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Consumer Willingness-To-Pay for Blemished Fresh Produce and its Implications for Food Waste

Chloe' DeRyn Henson

Consumer willingness-to-pay for blemished fresh produce and its implications for food waste

By

Chloe' DeRyn Henson

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and its implications for food waste

By

Chloe' DeRyn Henson

Approved:

_____

Alba J. Collart
(Co-Major Professor)

_____

Matthew G. Interis
(Co-Major Professor)

_____

Joshua G. Maples
(Committee Member)

_____

Ardian Harri
(Graduate Coordinator)

_____

George Hopper
Dean
College of Agriculture and Life Sciences

Name: Chloe' DeRyn Henson

Date of Degree: August 10, 2018

Institution: Mississippi State University

Major Field: Agriculture

Major Professors: Alba J. Collart, Matthew G. Interis

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Pages in Study 71

Candidate for Degree of Master of Science

In developed countries, approximately 222 million tons of food is wasted at the consumer level per year (FAO, 2011). These amounts of food waste have large social, economic, and environmental impacts. Studies have shown that one of the main causes of food waste in developed countries is consumers' elevated expectations for appearances in fresh produce, causing imperfect produce to be wasted. In this study, we estimate consumer willingness to pay for sweet potatoes with five different skinning injury levels using a Vickrey 2nd price non- hypothetical auction. We test if consumer knowledge about (1) the percentage of blemishing, (2) the relationship between blemished produce and food waste, and (3) the environmental impacts of food waste influences willingness-to-pay for blemished produce. We find that consumer bids were affected by knowing the blemishing levels and after gaining knowledge about food waste and its environmental impacts.

DEDICATION

I dedicate this thesis to my parents, Stephen and Sandra Henson, sister, Addison Henson, and grandparents, Maxine and Franklin Henson, who have been patient with me during this stressful time and have constantly reminded me that my strength comes from God and not from anything of this world. Dedication also goes to my two nephews, Riley and Roman, and to Grant, Weston, and Silas for giving reasons to smile and reminding me why I chose to pursue a graduate degree. I also dedicate this thesis to my churches, Mt. Olive Church of God in Booneville, MS and First Pentecostal Church of West Point, whom I know have prayed endlessly for me during this time.

I would also like to give memory to Eric Benjamin Boren II, November 22, 2000-May 29, 2015.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

The Problem of Food Waste

Food waste, a part of food loss, has become an increasingly discussed topic over the past couple of decades. Some food lost throughout the supply chain occurs because of almost inevitable issues, such as food spoilage during transportation, product shrinkage after harvesting, or damage due to poor packaging (NRDC, 2012), making it not necessarily fit for human consumption (Kantor et al., 1997). However, some food loss in the supply chain could potentially be recovered because it is considered still fit for human consumption. This type of food loss is known as food waste, or "food which is fit for consumption being discarded, whether or not after it is kept beyond its expiry date or left to spoil" (United Nations, 2013, pg. 9). The United States Department of Agriculture (USDA) defines food waste as "occur[ing] when an edible item goes unconsumed, as in food discarded by retailers due to color or appearance and plate waste by consumers" (Vogliano and Brown, 2016, pg. 5). Different institutions, however, have varying definitions of food waste. Most recently, Bellemare et al. (2017) challenged these definitions suggesting that food waste, as it is currently defined, is overestimated. The authors encompass these definitions into one stating that food waste is "the difference between the amount of food produced and the sum of all food employed in any kind of productive use, whether it is food or nonfood use" (pg. 1152). While it may be true that

some estimates are overstated due to the varying definitions, it is generally agreed that there is a possibility to reduce the current amount of food waste.

Food waste is a top priority for the USDA as it results in large losses at both the producer and retailer levels and in environmental, economic, and social costs. In 2014, after recycling, composting, and energy recovery, food comprised 21.1 percent of all municipal solid waste that was landfilled in the United States, the largest contribution to total landfilled municipal solid waste (US EPA, 2016). If only five percent of retail, foodservice, and consumer food losses had been recovered rather than discarded, an annual amount of about $50 million (1995) could be saved from solid waste disposal costs alone (Kantor et al., 1997). Worldwide, the total amount of food waste and loss in 2012 contributed to global warming by producing 3.49 gigatons of carbon dioxide, almost equivalent to global road transport emissions, costing approximately $394 billion per year (United Nations, 2014). In fact, if food waste were a country, it would be the third largest greenhouse gas contributor behind the United States and China (United Nations, 2011). In Europe, the British Waste and Resources Action Program found that, from avoidable household food waste, citizens of the United Kingdom produced approximately 730 pounds equivalent of carbon dioxide per person per year, equivalent to one-third of carbon dioxide emissions associated with household electricity per person (Secondi et al., 2015). This landfilled food and associated greenhouse gas emissions provide evidence that food waste significantly impacts the environment.

