling literature provides both rationale for an examination of consumer preferences for plant-based meat alternatives under different labelling policies, and a foundation to build the methodological framework for this research. The literature indicates a complex relationship between the consumer, their perceptions of food labels, and their purchasing decisions. Labels that convey favourably perceived information will likely elicit a positive demand response for those products. However, provision of objective information on food labels may not always be perceived as intended by consumers, introducing the possibility for labels that confuse or mislead consumers, intentionally or unintentionally. Regulated labelling can reduce the possibility of misled consumers but may also restrict the firm's ability to effectively communicate information about their product. The market for plant-based meat alternatives serves as a prime example to examine how different labelling policies can influence consumer perceptions, and ultimately, demand for such products.

This chapter outlines the methodology used to assess the research objectives proposed in Chapter 3 and is organized as follows. First, the rationale for the selected methods of analysis is outlined. Then the DCE consumer survey is described, followed by an overview of the econometric models employed in eliciting preferences and willingness-to-pay estimates for the products and attributes in question.

4.2 Rationale for Selection of Methods

According to economic theory, consumers make decisions that maximize their utility, subject to a budget constraint dictated by income and prices. Utilizing their budget, the utility-maximizing consumer may purchase a bundle of goods, inclusive of meat and plant-based meat

alternatives. These goods will contain various attributes and features which will be valued differently among consumers. Thus, the utility derived from consuming a product in the bundle purchased by the consumer can be expressed as a function of the product's attributes (Lancaster, 1966). McFadden (1974) notes that beyond the alternatives in the choice set, choice behaviour is also described by the observed characteristics of the decision-maker and the distribution of behavioural patterns in the population. So, the purchase decision which maximizes utility can be described as a function of the products, attributes and prices in the choice set, the consumer's budget, relevant consumer-specific characteristics, and other factors that may be observable or unobservable.

Random utility theory (McFadden, 1974) is commonly utilized to empirically analyze consumer preferences. Random utility theory proposes that the determinants of consumer choice can be partitioned into observable and unobservable preferences. Using the terminology of Train (2002): consumer n faces J alternatives in making a choice among products, where U_{nj} is the utility the consumer gains from alternative j . The consumer makes their choice such that U_{nj} is maximized. In modelling this decision, the researcher is only able to observe certain attributes of both the products in the choice set and the decision-maker, while the remaining determinants of the consumer's utility are stochastic (McFadden, 1974). Again, drawing on Train (2002), the consumer's utility can be expressed as:

$$U_{nj} = V_{nj} + \varepsilon_{nj} \quad (4.1)$$

Where V_{nj} is a function of observable, non-stochastic determinants of the consumer's utility while ε_{nj} represents the stochastic aspects of utility not captured in V_{nj} .

The first step in modelling consumer preferences under this framework is to collect data to estimate the observable determinants of utility V_{nj} . Numerous methodologies have been

utilized for this purpose, each with their own advantages and drawbacks. Revealed preference methods capture consumer choices in real situations, using data sources such as grocery store scanner data. This data is reflective of real choices, but is limited in the sense that only existing purchasing scenarios can be assessed in this way, inhibiting the contexts in which it can be utilized (Train, 2002). Additionally, revealed preference methodology may be unable to extract consumer-specific data that can often improve the modelling of decision-making. Other revealed preference methods such as experimental auctions can allow for some of these drawbacks to be overcome, but are often costly, and given the risks associated with in-person experiments stemming from the COVID-19 pandemic, were not considered for this research.

Meanwhile, stated preference data is typically collected using surveys, utilizing hypothetical purchasing scenarios to capture consumer choices. Stated preference methods trade choice consequentiality for more flexible experimental design in terms of the varying attributes and prices within the choice set specified by the researcher, and allows for the assessment of preferences in novel or non-existent purchase scenarios (Train, 2002). Additionally, stated preference surveys allow the researcher to collect consumer-specific data which can be used to explain choices and preference heterogeneity. Despite their strengths, choice modelling methods that are not economically consequential are subject to issues of hypothetical bias. People may not always do in reality what they say they will in a hypothetical setting, and this gap between intention and reality can result in biased estimates if not addressed (Train, 2002). The researcher must be careful in designing the preference elicitation mechanism to mitigate hypothetical bias and ensure participants make choices as realistically as possible. While the weaknesses of stated preference methods are acknowledged, the novel nature of the plant-based meat alternative market and expectations that consumer-specific characteristics will have a significant impact on

preferences imply that stated preference methods are appropriate for research in this area.

Revealed preference research could provide an interesting complement in the future as data becomes available.

Ultimately, a survey containing a discrete choice experiment was selected as the method of data collection. In the discrete choice experiment, respondents are assigned to one of three labelling policy treatments – an unregulated policy environment, the current Canadian regulations, and a meat-related terms ban. Then, respondents are asked to choose between meat and plant-based alternatives, with varying attributes and prices, in hypothetical purchasing scenarios that mimic what one might find in the grocery store. In addition to addressing the role labelling policy may have on preferences and willingness-to-pay for plant-based meat alternatives, the survey captures preferences for regulated protein claims, and collects socio-demographic, attitudinal, and behavioural data to evaluate preference heterogeneity among consumers. A detailed explanation of the choice experiment and other survey components is provided in the following sections.

4.3 Survey Administration

An online survey was chosen to collect the data for the empirical analysis for several reasons. First, the internet is widely accessible in Canada. According to Statistics Canada (2021), most Canadians (94%) have access to the internet. This broad reach, along with ease of data compilation and other considerations, made online survey delivery an obvious choice when compared with other options such as telephone or mail.

The target population for this analysis was English-speaking, Canadian grocery shoppers. Those who do not regularly shop for groceries were not considered, as accounting for the decisions of non-grocery shoppers in the choice experiment impact the implications of this

research, given that they are not making decisions in real grocery shopping scenarios. The survey was only administered in English. Further, a sample as representative as possible to the Canadian population was desired. To achieve these goals, survey respondents were shown a series of screening and quota questions. First, respondents were asked whether they are the primary grocery shopper in their household. If they did not identify as the primary shopper or sharing in the responsibilities, their survey was terminated. Next, two representative quotas were enforced: age and province of residence. These quotas were established to ensure a demographically representative sample in those respects and prevent over- and under-sampling of certain regions and age groups. While imposing additional quotas for other socio-demographic indicators would provide further assurance of proper sample representation, they were not considered due to timeline constraints. Additional quotas can result in a prolonged wait time for the dataset since the duration of the survey's availability to the public extends as long as it takes to fill the researcher's desired quotas. 2016 Canadian Census data was used to develop the desired quotas for each age category and province, as 2021 Census data was not available at the time of survey distribution. A comparison of sample characteristics with 2021 Canadian Census data can be found in Table 5.1.

The survey was developed through several iterations to ensure that the questions asked of respondents were comprehensible and relevant to the research. The survey was pre-tested informally to collect feedback on timing, clarity, and cognitive difficulty. A full pre-test on a random online sample was not feasible for this research. Several constraints limited the ability to comprehensively pre-test the survey, including time constraints with the graphic design of the label images, time constraints with the survey coders and administrators, and additional costs associated with pre-testing on a desirable sample.

Upon receiving behavioural ethics approval,¹ the survey was released to the public on February 18th, 2022, and remained open to respondents until March 11th, 2022, when desired age and province-of-residence quotas were filled. Each respondent was assigned an individual identification number to ensure respondent anonymity. In total, 1203 Canadian grocery shoppers completed the survey, and all results presented in this chapter will include this sample unless noted otherwise. The survey was programmed by the Canadian Hub for Applied and Social Research (CHASR), hosted online by Voxco, and distributed to respondents via Asking Canadians online research service.

4.4 Survey Design

The survey contains four sections, each of which facilitates collection of key data to be used in the empirical analysis or provide insight into consumer perceptions and consumption habits of plant-based meat alternatives. The survey can be found in Appendix 1. The following subsections will outline each section, addressing the survey design, and providing rationale for inclusion and anticipated uses of the data in the empirical analysis.

4.4.1 Attribute Selection and Choice Set Development

The preference elicitation mechanism utilized in this research is a discrete choice experiment (DCE). In a DCE, survey respondents view a series of purchasing scenarios with products that vary in attributes and prices, and are asked to choose the alternative they most prefer. The data from these iterative choices is used to estimate marginal utilities for price and the selected product attributes.

¹ The survey received University of Saskatchewan Behavioural Ethics Approval on January 13th, 2022, BEH ID#3129

Ground beef, and equivalent plant-based analogues, was chosen as the product for this study. This selection follows the rationale of Adalja et al (2015), who used ground beef to assess consumer preferences for local products, in part due to the limited attributes of this generic, staple product, allowing for a focus on the attributes of interest. While the majority of DCEs investigating plant-based meat alternatives use burgers as the product,² ground beef is a comparatively staple and versatile product, and contextually different from hedonic goods like burgers (Berning et al, 2010; Drugova et al, 2020; Villas-Boas et al, 2020). Therefore, using ground beef in the DCE allows for a more straightforward examination of preferences for policy effects and health-related attributes in plant-based meat alternatives. Each choice set contains a real ground beef product, alongside two plant-based alternatives – one composed of pea protein and one soy-based product – and a no purchase option. The protein source attributes are similar to those chosen by Van Loo et al (2020) and represent the most common sources of protein in plant-based meat alternatives. Beef thus serves as a point from which preferences for pea- and soy-based alternatives can be compared. Further, these product options represent a realistic purchasing scenario encompassing the common products on the market, simulating the product mix available to consumers at most Canadian grocery stores.

Table 4.1: Choice experiment attributes and levels

Attribute	Level
Product Source ³	Beef, Pea-based, Soy-based
Protein Claim	None, An Excellent Source of Protein, A Complete Source of Protein
Sustainability Claim	None, Certified Carbon Neutral
Price	\$5.00, \$6.50, \$8.00, \$9.50, \$11.00, \$12.50

² Apostolidis and McLeay (2016) also utilize ground beef and ground beef alternatives in their choice experiment.

³ Because each choice set contains one product with each protein source attribute (one beef, one pea, and one soy per choice set), these attributes can also be considered as alternatives, along with the no purchase option.

The product attributes and levels for the DCE can be found in Table 4.1. The two non-monetary attributes beyond those pertaining to the product's protein source relate to sustainability- and health-related preferences, both of which have been found to be key drivers of demand for meat alternatives. These attributes can be defined as credence attributes, which are not easily discernable by consumers at the point of purchase or consumption. Firms will attempt to communicate these product attributes to consumers using label claims, in order to transform them into search attributes. The firm is motivated to express these attributes in a way that consumers can easily identify them and in turn, be more likely to purchase those products than they would in the absence of information provision. Therefore, in the choice experiment, the presence (or lack thereof) of these attributes is communicated to respondents through claims on the product label images.

Health and sustainability credence attributes are often based on objective standards and are subject to monitoring to ensure quality. Taste, the other key attribute which influences demand for meat alternatives, is perceived subjectively. Preferences for taste are formed by the perceptions of the individual consumer at the point of consumption. Due to these differences in the ability of firms to credibly communicate the presence of their products' attributes, a taste-related attribute was not feasible, and therefore not included in the choice experiment. It is anticipated that a considerable portion of consumers' taste-based preferences will be associated with the protein source attributes.

The health attributes in the DCE are communicated to respondents using qualitative protein content and quality claims regulated by the CFIA (CFIA, 2021b). Since plant-based meat alternatives generally replace meat protein in a meal, it is anticipated that protein attributes will

be important for consumers that choose plant-based options. Firms in the plant-based meat industry typically promote protein attributes on their product labels, although protein content tends to be displayed quantitatively by weight in grams, rather than utilizing the claims regulated by the Canadian government.⁴ Figure 4.1 provides an example of how protein attributes are often communicated on the labels of plant-based meat alternatives, where the protein claim is prominently displayed in grams per serving.

Figure 4.1: Beyond Meat plant-based ground beef product.



Beyond Meat, 2022.

Findings from the labelling literature indicate that simple, qualitative health claims are more salient to consumers than quantitative nutrition facts panel information (Villas-Boas et al, 2020). Further, consumer response to standardized nutrition labels is often based on subjective beliefs and interpretations of the information, resulting heterogeneous preferences for health label claims (Costanigro et al, 2014). An assessment of how consumers value the qualitative

⁴ The Canadian government regulates protein label claims. To recap, “An Excellent Source of Protein” describes a product with a protein rating of at least 40. “A Complete Source of Protein” describes a product with a protein rating of at least 20, containing a full suite of essential amino acids.

health claims listed in Table 4.1 will provide key insight for future product development and marketing.

The selected claims, “A Complete Source of Protein” and “An Excellent Source of Protein,” do not appear simultaneously on the labels in the choice experiment. Although products that carry one claim may also meet criteria for the other, it does not appear to be common to include both claims on the same label. Additionally, the claims remain separated to mitigate respondent confusion. These protein content and quality claims were explained to respondents prior to the choice experiment.

The role of the sustainability attribute in the DCE is to capture sustainability-related preferences for plant-based meat alternatives, while serving as a point of comparison for protein claim preferences. Much consideration was given to this attribute so it could be applied to all products in the choice set. For example, the inclusion of the soy-composed alternative excludes the feasibility of an organic sustainability attribute, since soybeans tend to be genetically modified and therefore conflict with organic standards.⁵

Ultimately, a carbon-neutral attribute was selected for this experiment. Carbon-neutral means that carbon emissions from production are matched or exceeded by carbon sequestration and green energy use. Plant-based meat alternative brands such as Lightlife (2020) promote themselves as carbon neutral, suggesting that the claim is feasible in the plant-based meat alternative industry. While the conventional beef industry is much-maligned for its greenhouse gas emissions, evidence has emerged that grass-finished cattle in multi-paddock grazing systems can reduce emissions and increase carbon sequestration to beyond the point of carbon-neutrality (Stanley et al, 2018). In addition, the Australian red meat industry has set a target to be carbon-

⁵ Less than 1% of soybeans are produced organically in the United States (Economic Research Service, 2021).

neutral by 2030, indicating that widespread adoption of carbon-neutral production practices may be commonplace in the near future (Meat and Livestock Australia, 2021). Stated preference methods are advantageous in that they allow the researcher to assess preferences for new or soon-to-be-existent product attributes, and the carbon-neutral attribute is therefore fitting for these circumstances. In other contexts, willingness-to-pay premiums for a carbon-neutral attribute were estimated to be 28% for eggs and 23% for olive oil (Drichoutis et al, 2016).

Finally, the scale for the price attribute was determined based on actual per half-kilogram market prices for ground beef and plant-based alternatives in Canada (Statistics Canada, 2022b), reflective of the strategy taken by Van Loo et al (2020). The chosen price range encompasses the low-to-high end of Canadian ground beef prices, and the lower range of plant-based ground meat prices. The scale begins at \$5.00, increasing to \$12.50 by increments of \$1.50 for six levels. Plant-based meat alternatives are currently more expensive than the meat products they imitate, but this difference is expected to shrink in the coming years (Sozzi, 2020).⁶ Therefore, using a similar price scale for both is appropriate, but an important assumption to note. Same-price scaling was also used for meat and plant-based alternatives in previous research (Apostolidis and McLeay, 2016; Slade, 2018; Van Loo et al, 2020).

4.4.2 Labelling Treatments

To investigate the impacts of labelling policy on consumer preferences for plant-based meat alternatives, labelling treatments were used in the DCE. Upon beginning the survey, each respondent was randomly assigned to one of three treatments corresponding to a different labelling policy framework. Information regarding the product names, which varied between treatments, and attributes were presented as images of product labels similar to those found in

⁶ Per interview with Beyond Meat CEO Ethan Brown.

Canadian grocery stores.⁷ The use of meat-related terms and disclaimers on the label images viewed by respondents varied across the three treatments: an unregulated labelling treatment, a current Canadian labelling regulations treatment, and a meat-related terms ban treatment. The label images were created with the help of a local graphic designer.

To recap the theory underlying the labelling policy treatment design, the consumer obtains a non-trivial amount of purchase-influencing information regarding product attributes from the information displayed on the label. One can therefore infer that different information on the label of the same product will elicit different preferences from consumers. If the information on the label is presented in a way that is perceived favourably, the consumer will exhibit a higher likelihood of selecting that product, while information that is presented in a less appealing manner will have the opposite effect. It is anticipated that label information for plant-based meat alternatives in an unregulated market will be perceived relatively favourably by most consumers, as the product labels liken the plant-based product to meat without restriction. Meanwhile, plant-based meat alternatives are likely to be less appealing under a meat-related terms ban, as firms are forced to describe their products with terms unfamiliar to consumers. Finally, if there is no significant difference in preferences between the labelling treatments, consumers may not care about the labels on plant-based meat alternatives, trivializing the ongoing policy debate. The ground beef alternative product labels remain constant throughout the choice experiment as these products would be unaffected by labelling policy for plant-based meat alternatives. The following sections outline each labelling treatment in more detail.

⁷ See Figures 4.3-4.5 for choice set examples.

4.4.2.1 Treatment 1: Unregulated Labels

Most markets where plant-based meat alternatives are sold exhibit some degree of regulations dictating acceptable language on product labels, so some conjecture regarding firm incentives was required to develop these labels for the DCE. The legal pushback from plant-based meat advocates against certain labelling legislation lends further insight into how firms would market their products in the absence of regulation. A particularly valuable example is the legal proceedings in the state of Oklahoma. In late 2020, legislation was introduced that would require plant-based meat alternative firms to include a label disclaimer describing the meat-free nature of the product that is at least as prominent in size as the product's name, while still permitting the use of meat-related terms (Watson, 2020).⁸ This law was challenged by Upton's Naturals and the Plant Based Foods Association, but was upheld (Molen, 2021). In terms of the ramifications for plant-based meat firms, this implies that even though meat-related terms were still permitted on labels, the large disclaimers required by the Oklahoma legislation were perceived as a threat requiring legal a response. So, it is realistic to assume that in an unregulated market, plant-based meat alternative firms will prominently display their product's name containing the meat-related term on the packaging, along with other favourable claims, and try to avoid large disclaimers revealing the plant-based nature of the product, making their product seem more familiar and appealing to the average omnivorous consumer.

Conversely, these firms will not intentionally deceive consumers and market their product as a meat product, as deceived consumers could generate ill will towards the firm. Further, this would alienate vegetarian and vegan consumers, an important subset of the market for plant-based meat alternatives in Canada (Slade, 2018). The plant-based nature of the product

⁸ This legislative outcome is similar to the current situation in Canada.

may also be perceived favourably by omnivores motivated by certain sustainability-and health-related attributes.

Given these market incentives, it is reasonable to assume that in an unregulated market, plant-based meat alternative firms will prominently feature the product's name, including a meat comparison, for their products to appeal to omnivorous consumers. They will also include a subtle plant-based indicator to inform consumers about the nature of the product without detracting from the promotional effect of the label. While not intentionally deceptive, this label clearly functions to attract omnivorous consumers before conveying information about the product's composition, which could mislead some consumers, lending credence to the arguments of some meat-industry advocates. This label could be considered a "worst-case scenario" for proponents of a meat-related terms ban. Therefore, this label serves to capture an opposite side of the labelling restrictions spectrum from a meat-related terms ban. In the choice experiment, these labels are designed in such a way that "Ground Beef" is prominently presented along with protein/sustainability claims, while "made with pea/soy protein" is presented in smaller font underneath.⁹ While the ground beef option is expected to remain the dominant choice, it is anticipated that preferences for the plant-based options in this treatment will exceed that of the other two treatments, as consumers will find the language on these labels more familiar. An example can be found in Figure 4.2, where product framing is consistent with treatment one and attributes vary across products.

⁹ A noticeable difference between labels in the unregulated treatment and the other two policy frameworks is the position of the protein source attribute, which is near the bottom of the label, rather than positioned underneath the product's name. This slight difference was intentional from a design standpoint. While regulations in Canada force firms to include the plant-based disclaimers immediately adjacent to the product name (CFIA, 2021a), firms in an unregulated market would have no obligation to do so. Given the assumption that firms would not detract from the promotional effect of their labels, the protein source attribute information is placed below the protein and sustainability claims, in an attempt to encourage consumers unfamiliar with meat alternatives to purchase the product.

Figure 4.2: Example of a choice set in the Unregulated Policy Treatment.

Please imagine you are shopping for a ground meat product in a grocery store, with the following three options. Please use the information presented on the product labels to select the product you would choose in a real grocery store setting. **Each product is 500g.**

Option 1	Option 2	Option 3	Option 4
			I would not purchase any of the options.
\$12.50 <input type="radio"/>	\$9.50 <input type="radio"/>	\$5.00 <input type="radio"/>	<input type="radio"/>

4.4.2.2 Treatment 2: Canadian Regulations

The regulations dictating acceptable language on the labels of plant-based meat alternatives in Canada have already been thoroughly discussed.¹⁰ The label design for this treatment adheres to the Canadian regulations as of early 2022 and serves as a middle-ground to assess the more divergent ends of the policy spectrum: the unregulated policy environment, and a meat-related terms ban. Under Canadian policy, plant-based meat alternatives must carry disclaimers that state the product is a simulated meat product and contains no meat. Meat-related terms are permitted on these labels as long as the disclaimers are present. The design of these

¹⁰ See 3.2.1.1 for a detailed description.

labels is based on labels found in grocery stores in Canada.¹¹ An example can be found in Figure 4.3.

Figure 4.3: Example of a choice set in the Canadian Regulations Policy Treatment.

Please imagine you are shopping for a ground meat product in a grocery store, with the following three options. Please use the information presented on the product labels to select the product you would choose in a real grocery store setting. **Each product is 500g.**

Option 1	Option 2	Option 3	Option 4
			I would not purchase any of the options.
\$12.50 <input type="radio"/>	\$9.50 <input type="radio"/>	\$5.00 <input type="radio"/>	<input type="radio"/>

4.4.2.3 Treatment 3: Meat-related Terms Ban

Under a meat-related terms ban, plant-based meat alternative firms would be prohibited from using any language on product labels comparing the product to meat. These regulations have been implemented in several jurisdictions, including the U.S. State of Arkansas¹² and France. Under the State of Arkansas legislation (2019), for example:

“ ‘Beef’ means the flesh of a domesticated bovine, such as a steer or cow, that is edible by humans;

¹¹ See Figure 4.1 for comparison.

¹² This legislation has since been amended to remove the ban. Meat-free disclaimers are now required instead of a total ban on meat-related terms.

‘Beef product’ means an agricultural product that is edible by humans and produced in whole or in part from beef, including without limitation beef jerky, beef patties, chopped beef, fabricated steak, hamburger, ground beef, ribs, and roast”

Under the activities prohibited by the Act:

“Representing the agricultural product as beef or a beef product when the agricultural product is not derived from a domesticated bovine...”

“Utilizing a term that is the same as or similar to a term that has been used or defined historically in reference to a specific agricultural product...”

Therefore, even the term “ground” could be barred from appearing on the label of a plant-based meat alternative. Firms in this market would need to utilize a term not historically associated with a beef product on their labels. For example, a permitted label from French brand Bon Vegetal’s simulated ground beef product reads “hache cru soja a cuisine,” which roughly translates to “chopped raw soy to cook.”

The term selected to characterize the plant-based options in the meat-related term ban treatment is “crumble.” This term derives from a Beyond Meat product – a flavoured ground beef simulant different from their regular plant-based ground product. It is anticipated that preferences for plant-based options will decrease in this treatment relative to the other treatments due to unfamiliarity with the product description on the label. Omnivorous consumers may perceive these products as unpalatable due to the product name and strengthen their preferences for meat products. A sample choice set can be found in Figure 4.4.

Figure 4.4: Example of a choice set in the Meat-related Terms Ban Policy Treatment

Please imagine you are shopping for a ground meat product in a grocery store, with the following three options. Please use the information presented on the product labels to select the product you would choose in a real grocery store setting. **Each product is 500g.**

Option 1	Option 2	Option 3	Option 4
			I would not purchase any of the options.
\$12.50 <input type="radio"/>	\$9.50 <input type="radio"/>	\$5.00 <input type="radio"/>	<input type="radio"/>

4.4.3 Choice Experiment Design

After the product attributes and labelling treatments were determined, Bayesian D-efficient choice sets were designed in RStudio, using the package *idefix* (Traets et al, 2020). A full factorial choice set is infeasible; that many choice sets would require a very large sample to ensure statistical validity. This means that the choice sets must be pared down such that sample size requirements can be fulfilled. D-efficient design has become the standard method for choice set design (Johnson et al, 2013). The D-efficient choice set design maximizes the determinant of the inverse variance-covariance matrix for the model to be estimated from the choice experiment (Johnson et al, 2013).¹³ This method selects choice sets that encourage trade-offs between the

¹³ The model used in the choice set design algorithm is the multinomial logit base model. The D-efficient design algorithm was not run for the other choice models.

products and attributes in the choice set, maximizing the information one can extract from the choice experiment (Traets et al, 2020).

Using a Bayesian approach, prior coefficients and distributions for each attribute and level were specified from the literature.¹⁴ Specification of well-informed priors results in a more statistically efficient design than incorrect or uninformed prior coefficients (Johnson et al, 2013), so these priors were selected only after careful consideration. Traets et al (2020) further recommend specifying a distribution for the prior coefficients rather than point estimates to improve design robustness. In this case, priors were specified to adhere to a normal distribution around the means derived from the literature. Each choice set was specified to include one beef, one pea, and one soy product, along with a no purchase option. This specification mirrors that of Van Loo et al (2020). Additionally, this specification was deemed more realistic than one where protein source attributes vary across choice sets, since most grocery stores offer all three options, and it is rare for one of the three to be absent.

Along with the prior coefficients, the desired number of choice sets was specified prior to running the choice set design algorithm. In the context of the attributes specified, this was narrowed down to 24 or 36 to maintain the possibility of a balanced design, a requirement for a perfectly efficient design, where the number of choice sets must be perfectly divisible by the number of levels in each attribute (Johnson et al, 2013). The choice set specification and prior coefficients were inputted to a coordinate exchange algorithm (CEA)¹⁵ to develop the Bayesian D-efficient choice set design for the specified attributes and levels. The CEA was run for a design of both 24 and 36 sets; a 36-set design was selected due to a lower DB-error, the criteria

¹⁴ Protein claims (Van Wezemael et al, 2014), carbon neutral claim (adapted from Apostilidis and McLeay's (2016) carbon footprint attribute), no purchase and pea (Slade, 2018), soy (Slade, 2018, scaled relative to pea from findings of Van Loo et al, 2020), and price (Van Loo et al, 2020).

¹⁵ The CEA modifies the levels of individual attributes to optimize the choice set design (Traets et al, 2020).

for design efficiency outputted by the CEA (Traets et al, 2020). The 36 choice sets were then randomly assigned to one of six choice blocks to mitigate correlation between the choice sets and product attributes seen by a respondent. So, after first being randomly assigned to one the three labelling policy treatments, each survey respondent was then randomly assigned to one of six choice blocks, where they each respond to six choice sets.¹⁶ Finally, ordering of the alternatives from left to right within each choice set was randomized to mitigate ordering bias in the choice experiment, with the exception of the no purchase alternative, which was always positioned on the right-hand side of the choice set.

4.4.4 Additional Survey Components

An advantage of stated preference methods is that the researcher can query respondents on a number of topics beyond the choice experiment, adding richness to the dataset. Consumers are not homogeneous; their attitudes, knowledge, beliefs, and other characteristics can help explain why certain groups of consumers make decisions while others choose differently. Additionally, given the policy context of this research, the survey provides an opportunity to assess consumer opinions on the policy in question, and compare those sentiments with results from the choice experiment.

Consumer preferences are shaped by their own experiences, knowledge, and beliefs. To capture this information, survey respondents provided information about their food values, adapted for the context of plant-based meat alternatives from Lusk and Briggeman (2009), and self-reported knowledge of certain food attributes and industries. These questions were posed to respondents prior to the choice experiment.

¹⁶ Chung et al (2011) found that respondent choices vary with the amount of choice sets and information provided in the choice experiment and suggest that six choice sets per survey respondent is optimal.

After the DCE, respondents answered a number of follow-up questions pertaining to their food consumption habits and attitudes toward both plant-based meat alternatives and food label information. Next, respondents were presented with a referendum question, asking which of the three labelling policies they wish to see implemented in Canada. Prior to answering this question, the labelling treatments were shown and explained to the respondents.¹⁷ This was done so that consumers could view and understand the various labelling policies and vote for the one they deemed preferable for adoption in Canada with full information. The survey included the food neophobia scale (Pliner and Hobden, 1992) to assess how varying levels of food neophobia impacts preferences for plant-based meat alternatives. Finally, respondents provided socio-demographic data to allow for a better understanding of the consumers that participated in the survey, control for socio-demographic factors in the econometric analysis, and identify characteristics that explain preference heterogeneity.

4.5 Econometric Analysis Methods

As outlined in Section 4.2, random utility theory can be used to model consumer choices. The rational consumer n chooses among J alternatives, such that their utility $U_{nj}, j = 1, \dots, J$ is maximized. U_{nj} is decomposed into observable (V_{nj}) and stochastic (ε_{nj}) determinants of choice, displayed in equation 4.1. This behavioural model is outlined by Train (2002), where consumer n chooses alternative i if:

$$U_{ni} > U_{nj} \forall j \neq i \quad (4.2)$$

Substituting 4.1 into 4.2 yields:

$$V_{ni} + \varepsilon_{ni} > V_{nj} + \varepsilon_{nj} \quad (4.3)$$

¹⁷ The label policy reveal script and referendum question can be found on pages 6 and 7 of Appendix 1.

Train (2002) continues, noting that since part of utility (ε_{nj}) unobservable to the researcher, measurable determinants of utility, V_{nj} , cannot be equal to U_{nj} . The researcher treats ε_{nj} as random, specifying a distribution for the unobservable determinants of utility. This means that the consumer's choice of alternative i can be expressed probabilistically:

$$P_{ni} = Prob(V_{ni} + \varepsilon_{ni} > V_{nj} + \varepsilon_{nj} \forall j \neq i) \quad (4.4)$$

$$P_{ni} = Prob(\varepsilon_{nj} - \varepsilon_{ni} < V_{ni} - V_{nj} \forall j \neq i) \quad (4.5)$$

Therefore, the random utility model is the probability of consumer n choosing alternative i ; this choice occurs when the difference between the stochastic utility components of alternatives j and i is less than the difference in observable utility of j and i . Since the difference in stochastic utility levels is unknown to the researcher, a distribution must be specified to facilitate the modelling of consumer choice. Different choice models derive from the assumptions placed on distribution of stochastic utility components (Train, 2002).

For this research, the random utility model can be specified as:

$$U_{njt} = \alpha_{jt} + \beta_j X_{nj} + \varepsilon_{nj} \quad (4.6)$$

where U_{njt} is the utility consumer n , assigned to labelling policy treatment t , derives from choosing alternative j , a ground beef, pea-based, or soy-based alternative product, α_{jt} is an alternative-specific parameter representing the alternative (protein source attribute or no purchase option) corresponding to product j under policy treatment t , X_{nj} is a vector of product attributes (protein label claims, carbon neutral label claim, and price), β_j is a parameter vector of the utility obtained by consumers from each component of X_j , and ε_j represents the stochastic component of consumer n 's utility for alternative j .

To assess the effects of labelling policy on preferences for ground beef and plant-based alternatives and isolate the effects of interest, a certain parameterization of the alternative-

specific constant, α_{jt} , is required. The alternative-specific constant is segregated to capture two separate effects: preferences associated with broadly purchasing a product (where the no purchase utility function is normalized to zero), and preferences associated with the other alternatives, or protein source attributes. In the base model, each alternative-specific parameter is interacted with a policy treatment dummy variable t , where the unregulated treatment is normalized to zero and therefore serves as the point of comparison for preferences under the remaining two treatments.

This parameterization is done for two reasons. First, it allows for normalization of the no purchase utility function to zero. So, broad purchase-related preferences are included in the utility functions for the other alternatives, while isolating preferences for protein sources under different policy treatments. This leads to the second reason for this specification. Because a purchase parameter is included in the utility functions for the alternatives a respondent can select to purchase, the estimated parameters for pea and soy products can be interpreted relative only to beef. Only differences in utility matter, not absolute values, so alternative-specific parameters can only be estimated for $J - 1$ alternatives (Hensher et al, 2015). Therefore, since purchase parameters are included despite normalization of the no purchase utility function, utility for beef can also be normalized to zero. This allows for a more straightforward interpretation of the model results, where preferences for pea and soy under the various policy treatments can be compared directly to beef, with broad purchase-related utility accounted for separately. The pea and soy attributes can then be interacted with policy treatment t to elicit the effect that different labelling policy frameworks have on demand for plant-based meat alternatives relative to beef in the same regulatory environment.

This specification forms the base model for elicitation of preferences and willingness-to-pay estimates in the context of this research. The following sections introduce and discuss the models used in this analysis. Each model was estimated in RStudio, with the choice modelling package *apollo* (Hess and Palma, 2019).

4.5.1 Multinomial Logit Model

The researcher's specification of the distribution for the stochastic element of utility ε_{nj} determines the choice model used. The multinomial logit (MNL) model is the most common model used in discrete choice analysis (Train, 2002). The MNL model is derived when the distribution of ε_{nj} is assumed to be independently, identically distributed (IID) extreme value, also referred to as Gumbel or type 1 extreme value (Train, 2002). This specification implies that the error terms are independent of one another across alternatives and are therefore uncorrelated. Further, the error term is identically distributed among consumers, meaning that estimated model coefficients are fixed across the population and unobserved consumer heterogeneity is not accounted for in the MNL model. In practice, this assumption is unrealistic. However, the MNL model is relatively simple to estimate, and results can be interpreted as average preferences across consumers. The MNL model serves as the base model for this analysis.

The error distribution assumption can be applied to the random utility model specified in Equation 4.5 to produce the logistic choice probability, again using Train's (2002) notation:

$$P_{ni} = \frac{e^{V_{ni}}}{\sum_j e^{V_{nj}}} \quad (4.7)$$

where P_{ni} is the probability¹⁸ of consumer n choosing alternative i , and V_{ni} is the determinate portion of utility, expressed in the context of this research as:

¹⁸ A closed-form probability between zero and one.

$$P_{ni} = \frac{e^{\alpha_{it} + \beta_i' X_{ni}}}{\sum_j e^{\alpha_{jt} + \beta_j' X_{nj}}} \quad (4.8)$$

Maximum likelihood estimation can be used to evaluate the utility parameters specified in equation 4.6. Maximum likelihood estimation determines the parameters that maximize the probability of the model matching the choice data. The likelihood of consumer n choosing the alternative they selected in the DCE is:

$$\prod_i (P_{ni})^{y_{ni}} \quad (4.9)$$

where $y_{ni} = 1$ if the consumer chooses alternative i and $= 0$ if a different alternative is chosen (Train, 2002). The log-likelihood function can be written as:

$$LL(\alpha_{it}, \beta_i) = \sum_{n=1}^N \sum_i y_{ni} \ln P_{ni} \quad (4.10)$$

where the values of α_{it} and β_i maximize the function.

The MNL model has a number of benefits and drawbacks associated with the assumptions imposed on the error term. The MNL model is simple to specify and estimate, with closed form probabilities between zero and one. Interpretation of the attribute coefficients is straightforward as well. Attribute coefficients β_j yielded by the MNL can be interpreted as the marginal utility derived from each product attribute in X_{nj} . Further, the MNL model facilitates straightforward estimation of marginal willingness-to-pay values for product attributes, discussed in detail later in this chapter.

However, the MNL does exhibit some significant limitations, and results in the requirement for further modelling to address the hypotheses proposed for this research. Generally, due to the assumption of IID, the MNL model only accounts for systematic variation in tastes related to specified variables in the utility function. Unobserved and random taste heterogeneity is not accounted for in the MNL model. Given the prominence of preference heterogeneity for meat and plant-based alternatives outlined in Chapter 2, this limitation implies

that the MNL model is insufficient to capture such idiosyncrasies in consumer preferences that likely exist in practicality.

Another potentially relevant limitation of the MNL relates to the assumption of independence of irrelevant alternatives (IIA). The IIA assumption results from the IID assumption necessary to derive the logit model and implies that the probability of choosing one alternative over another is the same no matter the other alternatives available to the decision maker (Train, 2002). In other words, the effects of alternatives outside of those specified in the experimental design on consumer choice are assumed to be irrelevant. So, while this assumption is realistic in certain scenarios, if IIA is violated, methods that do not impose the IIA assumption are necessary to properly model choice. Train (2002) explains further that the IIA assumption can result in inflated demand for close alternatives.

The MNL model remains relevant in this research as a starting point from which models that incorporate consumer heterogeneity can build upon. The results of the MNL model can be thought of as representing broad, average preferences among the entire sample (Train, 2002), although these preferences likely do not tell the entire story. For a more practically sound model, preference heterogeneity must be accounted for. The MNL model results can be found in Section 5.4.1.

4.5.2 Random Parameters Logit Model

The Random Parameters Logit model (RPL) or Mixed Logit model relaxes the IID and IIA assumptions, allowing for the error term to vary across consumers and facilitate random taste variation. The RPL model can be derived in a number of ways, each yielding the same model conditions. While the model can be derived through decomposition of the error term (Hensher and Greene, 2003), Train (2002) provides the most succinct method based upon the specification

of random coefficients. Let the utility obtained by consumer n from selecting alternative j be expressed as:¹⁹

$$U_{nj} = \beta_n X_{nj} + \varepsilon_{nj} \quad (4.11)$$

Where X_{nj} is a vector of product attributes and other observed variables pertaining to the product or consumer, β_n is a vector of utility parameters associated with X_{nj} specific to consumer n , and ε_{nj} is the stochastic component of utility which is IID Type 1 extreme value, and consumer n chooses among j ($j = 1, \dots, J$) alternatives.

The β_n coefficients vary across consumers in the population with a density function $f(\beta)$. The RPL specification is similar to that of the MNL model, besides the fact that utility parameters vary across consumers. Therefore, the choice condition is the same as that defined in Equation 4.2. If the researcher observes β_n , the choice probability matches that of the MNL model, specified in Equation 4.8. Since the researcher does not observe β_n , the choice probability cannot be conditioned upon it (Train, 2002). So, the unconditional choice probability is defined as the integral of the conditional choice probability specified in Equation 4.8, over all possible values of β_n :

$$P_{ni} = \int \left(\frac{e^{\beta_n X_{ni}}}{\sum_j e^{\beta_n X_{nj}}} \right) f(\beta) d\beta \quad (4.12)$$

To facilitate estimation of the model, the researcher must specify a continuous distribution for $f(\beta)$. In this case, each of the parameters specified as random in estimation adhere to a normal distribution, though other distributions are commonly used as well.²⁰ The random parameters include those for the protein claim attributes, the sustainability claim, the protein

¹⁹ The derivation of the RPL model is provided in general terms for the purposes of this explanation. That which is used in estimation utilizes the random utility function specified in Equation 4.6.

²⁰ Distributions include but are not limited to: normal, lognormal, uniform, and triangular (Hensher et al, 2015).

source attributes, and the policy treatment interaction claims, while the price and purchase parameters are specified as fixed.