Food waste also has an impact on agricultural resources. The Food and Agriculture Organization of the United Nations (FAO) found that 1.4 billion hectares of land, or about 28 percent of the world's agricultural land, was used to produce food that

was eventually wasted or lost, enough land to be the second largest country in the world (United Nations, 2013). Additionally, if agriculture uses 70 percent of the freshwater supply (Postel et al., 1996), then the freshwater used to produce food that is eventually wasted accounts for more than one-quarter of total freshwater use (Hall et al. 2009).

As mentioned earlier, food waste occurs at all points throughout the supply chain. In developed countries, food waste mostly accumulates at the retail, consumer, and household levels (Vogliano and Brown, 2016); however, in developing countries, food waste, more accurately termed food loss in this context, occurs at either producer or transportation stages because of inadequate machinery or on-farm communication issues (KC Krishna, 2016). In developing countries, concerns are focused on food lost throughout the supply chain due to lack of proper infrastructure (Parfitt et al., 2010), such losses occur for example during post-harvest losses due to lack of proper storage (Hodges et al., 2011). Consumer level food waste in developing countries represents a smaller portion of these nations' food waste because wasting food is typically considered unacceptable from a cultural standpoint (United Nations, 2011). At the consumer level, developed countries waste approximately 222 million tons of food per year, almost the same as the total net food production (230 million tons) of the Sub-Saharan Africa (United Nations, 2011). In Europe and North America, consumers waste approximately 200 to 250 pounds of food per capita, while consumers in sub- Saharan Africa and South/ Southeast Asia only waste approximately 13 to 24 pounds of food per capita (United Nations, 2011).

Globally, a third of total production, or approximately 1.4 billion tons of food is wasted per year (United Nations, 2011)[1], and it has been shown that a noticeable portion of this is from fresh and processed fruits and vegetables. The Economic Research Service (ERS) estimated in 1995 that out of 356 billion pounds of food available for consumption, about 96 billion pounds was wasted, where around one-fifth (18.9 billion pounds) of that waste included fresh fruits and vegetables (Kantor et al., 1997). In 2010, the ERS estimated that out of 430 billion pounds of edible and available food, 133 billion pounds were thrown away, and 43.6 billion pounds of the thrown away foods were fresh and processed fruit and vegetables (Vogliano and Brown, 2016). The Natural Resources Defense Council estimated that in the United States, Canada, Australia, and New Zealand collectively an outstanding 52 percent of fruits and vegetables are considered food waste, while only 47 percent are being consumed (NRDC, 2012).

Blemished Produce and Food Waste

In the United States, food waste causes supermarkets to lose $15 billion annually in unsold fruits and vegetables alone, with one major cause being consumers' elevated expectations regarding fruit and vegetable appearance (Vogliano and Brown, 2016). Consumers want to have aesthetically pleasing fresh produce and tend to expect high levels of perfection in appearance and freshness in modern supermarkets (Aschemann-Witzel et al., 2015). According to one poll, eight in ten Americans consider appearance as at least somewhat important to them when shopping for fresh produce (PR, 2016),

[1] As suggested by Bellemare et al. (2017), the definition of food waste directly impacts the calculation of total food wasted. Thus, the United Nations estimate could be higher than if it had been estimated using another definition.

possibly because selecting fresh produce based upon appearance is something that consumers have control over while in store (Molinar, 1990). Most producers and retailers cater to this desire because when fresh produce is selected to go to the market or not, "[the decision] is mostly subject to consumer norms, like aesthetics" (Deckers, 2017, pg. 31).

The fruits and vegetables that consumers generally tend to look over because of their cosmetic imperfections are referred to as blemished produce. We define blemished or imperfect fresh produce as fresh fruits and vegetables that have the same nutritional value as perfect (unblemished) products but do not meet the generally accepted visual standards of quality needed to be sold in the fresh market. They may not meet shape, color, symmetry, or size requirements, or they may have marks or scarring on them due to skin injury during harvest, transport, packing and stocking but not necessarily due to disease.