The choice probability cannot be estimated to an exact value because the integral defining the choice probability does not have a closed form (Hensher and Greene, 2003). The choice probability is therefore estimated through simulation. The process by which parameter estimates are obtained is explained succinctly by Train (2002). First, a value from the specified distribution for each parameter is drawn for R replications or draws. Next, the utility is calculated for each individual draw. These utilities are then inputted to the logit formula, and the results from all the draws are averaged to obtain the mean parameter values. For the purposes of this research, 500 Sobol²¹ draws were taken to estimate the parameter means and standard deviations. Hensher and Greene (2003) show that RPL results tend to stabilize at around 500 draws. The model then provides mean and standard deviation parameter estimates for each random parameter. The standard deviation estimates are indicative of the amount of consumer preference heterogeneity for the alternatives, product attributes, and policy treatments.

While the RPL model improves upon the MNL model in terms of its ability to account for preference heterogeneity, this model still poses some challenges and drawbacks. Namely, while preference heterogeneity for each attribute, alternative, and policy treatment is indicated by the magnitude and significance of that parameter's standard deviation, the RPL model results do not explain the source of that heterogeneity. While the inclusion of consumer characteristics and correlated parameters is possible for RPL models, the model estimated in this research was kept simple intentionally. The role of the RPL model in this analysis is to serve as a bridge between the MNL base model and the LCL model, which provides consumer classes based on consumer

²¹ Halton draws are not recommended for models with more than five random parameters (Hess and Palma, 2022).

characteristics. The intention of the RPL model is to show, in a straightforward manner, the degree to which preferences for meat alternatives under differing labelling policies are heterogeneous across consumers, providing insight for the development of the LCL model. The addition of further complexity to the RPL model was not necessary to achieve this goal and was therefore not included in this analysis.

It remains important to note that reliance on this model could result in failure to identify important socio-demographic, attitudinal, and behavioural consumer characteristics that explain the degree of variation in preferences for plant-based meat alternative products and policy. Thus, further analysis is necessary to explain the drivers of preference heterogeneity for plant-based meat alternatives among Canadian consumers. Results from the RPL model estimation can be found in Section 5.4.2.

4.5.3 Latent Class Logit Model

The final method of estimation employed in this thesis expands upon the assessment of preference heterogeneity facilitated by the RPL model by lending insight into the sources of preference heterogeneity. The Latent Class Logit model (LCL) employs discrete distributions to explain underlying preferences for various alternatives and attributes, determined by a class membership function utilizing consumer characteristic data (Hensher et al, 2015). Each of these discrete distributions can be thought of as classes or segments of consumers, with similar preferences based upon the characteristic data included in the class membership function. Therefore, consumer segments arise endogenously from the data, rather than being imposed upon the sample by the researcher. The LCL model expands upon and complements the RPL model by explaining the sources of preference heterogeneity and identifying the size of various groups of consumers with similar preferences and responses to labelling policy.

The latent class model is comprised of two components. First, the class membership function can be defined as the likelihood of consumer n belonging to class s .

$$P_{ns} = \frac{e^{\delta_s Z_n}}{\sum_s e^{\delta_s Z_n}} \quad (4.13)$$

Where δ_s is a vector of class-specific parameters and Z_n is a vector of consumer characteristic variables, constituting the observed component of utility involved in class membership (Hensher et al, 2015).

The next component is that which determines the utility parameters within each class. Drawing upon the random utility model specified in Equation 4.6, let the utility of individual n , belonging to class s , selecting alternative j , under policy treatment t , be:

$$U_{nsjt} = \alpha_{sjt} + \beta_{sj} X_{nsj} + \varepsilon_{nsj} \quad (4.14)$$

The probability of consumer n , assigned to policy treatment t , selecting alternative i among j ($j = 1, \dots, J$) alternatives is therefore conditional upon belonging to class s ($s = 1, \dots, S$), because preferences are assumed to be specific to each class (Boxall and Adamowicz, 2002). Thus, the necessary adjustment to the multinomial logit probability found in Equation 4.7 is:

$$P_{ni|s} = \frac{e^{V_{nsi}}}{\sum_j e^{V_{nsj}}} \quad (4.15)$$

The class-dependent, conditional multinomial logit model is then interacted with the class membership function²² to yield the latent class model, which simultaneously utilizes choice experiment data and the socio-demographic, attitudinal, and behavioural characteristics of consumers to calculate preferences among s groups of consumers. This is presented in Equation 4.16.

²² See Boxall and Adamowicz, 2002 for derivation of the class membership likelihood function.

$$P_{nis} = \frac{e^{\delta_s Z_n}}{\sum_s e^{\delta_s Z_n}} * \frac{e^{V_{nsi}}}{\sum_j e^{V_{nsj}}} \quad (4.16)$$

One key decision the researcher must make is to specify the number of classes, S . Statistical criteria such as the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and the log-likelihood value of the model are useful parameters in making this decision. However, the researcher's judgement and economic theory also play a role in the decision. The factors involved in this decision are outlined in more detail by Boxall and Adamowicz (2002).

The LCL model can be considered a halfway point between the MNL model and RPL model (Boxall and Adamowicz, 2002), where the MNL model assumes a single homogenous group of consumers, while the RPL model treats each individual consumer as their own "segment." The key strength of the LCL model is its ability to assess and account for the consumer characteristics that drive preference heterogeneity. This is particularly important when examining policy impacts, allowing the analyst to determine the ways in which policy can impact different groups of consumers. Results from the LCL model can be found in Section 5.4.3.

4.5.4 Willingness-to-Pay Estimation

While the marginal utility parameter estimates obtained are informative in a theoretical sense, the findings therein are relatively intangible. Willingness-to-pay (WTP) estimates present these findings in a more intuitive manner. Marginal willingness-to-pay (MWTP) can be defined as the negative value of the consumer's marginal rate of substitution between an alternative or

product attribute, and money, such that the total change in utility is zero (Hensher et al, 2015).²³

This can be expressed mathematically as:

$$MWTP = -\frac{\beta_i}{\beta_{price}} \quad (4.17)$$

Where β_i is the estimated coefficient for a parameter of interest and β_{price} is the price coefficient. As noted earlier, these coefficients are interpreted as the marginal utility of the selected attribute and the marginal utility of spending money. A similar interpretation applies when the numerator is a policy treatment interaction term, where the numerator is interpreted as the marginal utility of a protein source alternative under policy treatment t . Therefore, MWTP can be considered as the amount of money the consumer would be willing to spend for one additional unit of a certain attribute.

MWTP estimates were calculated for both the LCL model and MNL model. While MWTP can be calculated in different ways, unconditional MWTP estimates utilizing the parameter means estimated by the MNL model and LCL model are used for this analysis. MWTP estimates were not calculated for the RPL model for the sake of brevity, since the estimates from the MNL model carry similar implications to the mean parameter estimates of the RPL model. Standard deviations are obtained using the delta method function in the apollo choice modelling package (Hess and Palma, 2022). These results are presented and analyzed in Section 5.4.4.

²³ The marginal rate of substitution is multiplied by -1 because the price coefficient is interpreted as the marginal utility of spending money – the opposite of the marginal utility of income – which according to economic theory, is a negative value. Therefore, an attribute with positive preferences and WTP would be expressed as a negative number without this transformation.

Chapter 5 Results of the Canadian Consumer Survey

5.1 Introduction

This chapter reports the results from the survey administered to Canadian consumers. The chapter is organized as follows: first, sample characteristics are outlined. Next, descriptive statistics are presented to lend insight into consumer attitudes regarding plant-based meat alternatives and food purchasing in general. Then, econometric model results and willingness-to-pay estimates are displayed and briefly discussed. Finally, the respondent referendum results are presented and analyzed.

5.2 Socio-demographic Characteristics of the Sample

The survey was distributed to respondents such that the sample was representative of the Canadian population with respect to age and province of residence, based on the 2016 Canadian Census (Statistics Canada, 2017).¹ Importantly, because non-grocery shoppers were filtered out before quotas were accounted for, the sample should be considered as grocery shopping Canadians representative to the population with respect to age and province of residence. Non-grocery shoppers may disproportionately reside in certain population groups, but data for comparison was not available. A comparison of the age and province sample quotas with the Canadian population² can be found in Table 5.1. The total counts from the survey align closely with the demographics of the Canadian population, ensuring a balanced sample with respect to these respondent characteristics.³ There were no respondents from either the Northwest Territories or Nunavut due to the low populations of those jurisdictions.

¹ 2021 Canadian Census data was not yet available for quota determination at the time of survey administration.

² Based on Statistics Canada data from the 2021 Canadian Census, ages 18+.

³ Despite adhering to a quota, the sample age does not align with the 2021 Canadian Census data to the degree that province of residence does, which was unexpected. This is likely a result of two factors: first, quotas were

Data on other socio-demographic characteristics⁴ was also collected and compared with Canadian Census data (Statistics Canada, 2017; Statistics Canada, 2022a), as presented in Table 5.1. In the survey, these questions included “prefer not to say” options. While the decision to implement this option excludes some participants from the dataset when these variables are employed in econometric estimation, it was made to ensure that respondents felt comfortable answering the questions and would be less likely to terminate the survey partially completed.

Table 5.1: Socio-demographic characteristics of the sample relative to the Canadian population.

Characteristic	Sample Proportion (%)	Canadian Population (%)
Province of Residence		
Alberta	11.2	11.5
British Columbia	13.9	13.5
Manitoba	3.4	3.6
New Brunswick	2.1	2.1
Newfoundland and Labrador	1.3	1.4
Northwest Territories	0.0	0.1
Nova Scotia	2.6	2.6
Nunavut	0.0	0.1
Ontario	38.6	38.5
Prince Edward Island	0.4	0.4
Quebec	23.1	23.0
Saskatchewan	3.3	3.1
Yukon Territory	0.1	0.1
Age (split into three categories)^{1, 2}		
18-34	27.4	29.6
35-54	33.9	30.9
55+	38.7	39.5
Education (% in each category)^{1, 4}		
Did not complete high school	1.2	18.3
High school	11.8	26.5
Trade/diploma/other certificate	24.3	32.0
Undergraduate degree	38.7	15.5
Master’s degree	17.9	6.9
Ph.D.	4.0	0.8

implemented based on 2016 Census data, and second, the 2021 Census data used for comparison uses 10-year age categories from age 15+, while the sample only includes respondents ages 18+.

⁴ Education, gender, household size, household income, and political leanings.

Prefer not to say	2.2	N/A
Gender (% in each category)^{1,3}		
Male	52.3	49.3
Female	46.7	50.7
Gender non-binary/Third gender/other	0.7	N/A
Prefer not to say	0.2	N/A
Household Data¹		
Household size (average)	2.3	2.4
Annual Household Income (% in each category)		
Less than \$100,000	58.4	59.6
More than \$100,000	34.2	40.4
Prefer not to say	7.4	N/A
Political Leaning (% in each category)		
Left-leaning (liberal)	31.9	N/A
Right-leaning (conservative)	17.8	N/A
Centre/moderate	24.9	N/A
Not political	17.2	N/A
Prefer not to say	8.1	N/A

Derived from author calculations with survey data and Statistics Canada data, 2022.

¹For respondents aged 18+ in the sample, and 15+ in the Canadian population.

²Age data expressed in Statistics Canada categories. Survey data on age was collected in six categories. There were 301 respondents characterized as seniors (65+) in the analysis.

³Categorized as Men+ and Women+, accounting for the non-binary/third gender population therein.

⁴Canadian population data obtained from 2016 Census due to unavailability of 2021 Census data at the time of writing.

The sample is skewed toward higher-educated individuals relative to the Canadian population. This is likely a characteristic of those who participate in Asking Canadians internet surveys. Education has been found to positively influence Canadian consumer purchasing of plant-based meat alternatives (Slade, 2018), so it is important to consider the relatively high education levels in the sample when interpreting the results. However, the sample is similar to the Canadian population with respect to sex/gender, household size, and income. Overall, 376 respondents were assigned to Treatment 1, 417 to Treatment 2, and 410 to Treatment 3. Although relatively fewer respondents were in the unregulated treatment, each treatment group

contains a similar mix of socio-demographic characteristics, as shown in Appendix 2.

5.3 Attitudinal and Behavioural Characteristics of the Sample

Alongside socio-demographics, it is anticipated that consumer attitudinal and behavioural characteristics will influence demand for plant-based meat alternatives and response to labelling policy, particularly in the assessment of consumer preference heterogeneity discussed in later sections. A number of questions were posed to respondents in order to elicit these characteristics and attitudes that may be relevant in the econometric analysis. The following subsections outline the responses to these questions and provide descriptive statistics to obtain a stronger understanding of the attitudes and behaviours of the sample.

5.3.1 Dietary Habits

Data on dietary habits with respect to meat consumption was collected. Diets that promote meat reduction or avoidance are anticipated to be influential in explaining preference heterogeneity for meat and plant-based alternatives. The sample statistics for these characteristics are presented in Table 5.2. Rates of meat avoidance⁵ align closely with the literature at around 5-10%, both in Canada (Slade, 2018) and abroad (Apostilidis and McLeay, 2016; Malek et al, 2019). Rates of flexitarianism in the literature fluctuate depending on the definition of flexitarianism specified by the researchers,⁶ and the geographic setting of the research. The degree of meat avoidance necessary to define oneself as flexitarian is uncertain, but stated intention of meat reduction is satisfactory for the purposes of this research. Flexitarians makeup 19.2% of the sample, a higher proportion than the rate of 10.2% found by Charlebois et al (2018)

⁵ Vegan, vegetarian, or pescatarian, composing 7.5% of the sample.

⁶ For this research, flexitarianism was defined as “I only eat meat and other animal protein sometimes.”

in their Canadian study. Conversely, rates of flexitarianism are slightly lower than that found from studies in other nations (Bryant and Sanctorem, 2021; Dagevos, 2021). The overwhelming majority of survey respondents identify as omnivores, as expected, though less than the proportion found by Charlebois et al (2018).

Table 5.2: Dietary habits of the sample.

Characteristic	Sample Proportion
Dietary Habit	
Vegan	1.8
Vegetarian	3.5
Pescatarian	2.2
Flexitarian	19.2
Omnivore	73.2

Derived from author calculations with survey data.

5.3.2 Adapted Food Values

Prior to the choice experiment, respondents answered a series of questions regarding the importance of various food-related values in their general food purchasing decisions on a scale of one to five, adapted from Lusk and Briggeman's (2009) food values. These responses illustrate respondents' food attribute values before the plant-based meat alternatives context was introduced in the survey. This data was collected under the assumption that the value associated with at least a subset of these attributes are influential in the purchasing decision for meat and plant-based alternatives. Based on the literature review, food values with assumed a priori importance include health and nutrition, environmental sustainability, animal welfare, taste, naturalness, and familiarity. Descriptive statistics from this portion of the survey are presented in Table 5.3.

Price, health, taste, and food safety stand out as the most important food attributes in the average consumer's purchase decision, consistent with other research on Canadian consumer

food values (Yang and Hobbs, 2020, for example). Health and taste are both crucial attributes in driving demand for plant-based meat alternatives, so it is notable that they are also highly relevant when removed from the context of plant-based meat alternatives. Food safety seems less relevant when taken into the context of this research, but it may play a role in determining consumer trust of novel food technologies employed in the production of plant-based meat alternatives. Interestingly, environmental sustainability and animal welfare, two important drivers of demand for plant-based meat alternatives, are not as relevant in the general food purchasing context on average.

Table 5.3: Average food values scores (from 1 = not important to 5 = extremely important).

Importance of...	Mean	Standard Deviation
Food safety	4.3	0.9
Price	4.1	0.9
Taste	4.1	0.8
Health and nutrition	4.0	0.9
Appearance	3.4	1.0
Naturalness	3.3	1.0
Familiarity	3.3	0.9
Convenience	3.3	0.9
Animal welfare	3.2	1.1
Environmental sustainability	3.2	1.1
Product origin	3.2	1.1
Brand	2.9	0.9
Novelty/trying something new	2.6	1.0

Derived from author calculations with survey data.

5.3.3 Self-reported Knowledge

Prior to the choice experiment, respondents were asked to self-report their knowledge on several broad topics related to plant-based meat alternatives on a scale of one (not knowledgeable) to five (extremely knowledgeable). Prior knowledge and opinions affect how consumers respond to label information, making it an important variable to account for. Since

this section was before the choice experiment, these opinions were elicited without influence from the nature of the study. Descriptive statistics are displayed in Table 5.4.

Table 5.4: Self-reported knowledge on topics related to plant-based meat alternatives (from 1 = not knowledgeable to 5 = very knowledgeable).

Knowledge of...	Mean	Standard Deviation
Nutrition and healthy eating	3.3	1.0
Environmental sustainability	2.7	1.0
Animal welfare	2.5	1.0
The meat industry in Canada	2.5	1.0
Plant-based meat alternatives	2.4	1.1

Derived from author calculations with survey data.

Consumers generally report an average amount of knowledge on each topic, besides nutrition and healthy eating, where relatively more knowledge is claimed. This knowledge and implied interest in healthy eating could be indicative of consumer preferences for health-related attributes over those related to the environment or animal welfare. In combination with the high importance of health-related attributes presented in Section 5.3.2, these results show that health-related components of food products are both important and of interest to consumers and may be indicative of preferences in later analyses. Based on these results, health and nutritional claims and attributes are likely to elicit a positive demand response in the case of plant-based meat alternatives.

5.3.4 Consumption Habits and Other Attitudinal Indicators

Upon completion of the choice experiment, respondents were asked a number of questions pertaining to their consumption habits of meat and plant-based alternatives. Past consumption habits and attitudes toward food products are expected to influence how consumers respond to label information and make purchasing decisions in the present and future. Further,

data on both frequency of consumption and product type provide a clearer picture of the market for plant-based meat alternatives in Canada. Table 5.5 outlines relevant consumption habits for meat and plant-based meat alternatives.

Table 5.5: Plant-based meat alternative consumption habits and attitudes.

Survey Question	Percentage of Sample (%)
Which types of plant-based meat alternatives have you tried?	
Burger substitute	48.3
Ground meat substitute	27.2
Sausage substitute	22.4
Chicken tenders/nuggets substitute	21.3
Meatball substitute	16.0
Deli meat substitute	9.8
Other	2.7
None	36.0
In the last month, how often was a plant-based meat alternative the primary source of protein in a meal?	
Never	49.8
Less than one meal per month	16.6
More than one meal per month, but not weekly	15.0
One or two meals per week	9.2
More than one or two meals per week, but not daily	5.6
One meal per day	2.4
More than one meal per day	1.2
In the last month, how often was a meat product the primary source of protein in a meal?	
Never	4.4
Less than one meal per month	1.7
More than one meal per month, but not weekly	5.7
One or two meals per week	16.0
More than one or two meals per week, but not daily	30.1
One meal per day	27.8
More than one meal per day	14.3
Do you intend on incorporating more plant-based meat alternatives into your diet?	
Yes	22.9
No	38.3
Maybe	38.7
What is the most important factor in adopting your current meat consumption habits?	
Health/nutrition	27.8
Price	26.8
Taste/sensory appeal	19.5

Familiarity/habit	13.5
Animal welfare	3.6
Environmental sustainability	3.4
Religion	2.4
Other	3.0
Have you ever mistaken a plant-based meat alternative for a real meat product when grocery shopping?	
Yes	10.5
No	81.2
I don't know	8.3

Derived from author calculations with survey data.

Table 5.5 reveals some informative observations about Canadian consumer consumption habits and attitudes toward plant-based meat alternatives. First, 64% of Canadian consumers have tried a plant-based meat alternative product, with burger substitutes the most common. This is likely due to their widespread availability in fast food restaurants and grocery stores. Other product categories lag behind burgers but are generally newer product lines that have not received the same level of promotion as burger substitutes.

While 36% of respondents have never tried a plant-based meat alternative, even fewer (49.8%) consumed one in the last month. This implies that a large portion of consumers are either unwilling to try plant-based meat alternatives, or consume them only sporadically, perhaps no more than once or twice. The remaining half of consumers constitute the current feasible target market for plant-based meat alternatives. Meanwhile, over half of respondents do not consume meat daily, indicative of a large segment of consumers practicing some degree of flexitarianism. Finally, a sizeable segment of consumers (22.9%) expresses an intention to increase their consumption of meat alternatives going forward, while an additional 38.7% are unsure. This analysis demonstrates that on a broad level, there appears to be a clear segment of enthusiastic meat-reducing consumers that intend to regularly replace meat with plant-based substitutes, with an even larger proportion that express some interest in meat alternatives but are

still committed to eating meat regularly. These two groups of consumers, along with committed vegetarians and vegans, appear to compose around half of the sample.

Affirming the findings in the previous two sections, health, price, and sensory appeal are the three most important drivers of meat consumption habits among respondents. This is worth reiterating because this data was obtained after the context of the choice experiment is revealed. This affirms that the relative importance of food product attributes is similar in both the general food purchasing context and the specific case of meat and meat alternatives. Somewhat surprisingly, the prevalence of environmental sustainability and animal welfare remain low in this context, with only approximately 7% of consumers selecting these attributes as most important in their meat consumption habits combined. This provides further evidence for the relative strength of health and nutrition attributes compared with ethical motivators in driving market demand for meat and meat alternatives. Finally, the aspect of familiarity, deemed most important by 13.5% of respondents, is of interest, particularly when focusing on the effects of labelling policy on demand for plant-based meat alternatives. Under a meat-related terms ban, less familiar product names for plant-based meat alternatives could result in reduced demand, especially for consumers that rely on familiarity when choosing meat products at the grocery store. Meanwhile, looser regulations may incentivize purchasing among this group as plant-based products could be perceived as increasingly analogous to meat.

Lastly, a small portion of consumers (10.5%) have mistaken plant-based meat alternatives for real meat products in the grocery store. However, the overwhelming majority (81.2%) have never conflated meat and plant-based alternatives, suggesting that the current Canadian regulations prevent consumer confusion most of the time. This aligns with the results of the 2020 CFIA consultation, where 79% of consumers reported no issues in distinguishing

between meat and alternatives (CFIA, 2021c). This assessment provides an informative snapshot of plant-based meat alternative consumption in Canada, illustrating a high degree of heterogeneity in the rates at which meat and plant-based alternatives are consumed, and further solidifying the importance of nutrition and taste in the decision-making process.

Table 5.6 outlines responses to a series of questions to gather further information on consumer attitudes toward meat plant-based alternatives. Respondents were asked to express their (dis)agreement to a series of statements on a five-point Likert scale.⁷ These statements pertain to opinions on food labelling, the broad impact of food choices, and elicit a comparison between meat and plant-based alternatives in several common attributes. Results from this section of the survey are displayed in Table 5.7.

On average, plant-based meat alternatives are perceived to be healthier and more sustainable than meat products, and similar in terms of taste quality. Meanwhile, on average across the sample, they are also seen as too expensive, containing strange ingredients, and while respondents claim they may taste as good as meat, they are not perceived to taste the same. These attitudes highlight the barrier to consumption posed by perceived taste and sensory qualities of plant-based meat alternatives and emphasize the potential for health and environmental attributes to expand the market. Consumers clearly recognize these attributes; however, the degree to which they influence purchasing behaviour is unclear at this juncture. It is notable that although plant-based meat alternatives are broadly perceived to be more environmentally sustainable than meat, the importance of sustainability attributes in the purchasing decision lags most other relevant factors.

⁷ Where 1 indicates strong disagreement and 5 indicates strong agreement.

Table 5.6: Respondent attitudes toward plant-based meat alternatives, labelling, and food consumption impacts (from 1 = strongly disagree to 5 = strongly agree).

Question	Sample Mean	Standard Deviation
Positively framed prompts:		
In general, plant-based meat alternatives are a more sustainable choice than meat products.	3.2	0.9
In general, plant-based meat alternatives are healthier than meat products.	2.9	0.9
In general, plant-based meat alternatives taste better than meat products.	2.5	0.9
Negatively framed prompts:		
Plant-based meat alternatives are too expensive.	3.6	0.9
Plant-based meat alternatives don't taste like meat from animals.	3.5	0.9
Plant-based meat alternatives contain too many strange ingredients.	3.4	1.0
Attitudes on food labels:		
Food labels are helpful in making food purchasing decisions.	4.1	0.8
Information on food labels is trustworthy.	3.3	0.8
Impacts of food choices:		
A person's food choices can influence their health.	4.3	0.8
A person's food choices can contribute to climate change.	3.6	1.0

Derived from author's calculations with survey data.

Food labels are generally viewed as helpful in making food purchasing decisions, but the degree to which consumers trust label information is significantly lower. Trust in labels is key for use of that information by consumers, and regulation (or lack thereof) of labelling, claims, and standards can impact the degree to which consumers trust and respond to label information. Finally, consumers are generally aware of both the health and environmental impacts of their

food consumption. Whether this awareness translates into action in terms of consumption habits remains unclear.

5.3.5 Food Neophobia Scale

Food neophobia is anticipated to play a significant role in how consumers respond to plant-based meat alternative products under different labelling policy frameworks. Unfamiliar label language could result in increased influence of food neophobia characteristics in the decision to purchase plant-based meat alternatives. This component of the survey was adapted from Pliner and Hobden (1992). Consumers were asked to indicate their (dis)agreement with a series of statements pertaining to their food neophobic/neophilic tendencies on a five-point Likert scale. Taking the average of a consumer's responses reveals their food neophobia score, where a score closer to five indicates a relatively higher degree of food neophobia. Descriptive statistics for each individual prompt and food neophobia score are displayed in Table 5.7.

Table 5.7: Descriptive statistics for the food neophobia scale (from 1 = strongly disagree to 5 = strongly agree).

Statement	Mean	Standard Deviation
I am very particular about the foods I will eat.	3.2	1.1
If I don't know what's in a food, I won't try it.	3.1	1.1
I am afraid to eat things that I have never had before.	2.5	1.1
I don't trust new foods.	2.4	0.9
Ethnic food looks too weird to eat.	2.1	1.0
I like foods from different countries.*	4.0	0.9
At dinner parties, I will try a new food.*	3.8	0.9
I like to try new ethnic restaurants.*	3.6	1.0
I am constantly sampling new and different foods.*	3.2	1.0

I will eat almost anything.*	3.1	1.2
Food neophobia score:	2.6	0.7

*Reverse coding for calculating food neophobia score.

Derived from author calculations with survey data.

On average, Canadian consumers in this sample population are slightly food neophobic. Consumers are generally not apprehensive about eating ethnic foods. However, they are averse to food that looks “weird,” and are particular about the foods they will eat. Further, they are somewhat reluctant to try new foods, and display average levels of trust in new foods. Those consumers that exhibit a lack of trust in new foods are unlikely to purchase plant-based meat alternatives, particularly if label information facilitates perceptions of unfamiliarity.

5.4 Results from the Discrete Choice Experiment

This section presents the results from the discrete choice experiment. Using a multinomial logit (MNL) base model, these results provide insights into how Canadian consumers value various product attributes, view plant-based products relative to meat, and respond to various labelling policy frameworks. Further, this analysis is expanded to provide an assessment of consumer preference heterogeneity in the aforementioned factors. Random Parameters Logit (RPL) and Latent Class Multinomial Logit (LCL) modelling techniques are used to incorporate preference heterogeneity into the analysis and display how this heterogeneity affects the demand for plant-based meat alternatives among label policy treatments. Finally, the parameters from these models are used to calculate willingness-to-pay estimates, quantifying consumer preferences into monetary values. Descriptions of the variables used in the analysis are presented in Table 5.8.

Table 5.8: Choice experiment variable codes and descriptions.

Choice Variable	Variable Description
Purchase, Unregulated	Alternative specific constant for purchasing a product in the unregulated policy treatment. ¹
Purchase, Canadian Regulations	Alternative specific constant for purchasing a product in the Canadian regulations policy treatment. ¹
Purchase, Meat-related Terms Ban	Alternative specific constant for purchasing a product in the meat-related terms ban policy treatment. ¹
Purchase, Pooled Treatments	Alternative specific constant for purchasing a product, pooled across treatments. Only used in the LCL model. ¹
Pea, Unregulated	Interaction dummy = 1 for a pea-based product in the unregulated policy treatment. ²
Pea, Canadian Regulations	Interaction dummy = 1 for a pea-based product in the Canadian regulations policy treatment. ³
Pea, Meat-related Terms Ban	Interaction dummy = 1 for a pea-based product in the meat-related terms ban policy treatment. ³
Soy, Unregulated	Interaction dummy = 1 for a soy-based product in the unregulated policy treatment. ²
Soy, Canadian Regulations	Interaction dummy = 1 for a soy-based product in the Canadian regulations policy treatment. ³
Soy, Meat-related Terms Ban	Interaction dummy = 1 for a soy-based product in the meat-related terms ban policy treatment. ³
An Excellent Source of Protein	Dummy = 1 if the product displays “An Excellent Source of Protein” label claim.
A Complete Source of Protein	Dummy = 1 if the product displays “A Complete Source of Protein” label claim.
Certified Carbon Neutral	Dummy = 1 if the product displays a “Certified Carbon Neutral” label claim.
Price	6-level continuous variable ranging from \$5.00 per 500g to \$12.50 per 500g.
Individual Specific Variable	Variable Description
Meat Avoid	Dummy = 1 if the consumer adheres to a vegan, vegetarian, or pescatarian diet.
Flexitarian	Dummy = 1 if the consumer adheres to a flexitarian diet.
Conservative	Dummy = 1 if the consumer is politically conservative.
Under \$100k	Dummy = 1 if the consumer earns less than \$100,000 per year before taxes.
Millennial	Dummy = 1 if the consumer is between the ages of 18-34.
Senior	Dummy = 1 if the consumer is over 65 years old.
Neophobic	Dummy = 1 if the consumer’s food neophobia score is 3 out of 5 or higher.

Eastern Canada	Dummy = 1 if the consumer resides in Ontario, Quebec, or the Maritime provinces.
Food Values Health	1-5 Likert scale regarding the importance of health and nutrition in food purchasing decisions. ⁴
Food Values Environment	1-5 Likert scale regarding the importance of environmental sustainability in food purchasing decisions. ⁴
Food Values Taste	1-5 Likert scale regarding the importance of taste in food purchasing decisions. ⁴
Food Values Familiarity	1-5 Likert scale regarding the importance of familiarity in food purchasing decisions. ⁴
Food Values Naturalness	1-5 Likert scale regarding the importance of naturalness in food purchasing decisions. ⁴
Confused	Dummy = 1 if the consumer reported confusing a plant-based meat alternative for real meat while grocery shopping in the past.

¹ Interpreted relative to the “no purchase” option in the same policy treatment.

² Interpreted relative to beef in the unregulated policy scenario.

³ Interpreted as deviation in preferences from the unregulated scenario for the pea/soy product. Captures the effect of labelling policy relative to the absence of it.

⁴ Where 1 is not important at all and 5 is extremely important.

Prior to the presentation and discussion of results, it is necessary to reiterate the context in which these choice models are interpreted. The results from these choice models are best interpreted in relative terms, meaning parameter estimates for various product attributes should be thought of as comparisons with the parameters of other attributes in the model. So, these results show the relative value Canadian consumers place on plant-based meat alternatives and their attributes under different policy treatments. While willingness-to-pay estimates are considered more tangible than marginal utility parameters, it is important to consider those values in relative terms as well. These results are only informative when considered within the correct context.

5.4.1 Multinomial Logit Model Results

The results from the multinomial logit model (MNL) specified in Section 4.5.1 are displayed in Table 5.9. This model did not require any filtering for non-responses, therefore utilizing the full sample. These results constitute the base model for this analysis.

Table 5.9: Multinomial logit model parameters for ground beef and plant-based alternatives product choices.

Variable	Coefficient
Price	-0.2417***
An Excellent Source of Protein	0.2731***
A Complete Source of Protein	0.4466***
Certified Carbon Neutral	0.1641***
Pea, Unregulated ¹	-1.0728***
Pea, Canadian Regulations ²	-0.4738***
Pea, Meat-related Terms Ban ²	-0.5309***
Soy, Unregulated ¹	-1.0366***
Soy, Canadian Regulations ²	-0.6891***
Soy, Meat-related Terms Ban ²	-0.6885***
Purchase, Unregulated	2.3055***
Purchase, Canadian Regulations	2.6632***
Purchase, Meat-related Terms Ban	3.1821***
Model Statistics	
Number of Respondents (6 choices each)	1203
Log-Likelihood	-8015.58
Pseudo R-square	0.1989
Adjusted Pseudo R-square	0.1976

¹ Interpreted relative to the beef product in the unregulated policy treatment.

² Interpreted as deviation in preferences from the unregulated scenario for the pea/soy product. Captures the effect of labelling policy relative to the absence of it.

* Significance at $p < 0.10$

** Significance at $p < 0.05$

*** Significance at $p < 0.01$

The base model coefficients are interpreted as the average marginal utility that consumers derive from each attribute in the model. Each estimated coefficient is significant at the 1% level.

The model fit is slightly less than desirable, with a pseudo r-square of 0.1989; Hensher et al, (2015) indicate that a pseudo r-square of at least 0.3 is ideal for choice models.

The MNL model results reveal some interesting insights about consumer preferences for ground beef and plant-based alternatives. The coefficient for price is negative, indicating that the marginal utility of spending money is negative,⁸ consistent with economic theory. Utility associated with purchasing a product, expressed relative to selecting the no purchase option, is positive and significant for all three policy treatments. Oddly, preferences for product purchase are particularly strong in the meat-related terms ban treatment. “No purchase” was chosen 314 times in the ban treatment, while it was chosen 482 and 485 times in the unregulated and Canadian treatments respectively. Since the preferences for meat and plant-based products are similar between the Canadian and meat-related terms ban treatments, it appears that the high propensity to purchase products under a meat-related terms ban does not result in drastic changes to substitution patterns between meat and plant-based alternatives, relative to the trends observed in other treatments. Instead, it appears that choice proportions between ground beef and plant-based substitutes remain similar to other treatments, mostly at the expense of selecting the “no purchase” alternative. In other words, while products are purchased more often under a meat-related terms ban, substitution patterns between the protein sources remain fairly consistent.

Coefficients for the unregulated pea and soy alternatives in the treatment are interpreted relative to beef in the same policy treatment. The negative and statistically significant coefficients for these attributes implies that consumers generally prefer beef to plant-based options. The effects of labelling policy are accounted for in the other interaction terms: Pea, Canadian Regulations, Pea, Meat-related Terms Ban, Soy, Canadian Regulations, and Soy,

⁸ Thereby implying a positive value for the marginal utility of money or income.

Meat-related Terms Ban. These parameters are interpreted as the changes in preferences for meat alternatives consumers incur when either of the two labelling policies are in place, from the baseline unregulated scenario. So, negative values for these parameters mean that plant-based options are preferred relatively more under the unregulated labelling policy framework than in the other treatments where regulations are present. Therefore, preferences for plant-based ground beef decrease when regulations are introduced. These results mostly align with prior expectations. Ground beef is generally preferred to plant-based alternatives, while plant-based options are most preferred when label language is unregulated. Preferences for plant-based options decrease further in the presence of labelling regulations. The small difference in utility between the Canadian and ban treatments is somewhat surprising and indicates that Canadian label disclaimers are functionally similar to a meat-related terms ban in the aggregate.

Parameters for claims displaying carbon neutral production, an excellent source of protein, and a complete source of protein are all positive and significant as expected. Interestingly, consumers tend to prefer a complete source of protein claim to an excellent source of protein, indicating that obtaining a full suite of amino acids from plant-based meat alternatives is generally more important than high protein content. Confirming the attitudinal observations from Section 5.3, consumers exhibit stronger preferences for health and nutrition claims than they do for sustainability claims. This result is of interest as it contradicts the findings of several other studies (Van Loo et al, 2020; Ye and Mattila, 2021) and implies that firms could increase demand for their products by promoting the nutritional qualities of their products.

While the MNL model yields some interesting results about consumer preferences for plant-based meat alternatives under different labelling policy frameworks, further modelling and analysis is necessary to properly quantify these preferences across heterogeneous consumers.

Expanding the analysis to incorporate and assess consumer preference heterogeneity will improve model fit, overcome unrealistic assumptions posed by the MNL, and paint a clearer and more realistic picture of the demand for plant-based meat alternatives and the ways in which labelling regulation impacts that demand for various consumer groups.

5.4.2 Random Parameters Logit Model Results

As outlined in Chapter 4, the Random Parameters Logit model (RPL) incorporates consumer preference heterogeneity by assuming each consumer has their own unique preferences for alternatives and attributes, which fall under a distribution specified by the researcher. Thus, the RPL model output includes both mean and standard deviation estimates for each parameter specified as random. Meanwhile, price and the purchase parameters were specified as fixed. Careful consideration was given to the specification of random parameters, illustrating preference heterogeneity for only the attributes and policy effects of particular interest for this research. The standard deviation parameters are indicative of the degree of preference heterogeneity for each alternative and attribute included in the choice experiment.

Results from the RPL model are found in Table 5.10.

Table 5.10: Random parameters logit model parameters for ground beef and plant-based alternatives product choices.

Variable	Parameter Mean	Parameter Standard Deviation
Price	-0.3653***	N/A
An Excellent Source of Protein	0.4049***	0.8035***
A Complete Source of Protein	0.5704***	1.3087***
Certified Carbon Neutral	0.2158***	1.3359***
Pea, Unregulated ¹	-2.2343***	2.5313***
Pea, Canadian Regulations ²	-1.3776***	2.3242**
Pea, Meat-related Terms Ban ²	-1.5974***	2.2375***
Soy, Unregulated ¹	-2.2555***	2.6249***
Soy, Canadian Regulations ²	-1.7799***	2.4077***
Soy, Meat-related Terms Ban ²	-1.6155***	2.4980***
Purchase, Unregulated	3.3152***	N/A

Purchase, Canadian Regulations	3.7791***	N/A
Purchase, Meat-related Terms Ban	4.3499***	N/A
Model Statistics		
Number of Respondents (6 choices each)	1203	
Log-Likelihood	-6846.7	
Pseudo R-square	0.3158	
Adjusted Pseudo R-square	0.3136	

¹ Interpreted relative to the beef product in the unregulated policy treatment.

² Interpreted as deviation in preferences from the unregulated scenario for the pea/soy product.

* Significance at $p < 0.10$

** Significance at $p < 0.05$

*** Significance at $p < 0.01$

The RPL model results displayed in Table 5.10 indicate that each estimated mean parameter is statistically significant at the 1% level. Further, the standard deviation parameters are significant at the 1% for all model components besides Pea, Canadian Regulations, which retains statistical significance at the 5% level, implying that there is significant preference heterogeneity associated with each of the random parameters, as expected. The RPL model fits the data well, with a pseudo r-square value greater than 0.3.

Overall, the RPL results carry similar interpretations to those from the MNL, but with the added context provided by the analysis of preference heterogeneity. Plant-based products remain unfavourable relative to beef, though the disparity is smallest in the unregulated labelling treatment. Standard deviation estimates for the plant-based attributes imply that preferences for these products have a wide range across consumers, from being valued positively relative to beef, to extremely undesirable. There is also significant preference heterogeneity in the effects of labelling policy relative to the unregulated base scenario. The introduction of labelling policy results in decreased mean preferences for meat alternatives, alongside additional preference heterogeneity from the unregulated baseline scenario. Interestingly, preferences decline most for pea products in the ban treatment, while preferences are lowest for soy products in the Canadian

policy treatment. This result indicates that the inclusion of additional label information which makes obvious the plant-based nature of these products can have vastly different effects on consumer preferences and highlights the importance of obtaining a stronger understanding of what might drive these differing responses to regulated labels from the baseline scenario. For some consumers, such as meat-avoiders and meat-reducers, these policy effects may positively influence demand. However, for non-traditional consumers of plant-based meat alternatives, these changes to the labels of plant-based meat alternatives likely reduce their propensity to purchase them. Further, if consumers are confused or inattentive in the unregulated policy environment, the introduction of labelling policy could mitigate those issues, resulting in different purchase behaviour. This assessment provides context for the Latent Class Logit model (LCL), where the sources of preference heterogeneity illustrated by the RPL model can be analyzed.