The abundance of blemished produce creates food waste at the consumer, producer, and retailer levels. Farmers and retailers believe that consumers' preferences towards blemished produce may be weak; therefore, much of the culling at the producer level results in the removal of products that are safe and edible but are removed because of consumer's preference for an aesthetically perfect product (Kantor et al., 1997). During harvest, farmers may go as far as to leave food behind in the field if they consider it will not meet certain quality standards (Deckers, 2017). With specialty crops such as red beets, composting and ploughing the produce back into the ground is the best method to avoid waste and to reduce incurred costs to the farmer; however, this is not the case for all fresh produce. Farmers generally incur great costs from the wasted produce because of

its aesthetic qualities. Retailers also believe that consumers prefer aesthetically pleasing produce. The retailer will further remove safe and edible produce that may make it to the market if they are not aesthetically pleasing due to shape, size, and color (NRDC, 2012). While more research is needed on consumer level food decisions to fully understand where household losses occur (NRDC, 2012), consumers will sort out produce, at point of purchase and consumption, based upon its aesthetic qualities (Deckers, 2017) and retailers will therefore cull the blemished produce again. At each level, culling blemished produce not only decreases revenue but also generates costs to farmers, retailers, and consumers (Deckers, 2017).

Because of the large food losses throughout the supply chain, governmental agencies have become concerned about consumers' preferences towards blemished produce. Recently, the House Appropriations Committee has directed the Economic Research Service (ERS) to conduct studies to identify the barriers in the market for cosmetically imperfect foods. Past studies have shown that prevention methods could be taken to help reduce the copious amounts of food waste and "future research should build on the previous research and, in particular, explore food waste consumer behavior in greater depth, by focusing on specific contexts, foods and segments" (Aschemann-Witzel, 2015, p.6471). Other studies have concluded that future studies "might address how educational or communication strategies affect purchase intentions of abnormally shaped foods" (Loebnitz et al., 2015, pg.418). Since "in general, most consumers in the USA do not appear to be concerned about food waste" (Hodges et al., 2011, pg. 42), this gap in the research of food waste issues with blemished produce is important as "it would require an increase in awareness of food waste for consumers to change their

consumption behavior and accept consumption of suboptimal produce" (Deckers, 2017, pg. 34).

General Objectives

In this study, we analyze consumer willingness-to-pay for blemished produce before and after consumers receive information on food waste and its environmental impact. We use a non-hypothetical second-price experimental auction to investigate if and how various information treatments designed to mitigate food waste affect consumer preferences for aesthetically different fresh produce.

To answer our research questions, we used sweet potatoes as an application to collect data on consumer preferences for aesthetically different, or blemished, produce. The experiment allowed for participants to bid in a non-hypothetical (real) experimental auction where we presented pictures of sweet potatoes with five different blemishing percent levels and, for each level, asked participants to bid their maximum willingness-to-pay for one pound. Using our experiment with sweet potatoes in conjunction with past willingness-to-pay studies, we investigate ways to mitigate the problem of food waste at the consumer level.

Findings from past studies suggest that some consumers will accept and purchase some blemished produce at a discounted price. Furthermore, experts agree that educating consumers could help reduce food waste at the household level (Aschemann-Witzel et al, 2015). However, no studies have been done that compare consumer willingness-to-pay for conventionally produced blemished produce after educating consumers about food waste and its environmental impact. Despite evidence that much food waste occurs at the retail and household levels and that food waste has negative social, environmental, and

economic impacts, few research studies have been conducted to understand consumer preferences for blemished produce. Consumers may have incomplete information when shopping for produce and there could possibly exist a market failure in this area.

Specific Objectives

First, our study seeks to explore food waste in greater depth by using data from a non-hypothetical second price auction to understand if and how consumer preferences toward blemished produce will change after learning information about food waste and its environmental impact. Previous studies have shown that consumers want environmentally friendly products, through organic production methods, but do not want the consequences of the products, such as blemished appearances (Yue et al., 2009). If consumers were aware that blemished produce was wasted and that there were environmental consequences of wasting blemished produce, would they be willing to purchase these blemished fruits and vegetables?