5.4.3 Latent Class Logit Model Results

As mentioned previously, the LCL model operates on the assumption that while consumers are broadly heterogeneous, they have homogeneous preferences within classes or segments. Membership to these consumer segments is determined by a class membership function incorporating behavioural, attitudinal, and socio-demographic characteristics. The membership function was defined to include consumer characteristics relevant to this research, drawing on insights from the literature review. While the researcher can include seemingly endless parameters in the class-membership function, often improving statistical fit, it is important to consider the drawbacks of over-specification. Namely, that as variables are introduced to the model, the explanatory power of other variables wanes. Therefore, the

researcher must be cognizant of the impacts that certain parameters may have on others when selecting which characteristics to include in the class membership function. Care was taken in selecting relevant variables for the class membership function to avoid overlapping effects, over-specification issues, and mitigate correlation between variables.⁹ Prefer not to say responses for the income variable were filtered out of the sample, thereby reducing the sample by 89 respondents. This filtering was only performed for the LCL model.¹⁰

Beyond the membership function, the researcher must also exogenously specify the number of classes in the LCL model. Boxall and Adamowicz (2002) outline the statistical criteria that should be utilized to make this decision, including the Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC) and the value of the Log-likelihood function at model convergence. Models from three to six classes were estimated with the same choice parameters and membership function. Ultimately, a 5-class LCL model was selected. The 5-class model exhibited stronger statistical fit than the 3-class and 4-class models respectively.¹¹ Meanwhile, the 6-class model exhibited worse statistical criteria than the 5-class model, demonstrating that the inclusion of additional classes was unlikely to improve fit, and cementing the 5-class model as most appropriate for the analysis. A comparison of model fit statistics can be found in Appendix 2.

The LCL model results are presented in Table 5.11. Class descriptions are based upon the preferential and characteristic profile of each segment and are discussed in detail in the following sections. These descriptions are not empirically driven but rather provide analytical and

⁹ An example of these selection decisions is the exclusion of a “Food Values Animal Welfare” variable. While animal welfare concerns can be an important driver in the decision to eat meat, the ethical motivators of consumption are captured by Food Values Environment to avoid overlap of effects in the analysis. The correlation coefficient between Food Values Animal Welfare and Food Values Environment is 0.62.

¹⁰ $n = 1114$.

¹¹ Lower values for AIC and BIC, and higher Log-likelihood function value at convergence.

descriptive context based upon the observations of utility and class parameter results. Parameter estimates are reported for each of the five estimated classes by column. The 4-class model results, including a brief comparison with the model presented in Table 5.11, can be found in Appendix 3.

Table 5.11: Latent class logit model parameters for ground beef and plant-based alternatives product choices.

Variable	Class 1: Health- focused Omnivores	Class 2: Price- conscious Meat-eaters	Class 3: Non- purchasers	Class 4: Sustainability -focused Meat- reducers	Class 5: Committed Meat-eaters
Class Probability	15.46%	14.96%	11.51%	24.99%	33.08%
Utility Parameters					
Price	-0.9627***	-1.1256***	-0.1393**	-0.2333***	-0.2210***
An Excellent Source of Protein	0.7760***	-0.4175	0.2075	0.7543***	0.6333***
A Complete Source of Protein	0.9629***	0.0205	0.6025**	0.9876***	0.9948***
Certified Carbon Neutral	0.4495***	-0.6316***	0.1993	0.7559***	-0.0191
Pea, Unregulated	-0.8264***	-4.7250***	-1.2262***	0.7379***	-4.1154***
Pea, Canadian Regulations ¹	-0.0234	-0.3778	-0.0053	-0.0331	-0.1516
Pea, Meat-related Terms Ban ¹	-1.0108**	-1.8839*	-6.4322	-0.1539	-0.6396
Soy, Unregulated	-0.5188**	-4.9758***	-0.5554*	0.5840***	-4.4477***
Soy, Canadian Regulations ¹	-0.0915	-0.1450	-1.1120*	-0.3061	-0.7867

Soy, Meat-related Terms Ban ¹	-1.8634***	-7.3225	-0.7920	-0.1759	-0.1078
Purchase, Pooled Treatments	10.5098***	9.8099***	-1.8222***	2.3166***	5.4774***
Class Membership Parameters (Class 5 is Reference Class)					
Meat Avoid	0.4263	0.5394	4.0004***	4.5216***	
Flexitarian	0.1428	-0.7287*	1.0144***	1.2481***	
Conservative	-0.5817*	-0.2893	-0.6898**	-0.4044	
Under 100K	-0.1182	0.2128	0.7531***	-0.0406	
Millennial	1.0782***	-0.0563	-0.0832	0.6721***	
Senior	-1.1482***	-0.3282	-0.3124	-0.6185**	
Neophobic	0.0751	0.4136*	0.2487	0.03389	
Food Values Health	-0.2501	-0.1769	0.0865	-0.0809	
Food Values Environment	0.2713**	-0.1876	0.0810	0.5553***	
Food Values Taste	-0.0635	0.0417	-0.2477	-0.1953	
Food Values Familiarity	-0.2048	-0.2175*	-0.4437***	-0.3438***	
Food Values Naturalness	-0.2583*	0.1096	0.3229**	0.2038	
Confused	0.2431	0.1085	0.0390	0.6391**	
Constant	1.1227	0.6327	-0.9702	-1.1493	
Model Statistics					
Number of Respondents (6 choices each)	1114				
Pseudo R- square	0.4917				
Pseudo Adjusted R- square	0.4798				
Log-likelihood	-4709.56				

Akaike Information Criterion	9641.13
Bayesian Information Criterion	10595.64

¹ Interpreted as deviation in preferences from the unregulated scenario for the pea/soy product. Captures the effect of labelling policy relative to the absence of it.

* Significance at $p < 0.10$

** Significance at $p < 0.05$

*** Significance at $p < 0.01$

As with the other choice models estimated previously, the results of the LCL model are best interpreted in relative terms, rather than as absolute, standalone values. Besides Purchase, Pooled Treatments, which combines purchase-related preferences from across the three treatments to facilitate successful model convergence, the utility parameters carry the same interpretations as the MNL and RPL. Price remains negative and significant across classes, though with contrasting magnitudes. Protein claims generally elicit positive utility values, typically greater in magnitude than the sustainability claim. Beef is strongly preferred by four of the five classes, while the policy effects vary significantly across segments of consumers. The consequent subsections outline the five classes from the LCL model, discuss differences in utility parameters, and summarize the consumer characteristics found to be influential in class membership determination. Importantly, all class-membership parameters are expressed relative to Class 5 and should only be interpreted as such for the other four classes.

5.4.3.1 Class 1: Health-focused Omnivores

The first class of consumers, dubbed “Health-focused Omnivores,” constitutes 15.46% of respondents. This group of consumers tend to be younger than 35 years old and express a relatively high importance of environmental sustainability in their food purchasing decisions.

Meanwhile, they are unlikely to be politically conservative, or express a high degree of importance for naturalness in food purchasing.

These consumers exhibit strong preferences for both regulated protein claims, and while this class of consumers prefers beef, their preferences are weaker than the other three meat-preferring classes. This mix of preferences implies that outside of consumers who already purchase and prefer plant-based meat alternatives, this class of consumers may be the most likely to begin incorporating plant-based meat alternatives into their diet, particularly if marketing efforts emphasize the health-related attributes of plant-based meat alternatives. However, these consumers are also sensitive to price, so dietary changes may be hindered by the relatively high prices of plant-based meat alternatives in the current marketplace. Since meat and plant-based options in the choice experiment used the same price scale, the effects of this price-sensitivity when prices diverge is unclear. However, the relatively high prices of plant-based meat alternatives would likely result in reduced selection of plant-based options for this segment than the choice experiment results reveal.

A meat-related terms ban would also pose a barrier to increased consumption of plant-based meat alternatives for this class. This segment of consumers incurs a significant decline in utility for plant-based meat alternatives in the meat-related terms ban treatment. Therefore, any future policies that hinder the ability of plant-based meat alternative firms' use of meat-related terms is likely to elicit a negative demand response for this segment of consumers and dissuade them from incorporating plant-based meat products into their diets. There is no significant difference in preferences between the unregulated base scenario and Canadian regulations treatment. These consumers appear to dislike the alternative wording necessitated by the meat-

related terms ban, likely making these products sound strange or unfamiliar and therefore eliciting a negative demand response.

5.4.3.2 Class 2: Price-conscious Meat-eaters

Class 2 is similarly sized to Class 1, composed of approximately 15% of respondents. These people are unlikely to be flexitarians. While they are the most likely segment to be food neophobic, they are also relatively unlikely to focus on familiarity when making food purchasing decisions. This contradiction is as interesting as it is confounding, perhaps suggesting that food neophobic consumers are unaware of their aversions to unfamiliar food products.

This segment of consumers is the most price-sensitive in the model by a fairly wide margin. They are indifferent to protein claims, and discount products with a carbon neutral label. These consumers strongly prefer beef to plant-based meat alternatives, and are insensitive to the policy treatments, outside of a meat-related terms ban on pea-based products. Those belonging to this class appear to be impervious to label information and are instead driven by price and established meat-eating tendencies. Thus, policy changes with respect to nutrition labelling and meat-related terms are unlikely to elicit much of a demand response from these consumers, as they express meat purchasing tendencies unrelated to those issues.

5.4.3.3 Class 3: Non-purchasers

Class 3 makes up 11.51% of consumers and is primarily defined by negative and significant preferences associated with purchasing a product. These consumers prefer not making a purchase under the grocery shopping scenario imposed by the DCE, implying that they do not purchase ground beef or alternatives, even though they display low levels of price sensitivity. This segment of consumers is also generally indifferent toward label claims on these products, with significant preferences only for “A Complete Source of Protein.” When these consumers do

purchase a product, they prefer beef, though the strength of those preferences are not to the degree of Class 2 or Class 5. Further, these consumers are not very sensitive to labelling policy, only experiencing a significant utility discount for soy-based ground under Canadian labelling regulations.

The class membership parameters provide a reasonable explanation for this segment's propensity to be non-purchasers. Consumers in this class are highly likely to adhere to a meatless or meat-reducing diet. They are the most likely class to earn less than \$100,000 in annual household income and are unlikely to be politically conservative. While familiarity is not important in their food purchasing decisions, aspects of naturalness are important. In combination, these results may indicate that these consumers may be meat avoiders that are so averse to ground beef (and potentially other meat products as well) that even plant-based analogues are unappealing. The parameters associated with label claims and food values indicate that these preferences are not necessarily driven by nutritional or ethical purchase motivators; rather these consumers may perceive plant-based meat alternatives as unnatural, and therefore unsuitable replacements for meat in their diet. They may be comfortable with meatless cooking and are not interested in replacing meat with meat simulants.

The policy implications for this segment are rather limited. Non-purchasers are not sensitive to labelling policy, and label claims do little to stimulate demand. However, this class poses concerning implications for the plant-based meat alternative industry. The preferences of this class indicate that certain meat-reducing consumers are not interested in plant-based meat alternatives. In fact, they may be so averse to plant-based meat alternatives that they prefer beef, despite their dietary habits. The fact that 26.7% of respondents adhere to these meatless or meat-

reducing dietary habits¹² seems to imply a robust market for plant-based meat alternatives. However, if a significant portion of those consumers are non-purchasers of meat alternatives, plant-based meat alternative firms may need to invest significant resources to access consumers belonging to other consumer classes and secure market growth going forward.

5.4.3.4 Class 4: Sustainability-driven Meat-reducers

Class 4 is the second largest in the LCL model, inclusive of approximately 25% of consumers. Class 4 is notable because it is the only segment with positive utility values for plant-based meat alternatives relative to beef. Consumers in this segment are not particularly price-sensitive, meaning the relatively high market prices for plant-based meat alternative likely do not pose too much of a barrier in their purchasing decisions. Class 4 consumers tend to be younger, and do not value familiarity in their food purchasing decisions. Like the non-purchasers of ground beef and alternatives, consumers in Class 4 are highly likely to adhere to vegan, vegetarian, pescatarian, or flexitarian diets. In contrast however, these dietary habits seem to be driven by ethical motivations, as these consumers are likely to value environmental sustainability in their food purchasing decisions and have the strongest positive preferences for the carbon neutral label claim. Thus, sustainability-related perceptions of plant-based meat alternatives drive preferences for this class of consumers. This profile aligns with the findings of Tonsor et al (2022), who found approximately 25% of American consumers to select a plant-based meat alternative instead of beef in a binary choice scenario, many of whom adhere to meatless or meat-reducing diets. Class 4 consumers also have strong preferences for both protein claims, implying that they are highly responsive to information on label claims.

¹² Table 5.2.

Despite receptivity to label claims, this segment of consumers does not experience significant demand effects from changes in labelling policy. This is likely because these consumers actively prefer plant-based meat alternatives over beef. Policy-driven preference changes for plant-based meat alternatives do not occur in Class 4 because these consumers prefer plant-based meat alternatives regardless of the terms permitted on the label. These consumers seem to absorb and respond to label information, but do not perceive label changes associated with the Canadian and ban policy frameworks as significantly negative.

A contrasting note is that Class 4 is the only group of consumers that is significantly likely to have confused a plant-based meat alternative for real meat in past grocery shopping experiences. This result does not necessarily imply that these consumers are confused to the point of mistaken purchasing, but it may indicate that these consumers perceive plant-based meat alternatives to be very similar to meat, and that some degree of confusion between those products exists. Even consumers that appear responsive to label information indicate instances of difficulty in differentiating between meat and plant-based alternatives. In terms of policy implications, this suggests that even though the demand effects of plant-based meat alternatives labelling policy are minimal for this class of consumers, there may be value in regulations that sufficiently indicate the plant-based nature of meat alternatives to mitigate consumer confusion. Policy instruments that minimally affect behaviour but provide necessary information to consumers are ideal from both the policymakers' and consumers' perspectives.

5.4.3.5 Class 5: Committed Meat-eaters

The final consumer segment identified by the LCL model is the largest, containing approximately one third of consumers. This class is defined as “Committed Meat-eaters,” primarily due to their strong aversion to plant-based meat alternatives. These consumers value

both protein claims, which in combination with their meat-consumption preferences, implies that they view traditional meat products as suitable, healthy sources of dietary protein and are unlikely to change their protein consumption habits based on the nutritional qualities of meat alternatives. Meanwhile, preferences for the sustainability claim are not statistically significant.

These consumers are impervious to labelling policy; they are unlikely to purchase plant-based meat alternatives regardless of the language and framing of labels. In this respect, Class 5 consumers are similar to those in Class 2. However, committed meat-eaters are not nearly as price-sensitive as price-conscious meat-eaters, a key differentiator between these two groups.

All class membership parameters in the LCL model are expressed in terms relative to this group. So, while there are no class membership function coefficients presented for Class 5, characteristics of these consumers can be analyzed through comparisons with the parameters estimated for the other four classes. Consumers in this class are significantly less likely to be meat avoiders or flexitarians than Classes 3 and 4, but more likely to be flexitarians than Class 2 consumers. Committed meat eaters are more likely to be politically conservative than Class 1 and Class 3, and likely older than those in Class 1 and Class 4. They are relatively unlikely to value environmental sustainability in their food purchasing decisions, but tend to value familiarity, likely posing a barrier to substitution away from meat.

5.4.4 Willingness-to-Pay Estimates

While marginal utility estimates provide valuable insight into the relative importance consumers place on the various attributes available in the choice experiment, and the effect of policy change on those preferences, there is an inherent lack of tangibility and accessibility in the interpretations associated with these estimates. In choice models, utility is considered ordinal,

where only differences in utility matter (Hensher et al, 2015).¹³ In this sense, the concept of utility is rather abstract and unintuitive, grounded not in standardized or unitary terms but rather in comparison with utility estimates for other attributes or products. Therefore, it is difficult to truly assess the practical implications of the choice experiment results for both marketers and policymakers with estimates that lack context outside of the experiment itself.

To provide additional context and a deeper understanding of both market and policy implications of the choice experiment results, marginal willingness-to-pay (WTP) estimates were calculated for both the MNL and LCL models, by the method outlined in Section 4.4.4. WTP estimates were not calculated for the RPL model for the sake of brevity, given its role as a bridge between the MNL and LCL models. Like marginal utility estimates, WTP results remain best interpreted relative to one another. However, estimates expand upon marginal utilities in two ways. First, they are presented in tangible, monetary terms, facilitating a more intuitive interpretation of the results. Second, WTP estimates account for the price sensitivity of consumers. This becomes particularly valuable when applied to the LCL model, where heterogeneous price sensitivity will impact the consumer's willingness-to-pay for different attributes, regardless of relatively high marginal utilities for those attributes. The marginal WTP estimates for the MNL and LCL models are presented in Table 5.12.

¹³ As opposed to cardinal utility, where both the value and magnitude of utility, measured in utils, is meaningful (Hensher et al, 2015).

Table 5.12: Willingness-to-pay estimates from the MNL and LCL models.

Variable	MNL	Class 1: Health- focused Omnivores	Class 2: Price- conscious Meat- eaters	Class 3: Non- purchasers of Ground Beef and Alternatives	Class 4: Sustainab ility- focused Meat- reducers	Class 5: Committe d Meat- eaters
An Excellent Source of Protein ¹	\$1.13***	\$0.81***	-\$0.37	\$1.49	\$3.23***	\$2.87**
A Complete Source of Protein ¹	\$1.85***	\$1.00***	\$0.02	\$4.33	\$4.23***	\$4.50***
Certified Carbon Neutral ²	\$0.67***	\$0.47**	-\$0.56**	\$1.43	\$3.24***	-\$0.09
Pea, Unregulat ed ³	-\$4.44***	-\$0.86***	-\$4.20***	-\$8.81	\$3.16***	-\$18.62***
Pea, Canadian Regulation s ⁴	-\$1.96***	-\$0.02	-\$0.34	-\$0.04	-\$0.14	-\$0.69
Pea, Meat- related Terms Ban ⁴	-\$2.20***	-\$1.05	-\$1.67	-\$46.19	-\$0.66	-\$2.89
Soy, Unregulat ed ³	-\$4.29***	-\$0.54*	-\$4.42***	-\$3.99	\$2.50***	-\$20.13***
Soy, Canadian Regulation s ⁵	-\$2.85***	-\$0.10	-\$0.13	-\$7.99	-\$1.31	-\$3.56
Soy, Meat- related Terms Ban ⁵	-\$2.85***	-\$1.94***	-\$6.51***	-\$5.69	-\$0.75	-\$0.49

¹Compared to the absence of a protein claim

²Compared to the absence of a sustainability claim

³Compared to beef in the unregulated base scenario

⁴Compared to pea products in the unregulated base scenario

⁵Compared to soy products in the unregulated base scenario

The WTP estimates are fairly aligned with the marginal utility parameters discussed previously for the MNL and LCL models. However, the incorporation of price with preferences for attributes and policy treatments provides a more tangible explanation of market demand for plant-based meat alternatives under different regulatory structures. The WTP results from the MNL model tell a similar story to that discussed earlier, where the Canadian and meat-related terms ban policy environments elicit similar demand effects, resulting in reduced WTP estimates for plant-based options relative to the unregulated scenario. In other words, negative WTP estimates for the plant-based options imply that consumers would need to be compensated to accept those products relative to beef. The monetary value required to accept the plant-based options increases in the presence of labelling policy. While soy is relatively favourable to pea in the absence of labelling policy, soy products incur a larger discount under the policy treatments, indicating that heightened awareness of the soy attribute may dissuade consumers from buying those products. “A Complete Source of Protein” elicits the highest WTP among the label claims. While consumers exhibit positive WTP for the sustainability claim, it is considerably less than that for both protein claims.

The LCL WTP estimates reveal some interesting results that expand upon the LCL model utility parameter estimates. Since each class of consumers has a unique marginal utility for spending money, WTP estimates may differ from marginal utilities for attributes and policy treatments. Class 3 (non-purchasers of ground beef and alternatives) is a clear example of how utility preferences can diverge from WTP. Class 3 consumers have a relatively low (in magnitude) marginal utility of money. Because the small-in-magnitude parameter is the

denominator in Equation 4.18, Class 3 WTP estimates inflate and lose statistical significance. This result is intuitive for this group of consumers. As non-purchasers of ground beef and alternatives, these consumers display statistically insignificant WTP for these products and associated attributes. In this way, WTP estimates facilitate a more realistic and tangible explanation of consumer preferences for plant-based meat alternatives and associated policy frameworks.

Consumers in Class 1 and Class 2 exhibit a relatively high-in-magnitude marginal utility of spending money, which poses a contrasting effect from Class 3. WTP estimates are therefore similar in relative terms to their marginal utilities, and both classes of consumers incur a significant decrease in WTP for soy products under a meat-related terms ban. In Class 4, the pea and soy WTP estimates remain positive and significant, implying that these consumers are willing to pay a premium for plant-based meat alternatives relative to ground beef. Further, they incur no significant discount with respect to labelling policy. Finally, Class 5 consumers remain staunchly in favour of meat products and would require a large price discount to accept plant-based meat alternatives. The divergence of Class 5's preferences from Class 2 in the WTP values is further illustrative of the key context WTP estimates provide. A lack of price sensitivity for Class 5 consumers relative to those in Class 2 results in much larger-in-magnitude WTP estimates for committed meat-eaters. However, they still do not incur a significant changes to preferences for meat alternatives with respect to labelling policy.

5.5 Referendum and Public Opinion of Labelling Policy Frameworks

To gauge public opinion regarding the use of meat-related terms on the labels of plant-based meat alternatives, a referendum question was posed to respondents. Prior to answering the referendum question (but after completing the choice experiment), each of the labelling

treatments was revealed and explained to respondents. Survey respondents were shown labels adhering to the same product under the three policy treatments, allowing for comparison among the policies and ensuring that the referendum was taken with informed voters. After viewing the information presented to them, respondents were asked to confirm that they had read and understood the labelling policy treatments, and then proceeded to vote. The referendum results are displayed in Table 5.13.

Table 5.13: Results from the referendum on plant-based meat alternative labelling policy framework in Canada.

Policy Framework	Percent Preferred
Unregulated Labelling	1.7%
Current Canadian Regulations	62.0%
Meat-related Terms Ban	24.4%
Don't Know/No Opinion	11.9%

The vast majority of Canadian consumers surveyed believe that the current labelling regulations for plant-based meat alternatives are sufficient, and do not advocate change from the status quo. This implies that most consumers feel that the existing policy framework, which utilizes label disclaimers, is sufficient in preventing consumer confusion between meat and plant-based alternatives. However, a sizeable minority of consumers express a preference for a meat-related terms ban. This desire for policy change indicates that the issues posed by plant-based meat alternative labelling may not be completely settled. These policy preferences may be driven by a desire to reduce consumer confusion by ensuring meat and plant-based alternatives are viewed as separate products, or feelings of protectionism for the meat industry.

Approximately 12% of voters are indifferent or unsure about their policy preferences. Meanwhile, only 1.7% of respondents are in favour of an unregulated policy environment, which would allow plant-based firms to label their products without government-imposed guidelines or restrictions. It is interesting to note that, while plant-based meat alternatives are most appealing

to consumers in the unregulated policy treatment, the vast majority of respondents are not in favour of an unregulated labelling policy environment. This disparity between market and policy preferences is a phenomenon known as the vote-buy gap and has been demonstrated in other agri-food policy scenarios such as cage-free eggs (Paul et al, 2019). This discrepancy is an important consideration for policymakers. Deviations from the current regulatory framework must weigh the political will of voters against actual market preferences and associated impacts of policy change.

Comparisons with the report from the Canadian Food Inspection Agency's public consultation regarding plant-based meat alternative policy (CFIA, 2021c) provides valuable context for the results of the referendum. According to the CFIA report, 62% of respondents consider the current guidelines to be clear, aligning with the portion of referendum voters who prefer the current Canadian regulations. While the scope of the CFIA report is considerably broader than the policy analysis of this research, these similarities show that Canadians are largely satisfied with current regulatory efforts to curb issues that may arise from meat alternative labelling. Despite broad satisfaction with current plant-based meat alternative regulations, respondents to the CFIA consultation did indicate that additional clarity in certain policy areas could provide further improvement from the status-quo, though these adjustments would likely be less drastic than a ban on meat-related terms, for example.

Specifically pertaining to the issues surrounding meat-related terms, the CFIA's consultation report (2021c) notes that 66% of respondents believe that plant-based meat alternative firms should be permitted to utilize meat-related terminology. While these sentiments align with the results from the referendum, they are in contrast with those of Van Loo et al (2020), who found that over 70% of American consumers believe plant-based meat alternatives

should be prohibited from using the word “beef” on product labels. This disparity between Canadian and American consumer perceptions regarding meat-related terms may simply be cultural. However, the study by Van Loo et al (2020) took place during the time where meat-related terms were a hot-button topic in American agri-food policy, with several state governments banning them in that timeframe. Opinions may have since relaxed as the policy debate in the United States has cooled somewhat. Notably, the findings of Van Loo et al (2020) pertain only to the word “beef,” so extrapolations of these results to other meat-related terms may not perfectly align.

Chapter 6 Summary, Implications, and Conclusions

The final chapter of this thesis summarizes the key findings and results, which are discussed in comparison with the current body of literature. Then, policy and market implications of the results are explained and analyzed. Limitations of this research are outlined. Finally, suggestions for future research are explored.

6.1 Summary of Research Objectives and Methods

The primary objective of this thesis was to assess how consumer preferences for meat and plant-based meat alternatives change under different labelling policy structures – in particular, policy which governs use of meat-related terms on product labels. While permitted in Canada, there is significant debate as to whether meat-related terms are appropriate descriptors of plant-based meat alternatives. Despite this policy debate, both in Canada and abroad, research investigating the consumer demand effects of plant-based meat alternative labelling policy was quite limited. The objective is motivated by the gap in the current literature, and findings can provide insight to policy discussions going forward.

Two extensions of this objective were also explored. The first of these extensions was an investigation of consumer demand for two protein-related attributes and associated regulated label claims. Namely, “An Excellent Source of Protein,” and “A Complete Source of Protein” which correspond to high protein content and high protein quality respectively. This extension provided an opportunity to investigate a different aspect of plant-based meat alternative policy – nutrition standards, and regulated claims that communicate that information to consumers. The second extension was an analysis of both the degree and sources of preference heterogeneity for plant-based meat alternatives, their attributes, and labelling policy effects.

A consumer survey containing a discrete choice experiment was selected as the data collection mechanism. The choice data obtained from a representative sample of Canadian consumers was then used in three random utility modelling techniques to address the objectives of this research. The DCE utilized images of product labels, which changed under three different regulatory scenarios, to elicit preferences for ground beef and plant-based alternatives. Label claims were utilized to communicate nutrition- and sustainability-related product attributes and assess consumer preferences for them. Prices were derived from real market prices for meat and plant-based alternatives in Canada.

Three choice models, each with their own set of strengths and weaknesses, were estimated using the survey data. A multinomial logit model serves as the base model, capturing broad, average preferences across consumers. Next, a random parameters logit model is estimated, highlighting the degree of preference heterogeneity for the attributes of plant-based meat alternatives, and protein sources under the three labelling policy frameworks. This model serves as a bridge to the third model estimated for this analysis. The latent class model operates under the assumption that there are classes or groups of consumers, defined by socio-demographic, behavioural, and attitudinal characteristics, among others. Each of these classes display different preferences for ground beef and plant-based alternatives, but preferences are assumed to be homogeneous within each class. The results from this model facilitate an analysis of labelling policy effects and demand for product attributes on identifiable groups of consumers, the implications of which are relevant from market and regulatory perspectives.

6.2 Summary and Discussion of Results

The results of the consumer survey and choice models are presented and discussed in Chapter 5. A number of questions were included in the survey to gather information regarding

the meat consumption habits of Canadian consumers, the current market for plant-based meat alternatives, and the opinions, attitudes, and views of consumers on the matter. Several key insights arise from this analysis. First, consumers tend to value a common subset of product attributes, both with respect to general food purchasing decisions and the specific case of meat and meat alternative purchasing, more than others. These attributes include health and nutrition, price, taste, food safety, and familiarity. Importantly, environmental sustainability and animal welfare are on average relatively unimportant.

Dietary habits, particularly with respect to meat consumption, are changing rapidly in Canada (Charlebois et al, 2018). Therefore, an exploration of the current situation and trends for the future was warranted, providing an updated picture of the market for meat and meat alternative consumption in Canada. In the current survey, only 7.5% of respondents adhere to a meatless diet.¹ 19.2% of respondents identify as flexitarians – those who intentionally reduce their meat consumption without eliminating it entirely, while the vast majority are traditional omnivores (73.2%).

The descriptive statistics provide a detailed overview of the respondents' protein consumption habits, exhibiting a snapshot of the current market and insights for the future. Burger substitutes are the most popular plant-based meat alternative product line by a large margin, followed by ground beef and sausage substitutes. Nearly half of respondents have never consumed a plant-based meat alternative, while nearly 20% of consumers eat these products at least once per week. Meat consumption trends are not perfectly inverse of those for plant-based meat alternatives. Very few respondents avoid meat entirely, though less than half of respondents eat meat daily. Therefore, a large group of omnivorous consumers are not eating meat every day,

¹ Vegan, vegetarian, or pescatarian.

indicating that the proportion of practicing flexitarian consumers may in fact be larger than those who self-identify as such. While a large portion of consumers are unlikely to ever become regular purchasers of plant-based meat alternatives, there are certain segments of consumers who have become enthusiastic purchasers. We can expect these segments to increase in numbers; 23% of respondents plan in incorporating more plant-based meat alternatives into their diets in the future.

Attitudinal data adds depth to this snapshot of plant-based meat alternative consumption. Plant-based meat alternatives tend to be perceived as healthier and more sustainable than meat products. They are also considered to be too expensive, contain too many strange ingredients, and taste dissimilar to meat. These consumer attitudes largely align with the drivers and barriers to consumption of plant-based meat alternatives found in the literature review,² further cementing those findings.

While the descriptive statistics of sample characteristics provide necessary context for the remaining analysis, models utilizing the DCE data are the mechanism by which the research objectives are addressed. The MNL base model results are best interpreted as average preferences across consumers due to the assumptions imposed on the error term in estimation. Several key insights arise from this model. First, beef is broadly preferred by Canadian consumers. On average, consumers exhibit reduced preferences for plant-based products relative to ground beef. Second, this decrease in preferences widens when labelling policy is introduced. This reduction in preferences from the unregulated base scenario is of similar magnitude between the Canadian regulatory structure and the meat-related terms ban. The MNL model is informative; however, given the unrealistic assumptions imposed on the error term and

² See Chapter 2 for a detailed description.

suboptimal statistical performance, additional modelling was necessary to properly address the research objectives.

The RPL model expands upon the MNL model by assuming that each consumer has their own unique preferences under a specified distribution, therefore facilitating analysis of unobserved preference heterogeneity. The interpretation of the mean preference parameters from the RPL model are similar to those of the MNL model, whereas the standard deviation parameters indicate the degree of preference heterogeneity for each component of the utility model, under a normal distribution. The mean effect of labelling policy changes somewhat under this specification. We observe that reductions to preferences are relatively larger under the Canadian policy treatment than the meat-related terms ban for soy products, and an opposite effect for pea products, though each protein source carries a similar degree of preference heterogeneity under both policy frameworks. The high degree of heterogeneity within those preferences indicates that the demand response to labelling policy varies greatly across consumers. There is statistically significant preference heterogeneity for sustainability and protein claims as well.

The RPL model serves primarily as a point of comparison in this research, both with the MNL base model and the LCL model. It reveals the degree of preference heterogeneity associated with each attribute and policy treatment, thereby expanding upon the MNL model. Conversely, the sources of this preference heterogeneity were not included in the RPL model utilized for this research. The LCL model addresses this shortcoming by identifying the relevance of various traits in the formation of consumer segments.

The LCL model results complete the empirical analysis of this research, providing answers for remaining questions associated with the research objectives. A 5-class model was

selected as appropriate for this research, exhibiting stronger statistical criteria than the 3, 4, and 6-class models respectively. Each of the five classes display a different mix of preferences.³ Further, the socio-demographic, attitudinal, and behavioural characteristics specified in the class membership function drive membership probability. Therefore, sources of preference heterogeneity can be identified, and consumer segments defined and explained. Each class is described in detail in Section 5.4.3, while the marketing and political implications of the LCL model results are discussed in the following sections.

In summary, the results of the consumer survey and choice models fulfill the research objectives of this thesis. The first objective – an assessment of whether labelling policy pertaining to meat-related terms affects consumer preferences for plant-based meat alternatives – is clearly addressed. Each choice model exhibits significant impacts on preferences for plant-based meat alternatives when labelling policy is introduced. However, the magnitude of these effects varies among the models.

The second objective pertained to regulated protein claims, and the value consumers place on these claims in the case of plant-based meat alternatives. Broadly speaking, Canadian consumers have strong, positive preferences for protein claims. Further, “A Complete Source of Protein,” indicating that the product has a protein efficiency rating of at least 20 with a full suite of amino acids, tends to be valued more than “An Excellent Source of Protein,” which implies that the product has a protein efficiency rating of at least 40. So, the full suite of amino acids seems to hold increased importance among consumers of ground beef and plant-based alternatives, at least when communicated using regulated claims. Protein claims also tend to be valued more than the sustainability claim, a result that holds across models and most consumer

³ Health-focused Omnivores, Price-conscious Meat-eaters, Non-purchasers of Ground Beef and Alternatives, Sustainability-focused Meat-reducers, and Committed Meat-eaters.

segments. This finding is somewhat contradictory to the literature (Van Loo et al, 2020; Ye and Mattila, 2021), but agrees with Apostolidis and McLeay (2016), who found health-related attributes⁴ outweigh carbon footprint attributes in the case of plant-based meat alternatives. The marketing implications of these results are discussed in detail in the following section.

The third and final research objective was to assess the degree of preference heterogeneity for plant-based meat alternatives under different labelling policy structures. The RPL and LCL model results suggest that consumer preferences for ground beef and plant-based alternatives under varying regulatory structures are heterogeneous. There is a significant degree of preference heterogeneity for plant-based products under the Canadian and ban treatments respectively in the RPL, and varying policy effects across LCL model consumer classes. Certain consumer-specific characteristics, including dietary habit (meat avoidance and reduction), age, and the stated importance of environmental sustainability and familiarity attributes in food purchasing decisions are particularly influential in determining class membership. While hypothesized to be an important driver of preference heterogeneity based on previous literature (Hoek et al, 2011; Apostolidis and McLeay, 2016; Onwezen et al, 2021), food neophobia was only a statistically significant driver of preference heterogeneity for price-conscious meat-eaters, who are relatively likely to be food neophobic. Further, while certain food values such as those pertaining to the environment and familiarity are very influential in class determination, others that were expected to be significant such as health/nutrition and taste, were not. So, while the analysis confirms the presence of preference heterogeneity for plant-based meat alternatives, certain drivers of preference heterogeneity were unanticipated.

⁴ Though pertaining to fat content rather than protein.

6.2.1 Market Implications

Despite a focus on labelling policy, this research reveals several key implications for firms in the plant-based meat alternative market. The first important implication pertains to Canadian consumers' changing dietary habits, which appear to play a large role in the recent market growth of plant-based meat alternatives. The results of this research paint a multifaceted picture of these dietary trends, with contrasting observations indicating a more complex relationship between dietary trends and plant-based meat alternative consumption than previously assumed. While the proportion of self-identifying flexitarian consumers is slightly lower than previous findings in the literature at 19%, over 50% of consumers report eating meat less than once per day. However, only 33% of consumers eat plant-based meat alternatives more than once a month. So, there appears to be a disparity between meat-reducers and regular consumers of plant-based meat alternatives.

While it would be overly presumptive to expect direct dietary substitution from meat to plant-based meat alternatives among meat-reducing consumers all the time, gaining a stronger understanding of these substitution patterns is important in assessing the future of the plant-based meat alternative market in Canada. The LCL model results provide a possible explanation for this disparity between meat reduction and plant-based meat alternative consumption. In particular, the non-purchaser consumer class offers rationale for these meat substitution patterns. These consumers, constituting 11.5% of the market, are likely to be meat-reducers, but are unlikely to purchase plant-based meat alternatives, to the degree that they prefer beef instead. Preference for ground beef while adhering to a meatless or meat-reducing diet is initially confounding. However, their propensity to avoid selecting a product, and values of naturalness in food purchasing decisions, lends insight into their aversion to both meat and plant-based

alternatives. These consumers may perceive plant-based meat alternatives as unnatural,⁵ and therefore do not consider them as suitable replacements for meat, preferring other methods of meatless cooking instead. Only 25% of consumers exhibit positive preferences for plant-based ground beef relative to meat.

Although these findings dampen the promise and substitutability of plant-based meat alternatives, this research reports some encouraging market indicators as well. First, it is important to note that practicing an omnivorous diet doesn't preclude consumers from purchasing and eating plant-based meat alternatives. So, while this snapshot of dietary habits and meat consumption poses some concerns for continued market growth, these are dynamic variables that we should expect to continue evolving. Nearly 23% of consumers intend on incorporating more plant-based meat alternatives into their diets, and a further 38.7% are unsure. The results offer several potential vectors by which firms can continue to expand the market for plant-based meat alternatives.

The LCL model results reveal some of the characteristics and attitudes that drive preference heterogeneity for plant-based meat alternatives, yielding consumer segments with different preferences and characteristics. Only one segment, sustainability-driven meat-reducers, prefer meat alternatives to ground beef. These consumers have the highest WTP for the certified carbon neutral label claim and exhibit strong positive preferences for health claims as well. Plant-based meat alternative firms are already reaching these consumers, appealing to their concerns for the environment and healthy eating.

The remaining four classes prefer beef by varying degrees and constitute opportunities for expansion of the plant-based meat alternative market. Three of these segments – price-

⁵ This interpretation runs counter to Slade (2018), who found that consumers who believe the food they eat should be natural increased the utility of plant-based burgers relative to beef burgers.

conscious meat-eaters, non-purchasers, and committed meat-eaters – are seemingly unlikely to ever become regular consumers of plant-based meat alternatives. These groups constitute approximately 60% of consumers and display strong preferences for beef. Price-conscious meat-eaters are extremely price sensitive, do not respond to protein claims, and express negative preferences for the sustainability claim. So, many of the plant-based meat alternative attributes that consumers find appealing are not of interest to this group. They are also likely to be food neophobic, posing another barrier to consumption. Meanwhile, committed meat-eaters are receptive to protein claims, but are staunchly in favour of beef nonetheless, uninterested in shifting their protein sources.