Second, we hope to identify a profile of consumers who may be more likely to purchase sweet potatoes. Identifying a profile of consumers who are willing to pay price premiums and thus may be more likely to purchase sweet potatoes could help farmers guide their marketing efforts. They could, for example, save some of the crops unsuitable for the supermarket and sell them in alternative market channels that target the type of consumers identified here, conduct targeted promotional campaigns, or further investigate what drives these consumers to buy sweet potatoes more frequently and make repeated purchases.

Policymakers and other stakeholders could use this knowledge on consumer preferences to support the emerging imperfect food movement, educate consumers to

reduce food waste, and mitigate the negative externalities associated with food waste. By increasing information on the environmental impact of food waste, consumers could make more educated decisions when purchasing imperfect foods. If consumers are willing to purchase these products at a discounted price, and this price still makes it profitable for farmers to bring these products to the market, farmers could bring more produce to the fresh market and reduce the amount of culled or wasted produce.

CHAPTER II

LITERATURE REVIEW

Consumer Awareness of Food Waste

Recent literature has begun to focus on overall food waste and has attempted to understand what motivates consumers to waste food. Studies have used self-assessment surveys to understand consumers' perceptions on how much food they waste, why they waste that food, and why they choose not to waste, if they do. In an American study, only 42 percent of respondents indicated that they had either seen or heard anything about the issue of food waste, and 16 percent had sought information about reducing it (Neff et al., 2015). Twenty-two percent of respondents said that the environmental concerns of greenhouse gas emissions, energy, and water were "not all important" to them when considering discarding food (Neff et al., 2015), suggesting that consumers are not only missing the conversation on food waste but also seem to lack proper information about the consequences of food waste and its environmental impacts (Quested et al., 2013). Furthermore, this lack of concern for environmental issues when deciding to waste food might suggest that consumers have not yet made the link between food waste and its environmental impacts, possibly because consumers might have difficulty in judging what is good and bad for the environment; therefore, education about food waste and its environmental impacts might help alleviate this difficulty for the consumers. Literature indicates that additional research on communication to consumers about the

environmental impacts of food waste (i.e. a type of consumer education program) could motivate behavior changes when making the decision to waste food. One way to do this might be through increasing public engagement by companies to help reduce food waste (Quested et al., 2013) because "consumers demand retailers to take responsibility for the environment" (Deckers, 2017, pg. 33).

Motivations toward food waste are a crucial component when analyzing the aspects of household food waste (Aschemann-Witzel et al., 2015). While behaviors vary across individuals, there seems to be a common occurrence that food waste is a habitual process (Quested et al., 2013). A large part of household food waste occurs because consumers lack proper knowledge about practical ways to shop for food, how to plan for weekly meals (Aschemann-Witzel et al., 2015), or how to properly store foods (Roodhuyzen et al., 2017; Porpino et al., 2015). Consumers in small households who do not have the proper knowledge of shopping or storing food could create unnecessary food waste because they do not appropriately plan meals for themselves or their families and end up throwing food away, potentially because consumers desire to provide for the family and purchase more food than needed at the grocery store (Quested et al., 2013; Porpino et al., 2015). Consumers also may be unaware of the money that they are losing from purchasing this extra food, only to throw it away (Venkat, 2011). Therefore, creating awareness and providing information on how to appropriately purchase food could be beneficial to reducing food waste (Aschemann-Witzel et al., 2015).

Furthermore, in North–Eastern Italy, food waste increases with growing educational qualifications and with family size (Marangon et al., 2014). Thus, potentially those with larger families and increased education have limited time to shop and can only

purchase groceries once a week, so they purchase more than needed to avoid making extra trips to the grocery store, leading to the higher probability that the foods will be wasted toward the end of the week (Lusk and Ellison, 2017). About one-third of respondents in an Italian survey said that they would like to receive additional information about how to better store food to avoid waste (Marangon et al., 2014). This suggests that there is a need for consumer education on proper food management to reduce food waste and how this reduction will benefit the consumer.