Of these four consumer segments, the one with the highest propensity to purchase plant-based meat alternatives, regularly or otherwise, is health-focused omnivores. While they prefer beef, their preferences are not as strong as the other beef-preferring segments. These consumers are very responsive to both protein claims and the sustainability claim. However, their WTP estimates are reduced relative to their marginal utilities due to a high degree of price sensitivity. As plant-based meat alternatives approach price-competitiveness with meat in the near future (Sozzi, 2020), price sensitivity may no longer pose a barrier for these consumers.⁶ Continued promotion of appealing product attributes is a potential avenue for accessing health-focused omnivores and market expansion.

Ultimately, this research proposes two potential vectors for plant-based meat alternative firms to expand market share. First, regulated protein claims elicit positive and significant WTP

⁶ This point comes with the caveat that prices in the DCE do not reflect the real market price disparity between meat and plant-based alternatives, where plant-based meat alternatives tend to be more expensive than the meat products they imitate. DCE prices encompassed a range of prices associated with both ground beef and plant-based alternatives, but both types of products adhered to the same price range in the experiment. Therefore, we should expect real purchases of plant-based meat alternatives for this class of consumers to be lower than marginal utility estimates suggest due to this price disparity.

estimates for most consumer groups. This is particularly apparent in consumer segments that are already purchasing plant-based meat alternatives and promoting these attributes to health-focused omnivores could be a strong avenue for increased market share. Protein claims elicit a stronger demand response than a sustainability claim. While plant-based meat alternative firms are already communicating the nutritional benefits of plant-based meat alternatives to consumers, protein attributes are often communicated quantitatively – typically in grams of protein per serving – rather than qualitatively like the claims investigated in this research. Consumer response to protein related attributes may differ based on whether those attributes are communicated quantitatively or qualitatively – it can in other contexts, and qualitative label claims tend to be more salient (Villas-Boas et al, 2020). While a comparison between quantitative and qualitative claims was not performed in this research, findings indicate that consumers are very responsive to nutritional label claims in the case of ground beef and plant-based alternatives.

Although protein claims elicit a significant demand response, there are also differences in preferences between the two claims: “An Excellent Source of Protein,” and “A Complete Source of Protein.” Consumers tend to prefer “A Complete Source of Protein,” which seems to imply that a full suite of amino acids is important consumers, even at the expense of protein content. While label claim descriptions were provided to respondents, it is also possible that consumers were simply more responsive to the word (and associated perceptions of) “complete” than “excellent,” rather than a pure response to the definitions of these claims. All plant-based meat alternatives sold in Canada must have a protein efficiency rating of at least 40, qualifying these products for the “Excellent Source of Protein” label claim (CFIA, 2020a). However, if current or

future products contain the necessary suite of amino acids to warrant the “Complete Source of Protein claim,” promoting this attribute is likely to elicit a positive demand response.

Second, firms should utilize meat-related terms where legally permitted. The WTP discount associated with the meat-related terms ban policy treatment relative to the unregulated labels implies that consumers view these products differently when meat-related terms are not present on labels. This may stem from feelings of unfamiliarity or “weirdness” associated with a product labelled as “crumble” versus the more familiar “ground beef.” Even if disclaimers, such as those required, are necessary in tandem with meat-related terms, it seems that it is in plant-based meat alternative firms’ best interest to appeal to aspects of familiarity and utilize comparisons with analogous meat products when possible.

Finally, this research compared preferences for pea- and soy-based products. Overall, preferences for these different protein sources are similar. As of writing, limited literature assesses whether preferences differ based on the source of protein used in plant-based meat alternative production. Van Loo et al (2020) examine differences in American consumer preferences between pea and plant-based animal-like heme protein, an ingredient that aides in creating the “meaty” flavour of Impossible Foods products. Generally, consumers preferred pea, but became indifferent when exposed to branding and technological information treatments. Ultimately, while some consumers may have strong preferences either way, the differences between soy and pea protein are negligible on aggregate.

6.2.2 Policy Implications

There are several policy implications that arise from this research, which can inform regulators about the demand effects associated with potential changes to plant-based meat alternative labelling policy. Plant-based ground beef is generally most preferred in an

unregulated market, though still much less than beef. The labels in the experimental unregulated market were designed in a way that while clearly labelled as a plant-based product, these indicators are minimized so as not to detract from the promotional effect of the label. These labels may be thought of as a “worst case scenario” for proponents of a meat-related terms ban, and while not intentionally deceptive, there is likely room for confusion, particularly if consumers are inattentive. Additionally, if market incentives align in the absence of regulation, there is always the possibility for deceptive practices, though this does not appear to be an issue in the current Canadian plant-based meat alternative market due to clear labelling regulations.

In aggregate, consumer preferences for plant-based meat alternatives decrease to similar degrees between the Canadian regulations and meat-related terms ban. This implies that, when compared with the unregulated policy scenario, these two regulatory mechanisms are effectively similar. This finding trivializes the argument proposed by certain meat industry advocates that deviation from the status quo to a meat-related terms ban is necessary to combat consumer misperceptions about plant-based meat alternatives. We can extrapolate from these demand effects that the mandatory disclaimers in place in Canada seem to sufficiently differentiate plant-based meat alternatives from real meat, and that a meat-related terms ban would do little to provide further benefit to consumers or firms.

The key difference in consumer response between these labelling policy frameworks in the MNL model is the increased propensity for consumers to purchase a product in the meat-related terms ban, relative to the Canadian regulations treatment, while parameters for protein source attributes remain similar across those treatments. The drivers of this phenomenon are unclear but seem to be isolated to the effects captured by the purchase parameters. One potential explanation could be that the label language employed under a meat-related terms ban makes

plant-based meat alternatives more appealing to meat-reducers and avoiders, while at the same time making the beef product more appealing to committed meat-eaters. Therefore, the perceptions of the label language under a meat-related terms ban could elicit positive demand responses from these two disparate segments of consumers, and on aggregate, boost demand for protein products in general. However, this is conjecture at this point, and these effects may be isolated to the scenario presented by this choice experiment.

The implication that these policies are effectively similar in terms of demand for meat and plant-based alternatives deviates in models that account for preference heterogeneity. Clearly, the information provided to consumers in both the current Canadian regulations and meat-related terms ban policy treatments elicits a heterogeneous demand response, increasing the likelihood of some consumers to purchase meat alternatives, while removing any doubt in the minds of non-consumers of meat-alternatives.

LCL model results show that these demand effects are strongly felt by only certain subsets of consumers. Only one of the five classes exhibit statistically significant policy effects for the current Canadian regulations treatment (non-purchasers for soy-based ground beef). Meanwhile, significant policy effects occur under the meat-related terms ban for health-focused omnivores and price-conscious meat-eaters. The remaining classes of consumers, constituting nearly 60% of respondents, are not significantly affected by labelling policy treatments. Therefore, only certain subsets of consumers are tangibly susceptible to changes in preferences due to labelling policy, while most consumers are likely to continue their current purchase behaviours regardless.⁷

⁷ Where non-purchasers will continue to avoid ground beef and alternatives, sustainability-focused meat-reducers will continue to be enthusiastic consumers of plant-based meat alternatives and committed meat eaters will maintain strong preferences for meat.

It is important to consider the effects of policy on both a population and consumer-specific level. Ultimately, while there are significant, population-level demand effects of plant-based meat alternative labelling policy, these effects are mostly confined to certain subsets of consumers. If enacted, a ban of meat-related terms would likely hinder consumption of plant-based meat alternatives, particularly for the consumer segments that are most affected by those changes in label language. Reduced demand for plant-based meat alternatives would negatively affect firms in the market. Governments should also consider the indirect effects of meat and plant-based meat alternative consumption, such as those related to environmental sustainability and public health, if changes to labelling policy occur.

Although consumer preferences for plant-based meat alternatives are strongest in an unregulated market, this does not necessarily imply that deregulation of plant-based meat alternative labelling is optimal. As mentioned in Section 5.4.3.4, the demand effects of labelling policy must be weighed against the goals of that policy. In this case, disclaimers are used to inform consumers about the plant-based nature of meat alternatives, so that they have full information when purchasing these products. Nearly 11% of respondents reported mistaking a plant-based meat alternative for real meat in the past, indicating that a policy mechanism that alleviates these issues is beneficial to consumers.

The effects of changes to labelling policy on firms is also important to consider. The legal responses in American state-level jurisdictions to meat-related terms ban indicate that plant-based meat alternative firms consider meat-related terms crucial to the marketing of their products. This is apparent in the demand effects assessed in this research, as important consumer segments, namely health-conscious omnivores, are sensitive to changes in labelling policy. While the effects of a meat-related terms ban may not differ much from the current Canadian

regulations on aggregate, they would likely be detrimental for important subsets of consumers from the firm's perspective. The current regulatory structure in Canada seems to strike a happy medium between provision of necessary label information to consumers and permitting plant-based meat alternatives firms to utilize meat-related terms to appeal to omnivorous consumers. Unintrusive but helpful policy instruments can be beneficial for both sides of a transaction, and deviation from the status quo could disrupt this balance, hurting both consumer welfare and firm profitability. According to the survey referendum, the majority of respondents prefer the current Canadian regulations relative to the other policy frameworks, further cementing the suitability of the current policy. There does not appear to be mass popular will for changes to plant-based meat alternative labelling policy at this time.

The debate regarding meat-related terms in Canada seems to have settled somewhat in the last year or so. The 2020 CFIA consultation resulted in limited changes with respect to plant-based meat alternative labelling policy (CFIA, 2021c). Plant-based meat alternatives will be permitted to continue to use meat-related terms and language in labelling and promotional activities. However, stakeholders in both the meat and plant-based meat alternative industry expressed desire to protect against misleading practices and mitigate consumer confusion going forward (Loney and Stucken, 2021). Therefore, if issues arise in the future, it is likely that the policy debate is reopened. Future proposals to amend or change policy in this area should consider the findings and implications of this, and other experimental research in the process (Demartini et al, 2022).

6.3 Research Limitations

There are several limitations that bear mentioning. First, there were practical limitations inherent to the survey and methods of data collection. The survey was only presented in English,

and although a representative sample of Quebec residents was obtained, the data is not representative of Canadians who do not speak English. The sample was also not entirely representative of the population with respect to some indicators such as education. This is likely a consequence of internet survey distribution, where the sample is dependent upon the population that participates in such surveys.

The potential for hypothetical bias is perhaps the most prominent limitation associated with discrete choice experiments and associated methods. Since the DCE captures choices and trade-offs in a hypothetical scenario, the analysis relies on the assumption that the choices made by consumers in the DCE would mirror those they would actually make when grocery shopping. Steps were taken to address hypothetical bias, such as reminders to respondents to answer questions honestly, and confirmation boxes to affirm the instructions and questions were read and understood. Choice experiments cannot account for all real-world variables that enter the food purchasing decision, such as budget constraints or other alternatives outside the scope of this research (ground pork, for example). Therefore, results should be interpreted in relative terms, and only in the context presented to respondents in the DCE. For example, while consumers clearly display positive preferences for protein claims, the exact WTP values cannot necessarily be extrapolated to real products and prices.

Beyond structural limitations associated with methodological decisions, some uncertainties arise when analyzing and interpreting the results. The label images utilized in the DCE only capture three specific manifestations of labelling policy for plant-based meat alternatives. Additionally, label designs for the unregulated and meat-related terms ban treatments required conjecture, given the prevalence of labelling laws similar to those in Canada throughout the English-speaking world. Although careful consideration was given regarding firm

incentives, markets that align with these policy environments (France for the meat-related terms ban, for example), and current products on the market, some degree of uncertainty remains. Given regulatory interpretations and nuances in these scenarios, we cannot be certain that product labels would match those designed for this research, and consequently, how demand effects might change with deviations from the examples in this research. Ultimately, the label design offered two extreme deviations from the current Canadian regulations, and the assessment of consumer preferences under those policy frameworks is relevant. However, the scope of this research prevented a comprehensive assessment of other regulatory manifestations that could theoretically occur in Canada or elsewhere.

There are many attributes that consumers consider when making decisions at the grocery store. Only a subset of these product attributes that may be relevant in the case of plant-based meat alternatives, those deemed most important in the literature review, were selected in the choice set design, to ensure effects relevant to the research objectives could be assessed. Likewise, countless consumer characteristics can impact the likelihood of purchasing plant-based meat alternatives. However, careful consideration was applied in selecting relevant variables for the LCL model to avoid too much overlap in effects. Therefore, an entirely comprehensive assessment of potential product attributes and consumer characteristics was not undertaken.⁸

This research only assessed consumer preferences for plant-based meat alternatives under a meat-related terms ban for a single product: ground beef and plant-based alternatives. The degree to which these demand effects of a meat-related terms ban are translatable to other

⁸ See Aposotlidis and McLeay (2016), who assess preferences for a wider breadth of plant-based meat alternative attributes, and Slade (2018), who examines the effects of a fairly comprehensive set of consumer characteristics on demand for plant-based meat alternatives.

product lines is unclear. For example, would the terms used by firms for burgers under a meat-related terms ban elicit a similar response from consumers?

Lastly, this research only investigated the consumer demand effects of labelling policy in the case of plant-based meat alternatives. A full assessment of producer and consumer welfare effects was beyond the scope of this research but would be useful in providing concrete policy recommendations. Understanding the full market effects of regulatory change is important in ensuring societally beneficial policy is adopted.

6.4 Suggestions for Future Research

The findings of this thesis facilitate continued research in several areas. First, while this research assesses consumer preferences for plant-based meat alternatives under differing labelling policy in Canada, an assessment of this objective in other jurisdictions would be relevant for marketers and policymakers. Canada composes only a small portion of the market for plant-based meat alternatives, and an examination of preferences in areas with different food cultures and existing regulations could provide important insight into the development of markets and policy going forward. In particular, an examination of American and French preferences, where bans on meat-related terms bans have been implemented in some degree, would be of particular interest. American consumer policy preferences pertaining to meat-related terms bans have already been found to differ from Canadians' (Van Loo et al, 2020), but whether those preferences translate similarly in the market remains uncertain.

An evaluation of the demand effects of a meat-related terms ban would also be relevant for other product lines. For example, consumers may respond differently in the case of plant-based burgers or sausages than they do with ground meat alternatives. Framing effects have been found to impact consumer perceptions for various plant-based meat alternative product

categories in the E.U. (Demartini et al, 2022), so a market assessment could provide an explanation of more tangible consequences of labelling policy changes.

For the most part, consumers value regulated protein claims when purchasing meat and plant-based meat alternatives. Protein attributes in plant-based meat alternatives in Canada are typically communicated qualitatively in grams of protein per package/serving. A comparison of preferences and WTP for qualitative and quantitative protein claims would provide valuable insights, particularly given that plant-based meat alternatives must comply with the “Excellent Source of Protein” claim regardless of whether it is promoted in that manner.

There appears to be a gap in understanding of the substitution between meat, plant-based analogues, and other forms of vegetarian and vegan consumption. For example, non-purchasers in this study tend to be meat-reducers or meat-avoiders, but still prefer beef to plant-based meat alternatives. This is a confounding result; even if meat-avoiders and reducers are not eating plant-based meat alternatives, we should still expect some preference toward plant-based options in adherence with their dietary habits. Further work that examines these complex substitution patterns and the factors that drive them will provide additional clarity.

Finally, hypothetical bias is always an issue worth considering in survey-based discrete choice experiments. Revealed preference work, utilizing grocery store scanner data or experimental auctions, would be a strong complement and point of comparison for this research. There are logistical challenges associated with these methods, but a higher degree of incentive compatibility could facilitate a stronger understanding of the market and regulatory environment for plant-based meat alternatives.

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Appendices

Appendix 1: Consumer Survey Containing Discrete Choice Experiment.

2/10/22, 10:54 AM

Questionnaire

CONSENT



Participant Consent Form

You are invited to participate in a research study entitled: **Food Choices and Food Labels**

Student Researcher:

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This 15–20-minute survey will collect information on food purchasing choices in grocery stores. The information collected will help the researchers gain a stronger understanding of Canadian consumer preferences for certain food products. Respondents to this survey will answer general questions pertaining to their food purchasing habits, and participate in a choice experiment, where respondents will choose between products in a hypothetical grocery shopping scenario. Funding for this project comes from the Saskatchewan Ministry of Agriculture and is hosted by Voxco, a Canadian-owned and managed company. Data will be stored securely in Canada. There are no known or anticipated risks for respondents in participating in this research. The results of this research will provide researchers and policymakers with a better understanding of Canadian consumer preferences and purchasing decisions for food products.

For respondents, participation will incur compensation, a nominal incentive in the form of loyalty program points of the respondent's choice (i.e., worth approximately \$1.00–\$2.00 per 15 minutes) in appreciation of the respondents' time. Data collected from this survey will be used for a master's thesis, in other academic publications, and potentially in educational applications in University of Saskatchewan courses. Data may be made publicly available but will be in an anonymous form so that identification of respondents is not possible. The survey only asks general questions regarding purchase behaviours, values, beliefs, and sociodemographic characteristics, so respondents will not be identifiable by their responses.

This survey is hosted by Voxco and AskingCanadians. Please see the following for more information on Voxco's Privacy Policy <https://www.voxco.com/privacy-policy/> or AskingCanadians Privacy Policy <https://corporate.askingcanadians.com/privacy-policy/>. The data will be kept by CHASR on a secure University of Saskatchewan shared drive (shared by CHASR staff). The server, DataStore, is backed up daily. The data will also be stored electronically on the Principal Investigator's (Dr. Jill Hobbs') University of Saskatchewan password-encrypted computer in a locked office. Data will then be shared with the student researcher (Liam Boldt) through the University of Saskatchewan OneDrive system, with the data remaining password-encrypted. Data may be publicly shared upon publication of the results in a scientific journal and the data will be retained for five years post-publication as per the University of Saskatchewan Guidelines.

Participants for this survey must answer all questions, but withdrawal from participating in the survey can be done at any time by closing your internet browser. Participation in this research is strictly voluntary. Survey responses will remain anonymous. Since the survey is anonymous, once it is submitted it cannot be removed.

If you are interested in obtaining the results of this research, please feel free to contact one of the researchers listed at the top of this consent form after April 30th, 2022, to receive a summary of the research results.

If you have any questions or concerns, you can contact the researchers listed at the top of this consent form.

This research project has been approved on ethical grounds by the University of Saskatchewan Behavioural Research Ethics Board. Any questions regarding your rights as a participant may be addressed to that committee through the Research Ethics Office: ethics.office@usask.ca; 306-966-2975; out of town participants may call toll free 1-888-966-2975.

By completing and submitting this survey, your free and informed consent is implied and indicates that you understand the above conditions of participation in this study.

You may print off a copy of this Participant Consent Form for your own records.

QUOTA1

What is your current age?

- ☐ 18-24
- ☐ 25-34
- ☐ 35-44
- ☐ 45-54
- ☐ 55-64
- ☐ 65+

QUOTA2

What is your province or territory of residence?

- ☐ Alberta
☐ British Columbia
☐ Manitoba
☐ New Brunswick
☐ Newfoundland and Labrador
☐ Northwest Territories
☐ Nova Scotia
☐ Nunavut
☐ Ontario
☐ Prince Edward Island
☐ Quebec
☐ Saskatchewan
☐ Yukon Territory

S1Q1

How important are each of the following attributes when purchasing food products?

Attribute	Not important at all	Slightly important	Moderately important	Very important	Extremely important
	1	2	3	4	5
Price	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Brand	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Environmental sustainability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Health and nutrition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Animal welfare	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Familiarity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Expected taste and texture	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Appearance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Novelty/trying something new	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Convenience	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Product origin	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Food safety	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Naturalness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

S1Q2

How knowledgeable do you consider yourself to be on each of the following topics?

Topic	Not knowledgeable	Slightly knowledgeable	Moderately knowledgeable	Very knowledgeable	Extremely knowledgeable
	1	2	3	4	5
Environmental sustainability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Animal welfare	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nutrition and healthy eating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Plant-based meat alternatives	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The meat industry in Canada	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

DCE_INSTRUCT_1

In this section, please imagine that you are in a grocery store, shopping for a ground meat product. On the next few screens, you will see a series of choice scenarios that you may find yourself faced with in a real grocery shopping setting.

Instructions:

Please select the option you would choose if you were making this choice in a grocery store.

Please assume that in each choice set, these are the only options available to you.

Please do not compare options between choice sets; focus on each set separately.

In these choice sets, you will see ground meat and plant-based meat alternative products, made with either pea or soy protein. These products may include label claims indicating the presence of nutritional or sustainability attributes. Please read the following definitions:

"An Excellent Source of Protein" is a claim that can be displayed on the label of a food product that has a **protein rating of 40 or higher**, meaning such a product has a **very high protein content**. A product with this claim **may or may not** contain all nine essential amino acids.

"A Complete Source of Protein" is a claim that can be displayed on the label of a food product that has a **protein rating of 20 or higher** and **contains all nine essential amino acids**, meaning such a product has **good protein content** with all essential amino acids. A product with this claim **may or may not** also meet the qualifications for "An Excellent Source of Protein."

A product with the "Certified Carbon Neutral" label claim means that a product's carbon emissions are offset by carbon sequestration and green energy use.

The information gathered in this section of the survey is very important. We ask that you please make these choices as if you're in a real grocery store setting, adhering to a grocery budget like you might have in real life. The results of this research could inform both firms and policymakers in the future, so honest responses are meaningful. Thank you in advance for your participation and cooperation in ensuring your choices are representative of those that you would make in real life.

Example

This is an example of what you will see on the following pages. Please imagine you are shopping for a ground meat product in a grocery store, with the following three options. Please use the information presented on the product labels to select the product you would choose in a real grocery store setting. **Each product is 500g.**

Option 1



\$12.50



Option 2



\$5.00



Option 3



\$9.50



Option 4

I would not purchase any of the options



I have read and understood these instructions

CHOICE1

Choice [CHOICE_COUNTER]:

Please imagine you are shopping for a ground meat product in a grocery store, with the following three options. Please use the information presented on the product labels to select the product you would choose in a real grocery store setting. **Each product is 500g.**



Option 1

[C1_COST1]



Option 2

[C1_COST2]



Option 3

[C1_COST3]



Option 4
I would not purchase any of the options



C1_TIMER

CHOICE2

Choice [CHOICE_COUNTER]:

Please imagine you are shopping for a ground meat product in a grocery store, with the following three options. Please use the information presented on the product labels to select the product you would choose in a real grocery store setting. **Each product is 500g.**



Option 1

[C2_COST1]



Option 2

[C2_COST2]



Option 3

[C2_COST3]



Option 4
I would not purchase any of the options



C2_TIMER

CHOICE3

Choice [CHOICE_COUNTER]:

Please imagine you are shopping for a ground meat product in a grocery store, with the following three options. Please use the information presented on the product labels to select the product you would choose in a real grocery store setting. **Each product is 500g.**



Option 1

[C3_COST1]

☐

Option 2

[C3_COST2]

☐

Option 3

[C3_COST3]

☐

Option 4
I would not
purchase any
of the
options
☐

C3_TIMER

CHOICE4

Choice [CHOICE_COUNTER]:

Please imagine you are shopping for a ground meat product in a grocery store, with the following three options. Please use the information presented on the product labels to select the product you would choose in a real grocery store setting. **Each product is 500g.**



Option 1

[C4_COST1]

☐

Option 2

[C4_COST2]

☐

Option 3

[C4_COST3]

☐

Option 4
I would not
purchase any
of the
options
☐

C4_TIMER

CHOICE5

Choice [CHOICE_COUNTER]:

Please imagine you are shopping for a ground meat product in a grocery store, with the following three options. Please use the information presented on the product labels to select the product you would choose in a real grocery store setting. **Each product is 500g.**



Option 1

[C5_COST1]

☐

Option 2

[C5_COST2]

☐

Option 3

[C5_COST3]

☐

Option 4
I would not
purchase any
of the
options
☐

C5_TIMER

CHOICE6

Choice [CHOICE_COUNTER]:

Please imagine you are shopping for a ground meat product in a grocery store, with the following three options. Please use the information presented on the product labels to select the product you would choose in a real grocery store setting. **Each product is 500g.**



Option 1

[C6_COST1]

☐

Option 2

[C6_COST2]

☐

Option 3

[C6_COST3]

☐

Option 4
I would not
purchase any
of the
options
☐

C6_TIMER

S2_INTRO

The following two questions ask about the decisions you just made:

<https://na1.voxco.com/A4S/Survey/Questionnaire/Edit/1046#>

9/17

S2Q1

Among the options presented on the previous screens, which do you generally prefer?

- ☐ Ground beef
- ☐ Pea-based ground beef substitute
- ☐ Soy-based ground beef substitute
- ☐ I would not select any of these

S2Q2

To what extent did you feel confused about the differences between the products when making your choices?

- ☐ Not at all confused
- ☐ Slightly confused
- ☐ Sometimes confused
- ☐ Frequently confused
- ☐ Always confused

S3_REFERENDUM_INSTRUCT

In the earlier set of product choices, we wanted to assess how people responded to ground beef and plant-based alternatives under different labelling policies that regulate the use of meat-related terms on plant-based meat alternatives. Each survey respondent was randomly assigned to one of three policy treatments, where each respondent only saw products labelled according to their assigned policy. The three policy treatments are as follows:

Unregulated labelling: Under this policy, any meat-related language is allowed on plant-based meat product labels. These labels could look like this, compared with the label of a real meat product:



Canadian labelling: Under the current Canadian policy, meat-related terms can be used on plant-based meat product labels as long as required disclaimers are also present on the label. These labels could look like this, compared with the label of a real meat product:



Meat-related terms ban: Under this policy, the use of meat-related terms on plant-based meat product labels is not permitted. Instead, words like "crumble" could be used rather than "ground beef," for example. These labels could look like this, compared with the label of a real meat product:



The labelling of plant-based meat alternatives is an important food policy discussion. Some people involved in these discussions worry that consumers could be misled by the use of meat-related terms on the labels of plant-based meat alternatives, while others consider such terms essential in describing plant-based meat alternative products. We want to know what you think in terms of how Canada should handle this policy issue going forward.

☐ I have read and understood this information.

S3_REFERENDUM

Using the examples above, please indicate which plant-based meat alternative labelling policy you think should be adopted in Canada.

- ☐ Unregulated labelling
- ☐ Canadian labelling (current regulations)
- ☐ Meat-related terms ban
- ☐ I don't know/No opinion

S4INTRO

The following questions ask about your current dietary choices and habits.

S4Q1

When grocery shopping, how important are each of the following considerations to your typical purchase decisions?

	Not important at all	Slightly important	Moderately important	Very important	Extremely important
	1	2	3	4	5
A product's protein content	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A product's amino acid profile	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A product's carbon footprint	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

S4Q2

When grocery shopping, how often do you read product labels?

- ☐ Never
- ☐ Seldom
- ☐ Sometimes
- ☐ Often
- ☐ Always

S4Q3

How would you describe your current meat consumption habits?

- ☐ Vegan (I consume no meat or animal products)
- ☐ Vegetarian (I consume no meat but may eat some animal products such as dairy or honey)
- ☐ Flexitarian (I only eat meat and other animal products sometimes)
- ☐ Pescatarian (I consume no meat but will eat fish and seafood)
- ☐ Omnivore (I consume meat regularly)

S4Q3_2

What is the most important factor in adopting your current meat consumption habits?

- ☐ Health/nutrition
- ☐ Animal welfare
- ☐ Environmental sustainability
- ☐ Religion
- ☐ Taste/sensory appeal
- ☐ Price
- ☐ Familiarity/habit
- ☐ Other (please specify)

S4Q4

Which types of plant-based meat alternatives have you tried?

Select all that apply.

- ☐ Burger substitute
- ☐ Sausage substitute
- ☐ Meatball substitute
- ☐ Ground meat substitute
- ☐ Chicken tenders/nuggets substitute
- ☐ Deli meat substitute
- ☐ Other (Please specify)

☐ None

S4Q5

Please think back on the meals you ate in the last month. How often was a meat product your primary source of protein in a meal?

- ☐ Never
- ☐ Less than one meal per month
- ☐ More than one meal per month, but not weekly
- ☐ One or two meals per week
- ☐ More than one or two meals per week, but not daily
- ☐ One meal per day
- ☐ More than one meal per day

S4Q6

Please think back on the meals you ate in the last month. How often was a **plant-based meat alternative** (i.e.: plant-based burger/sausage/ground, tofu, etc.) your **primary** source of protein in a meal?

- ☐ Never
- ☐ Less than one meal per month
- ☐ More than one meal per month, but not weekly
- ☐ One or two meals per week
- ☐ More than one or two meals per week, but not daily
- ☐ One meal per day
- ☐ More than one meal per day

S4Q7

Do you intend on incorporating more plant-based meat alternatives into your diet in the future?

- ☐ Yes
- ☐ No
- ☐ Maybe

S4Q8

Have you ever mistaken a plant-based meat alternative for a real meat product when grocery shopping?

- ☐ Yes
- ☐ No
- ☐ Don't know

S4Q9

To what extent do you agree or disagree with each of the following statements?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
	1	2	3	4	5
In general, plant-based meat alternatives are healthier than meat products.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In general, plant-based meat alternatives are a more sustainable choice than meat products.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In general, plant-based meat alternatives taste better than meat products.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Plant-based meat alternatives are too expensive.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Plant-based meat alternatives don't taste like meat from animals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Plant-based meat alternatives contain too many strange ingredients.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Food labels are helpful in making food purchasing decisions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Information on food labels is trustworthy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person's food choices can influence their health.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person's food choices can contribute to climate change.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

S4Q10

Of the following sources of food information, please select the **three** most important sources that inform your food purchasing decisions.

- ☐ Social media
☐ Internet/websites/blogs (excluding social media)
☐ Television
☐ Radio/podcasts
☐ Print (newspaper/magazines)
☐ Product labels
☐ Friends and relatives
☐ Dieticians/healthcare professionals
☐ Government sources
☐ Food retailers/grocery stores
☐ Farmers
☐ Other (please specify):

S4Q11

To what extent do you agree or disagree with each of the following statements:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
	1	2	3	4	5
I am constantly sampling new and different foods.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't trust new foods.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I don't know what's in a food, I won't try it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like foods from different countries.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ethnic food looks too weird to eat.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
At dinner parties, I will try a new food.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am afraid to eat things that I have never had before.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am very particular about the foods I will eat.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will eat almost anything.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like to try new ethnic restaurants.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

DEMO_INTRO

This is the final section of the survey. In this section, we will be asking you broad questions to better understand the consumers that responded to this survey. **All the data collected is aggregated, anonymous, and confidential.**

D1_GENDER

What gender do you identify as?

- ☐ Man
☐ Woman
☐ Gender non-binary/Third gender/Other
☐ Prefer not to say

D2_MEMBERS_OF_HOUSEHOLD

Including yourself, how many individuals live in your household?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6 or more
- ☐ Prefer not to say

D3_UNDER_18

Are any members of your household under the age of 18?

- ☐ Yes
- ☐ No
- ☐ Prefer not to say

D4_POL_AFIL

In general, which of the following best describes your political leanings?

- ☐ Left-leaning (liberal)
- ☐ Right-leaning (conservative)
- ☐ Centre/moderate
- ☐ Not political
- ☐ Prefer not to say

D5_EDUCATION

What is your highest completed level of education?

- ☐ Did not complete high school
- ☐ Completed high school
- ☐ Completed college/trade school (diploma or trade)
- ☐ Completed an Undergraduate degree
- ☐ Completed a Master's degree
- ☐ Completed a Ph.D.
- ☐ Prefer not to say

D6_INCOME1

What is your yearly household income before taxes?

- ☐ Less than \$25,000
- ☐ \$25,001-\$50,000
- ☐ \$50,001-\$75,000
- ☐ \$75,001-\$100,000
- ☐ \$100,001-\$125,000
- ☐ \$125,001-\$150,000
- ☐ More than \$150,000
- ☐ Prefer not to say

D7_INCOME2

Your decision to refrain from stating your income is understandable. Instead, could you please simply indicate whether your annual income is greater than or less than \$100,000 before taxes?

- ☐ Less than \$100,000 before taxes.
- ☐ Greater than \$100,000 before taxes.
- ☐ Prefer not to say

COMPLETION

Thank you for participating in and completing this survey!

Your responses are much appreciated and will help us to complete our research. The purpose of this survey was to assess how consumers choose between ground beef and plant-based alternatives, under differing labelling policies that affect the use of meat-related terms on the labels of plant-based meat alternatives. The information from this survey also allows for a comparison of preferences for protein content and quality claims on a food label with a sustainability label claim. By choosing between different products with varying attributes, we can deduce which products and attributes are preferred by consumers. Additionally, we can see how factors such as food purchasing habits, knowledge, beliefs, and sociodemographic characteristics influence choice and preferences for plant-based meat alternatives.

If you would like to receive a summary of results from the research, please contact one of the researchers listed below after April 30, 2022.

Liam Boldt

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Jill Hobbs

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Appendix 2: Socio-demographic Characteristics of the Sample by Treatment.

Characteristic	Treatment 1 Count	Treatment 2 Count	Treatment 3 Count
Respondents in Treatment	376	417	410
Province of Residence (%)			
Alberta	13.6	11.8	8.5
British Columbia	16.2	14.6	11.0
Manitoba	2.9	4.6	2.7
New Brunswick	1.6	2.3	2.0
Newfoundland and Labrador	1.1	1.9	1.0
Northwest Territories	0.0	0.0	0.0
Nova Scotia	3.2	1.4	3.2
Nunavut	0.0	0.0	0.0
Ontario	38.3	35.5	42.0
Prince Edward Island	0.2	0.2	0.7
Quebec	19.9	23.7	25.4
Saskatchewan	2.9	3.4	3.7
Yukon Territory	0.0	0.2	0.0
Age (% split into three categories)			
18-34	27.1	29.3	25.6
35-54	34.6	32.9	34.4
55+	38.3	37.9	40.0
Education (% in each category)			
Did not complete high school	1.9	0.2	1.5
High school	11.7	12.7	11.0
Trade/diploma/other certificate	24.5	21.8	26.6
Undergraduate degree	35.9	42.2	37.8
Master's degree	19.4	17.7	16.6
Ph.D.	4.3	3.6	4.1
Prefer not to say	2.4	1.7	2.4
Gender (% in each category)			
Male	52.1	51.6	53.2
Female	46.5	47.7	45.9
Gender non-binary/Third gender/other	1.3	0.5	0.5
Prefer not to say	0.0	0.2	0.5
Household Data			
Household size (average)	2.3	2.3	2.3
Annual Household Income (% in each category)			
Less than \$100,000	58.8	60.0	56.3
More than \$100,000	34.8	31.9	36.1
Prefer not to say	6.4	8.2	7.6
Political Leaning (% in each category)			
Left-leaning (liberal)	34.8	29.5	31.7

Right-leaning (conservative)	17.6	16.8	19.0
Centre/moderate	25.5	26.6	22.7
Not political	16.0	17.3	18.3
Prefer not to say	6.1	9.8	8.3

Derived from author calculations with survey data and Statistics Canada data, 2022.

Appendix 3: Model Choice Criteria for 3, 4, and 5-class Latent Class Logit Models with Same Class Membership Parameters.

Criteria	3-Class Model	4-Class Model	5-Class Model	6-Class Model
Log-likelihood	-5410.74	-4933.73	-4709.56	-5112.86
Akaike Information Criterion	10943.49	10039.46	9641.13	10497.72
Bayesian Information Criterion	11443.31	10763.32	10595.64	11688.18
Pseudo R-square	0.4161	0.4675	0.4917	0.4482
Adjusted Pseudo R-square	0.4095	0.4583	0.4798	0.4335

Appendix 4: 4-class Latent Class Logit Model Results

Variable	Class 1	Class 2	Class 3	Class 4
Class Probability	46.01%	25.21%	12.64%	16.14%
Utility Parameters				
PRICE	-0.4292***	-0.2290***	-0.3283***	-0.9099***
EXC SOP	0.3199***	0.7430***	0.1037	0.6824***
COM SOP	0.2196	0.9902***	0.6403**	0.9209***
CARBON	-0.5314***	0.7473***	0.0982	0.4345***
PEA	-3.9965***	0.7123***	-1.2001**	-0.8246***
CDN PEA	-0.5222	-0.0388	0.4025	-0.2231
BAN PEA	-1.1483**	-0.1875	-12.6616	-0.9972**
SOY	-4.4081***	0.5596***	-0.7668**	-0.5078**
CDN SOY	-0.8176*	-0.2696	-1.0435*	-0.3417
BAN SOY	-0.7786*	-0.2103	-1.1392	-1.7768***
PURCHASE	5.8001***	2.4265***	-0.2847	9.6887***
Class Membership Parameters (Class 4 is Reference Class)				
AVOID	0.1714	4.4239	3.7443	
FLEX	-0.2887	1.1600***	0.8001**	
CON	0.4324	0.0719	-0.1974	
<100K	0.2527	0.1283	0.8080***	
MILLENIAL	-1.0498***	-0.3898	-1.1126***	
SENIOR	1.0761***	0.4636	0.6569*	
NEOPHOBE	-0.0536	-0.0680	0.2071	
IMP HEALTH	0.2002	0.1644	0.3702**	
IMP ENV	-0.3400***	0.2590*	-0.2280	
IMP TASTE	0.0464	-0.1764	-0.2232	
IMP FAM	0.1395	-0.1321	-0.2350	
IMP NAT	0.2897**	0.4512***	0.5269***	
CONFUSED	-0.1390	0.4800	-0.1772	
CONSTANT	-0.2943	-2.0422**	-1.6100*	
Model Statistics				
Pseudo R-square	0.4675			
Adjusted Pseudo R-square	0.4583			
Log-likelihood	-4933.73			
Akaike Information Criterion	10039.46			
Bayesian Information Criterion	10763.32			

The 4-class LCL model results are similar to the 5-class model presented in Chapter 5. Class 1 in this model is analogous to the committed meat-eaters class, in terms of both consumer characteristics and preferences. However, this class is larger in the 4-class model, likely encompassing a subset of consumers that belong to other meat-eating classes in the 5-class model. Correspondingly, Class 2 is comparable to sustainability-focused meat-reducers and is the only class in this model with positive preferences for plant-based meat alternatives relative to beef, and no significant changes to preferences with respect to labelling policy. Class 3 mirrors non-purchasers, with an insignificant purchase parameter and preferences for beef despite a likelihood of being flexitarian. Finally, Class 4 is similar to health-focused omnivores.

While the 5-class model is statistically superior, the 4-class model serves as an interesting point of comparison. The “missing” class between the two models, price-conscious meat-eaters, appears to merge with other groups. Given the similarities in preferences and characteristics between price-conscious meat-eaters and committed eaters in the 5-class model, along with the large increase in class probability between committed meat eaters and Class 1 of the 4-class model, it is intuitive to assume that these groups of consumers mostly combine when four classes are specified. Class 1 consumers are sensitive to the meat-related terms ban, but given their apprehension to plant-based meat alternatives in the absence of labelling policy, the market implications of these preferences are limited. Meanwhile, the policy and market implications for Class 4 are similar to those of health-focused omnivores, presenting a potential target market for plant-based meat alternative firms, but highly sensitive to price and changes to labelling associated with a meat-related terms ban.

Results from the 3- and 6-class models are not presented, due to each model converging to a saddle point. The consequence of this estimation error is missing standard errors for certain

parameters in those models. These issues can occur due to identification issues, models which are too complex for the data, or derivatives which result in zero probabilities (Hess and Palma, 2022). Thus, these models do not provide any additional context to the discussion beyond that of the 4- and 5-class models.