Very few studies, however, have been conducted to understand what type of educational methods to elicit a response from consumers. Because universities alone are estimated to waste one billion pounds of food per year, one study attempted this by implementing strategies into a college setting (Whitehair et al., 2013). Students were simply reminded to "eat what [they] take [and] don't waste food" (pg.65). Doing so created a significant decrease in food waste among the students. Furthermore, Qi and Roe (2017) showed that in a restaurant setting, consumers who are educated about the negative effects of food waste in a landfill will waste significantly less food than those who are not educated on the matter. Additionally, ReFED, or Rethink Food Waste through Economics and Data, reported consumer education campaigns as being the number two most efficient way to reduce food waste by saving approximately $4,500 per ton of food saved. The United States Environmental Protection Agency employed an initiative called "Food: Too Good to Waste" in which they aimed to reduce household food waste by examining wasteful household food management practices and educating consumers about proper ways to remedy those practices (USDA, 2016). In the pilot of this program, consumers reported that they found the information beneficial to helping

them reduce food waste in their own home. In this initiative, there were different campaigns in different cities where "campaigns found that there is a need to particularize environmental messaging to the household level for greatest effect" (USDA, 2016, pg. 30). These studies and reports show that consumers in a dining setting or at home will react to intervention methods that remind the consumer about wasting food or educate the consumer about the negative impacts of food waste, but more information should be collected about the environmental aspects of the food waste education.

However, no studies have been conducted that educate consumers about how blemished produce contributes to food waste. Currently, consumers are potentially uneducated in their purchasing methods as they seek for perfect produce because "the perceived risk level is increased in scale by a lack of knowledge about real and assumed food safety risks" (Aschemann-Witzel et al., 2015, pg. 6466). Consumers typically associate product damage with contamination and health risks (White et al., 2016). In a small study (sample size=26), consumers perceived aesthetically pleasing apples as healthier than blemished apples (Vanderwaal, 2017). Because of this perception of aesthetically pleasing produce being healthier than unaesthetically pleasing produce, consumers "expect high levels of perfection in appearance and freshness in modern supermarkets" (Aschemann-Witzel et al., 2015, pg. 6466). If consumers have this high expectation for perfection, then they are more likely to not accept the product if it is less than their expectations (Cardello, 1994). Educating consumers about how blemished produce contributes to food waste is important because "it needs to be clear that appropriating misshapen produce reduces food waste and improves the environment" (Deckers, 2017, pg. 34).

Consumer Preferences for Blemished Produce

Bellemare et al. (2017) produced a theoretical framework to represent the amount of food that is wasted and showed that if food is reverted back to the supply chain to eventually be eaten, then the total amount of food that is wasted would decrease. This food that could be reverted back to the food supply chain to be eaten could be from developing markets for ugly fruits and vegetables (Bellemare et al., 2017). This theoretical framework has been inadvertently studied in the past where studies have sought to determine exactly what product and process-based attributes consumers search for when purchasing produce. Purchasing habits, attribute preferences, and willingness-to-pay (from the National Family Opinion organization) have been analyzed to develop groups, or clusters, that search for certain attributes when shopping for fresh produce (Bond et al., 2008). Four clusters with different preferences were found; however, all four groups placed some type of preference on having firm, ripe, and appropriately colored fresh produce (Bond et al., 2008) showing that consumers are aware of these attributes when shopping for fresh produce. One group, the "Price Conscious" group shops more according to price than the perceived quality of the product, suggesting that there is a profile of consumers who will purchase lower quality produce for a discounted price.

Because we know that consumers are aware of these cosmetic qualities in produce, some authors have attempted to understand how much attention consumers give to the cosmetic defects of produce (Jaeger et al., 2016). Using eye tracking technology and surveys, the authors found that consumers fixated their eyes on defects (internal browning, bruising, and internal browning and cavities of apples) and increased their attention toward the defects as the severity of the defects increased. Consumers not only

increased their attention as severity increased but also increased the time that they fixated their attention on the defected apples. Overall, regarding browning and bruising, this suggests that consumers notice defects in apples even when they are not necessarily looking for them. Also, as the degree of bruising increased, consumers increased their desire to reject purchasing apples at the same supermarket, where more than 90% were rejecting apples with bruising exceeding 16% of the total flesh area.

While we may understand what consumers are aware of when shopping for produce, there is still a lack of information on if consumers are willing to accept and purchase blemished produce. To understand consumers' acceptance toward blemished produce, research has been conducted to assess willingness-to-pay for blemished produce by analyzing consumers' willingness to make a trade-off between production methods and blemished produce (Bunn et al., 1990; Thompson and Kidwell, 1998; Yue et al., 2007; Yue et al, 2009). Research has shown that consumers are willing to purchase blemished oranges after they have the knowledge that aesthetically pleasing citrus is heavily sprayed with pesticides and that demographics are not significant, suggesting that any profile of consumers might be more likely to purchase blemished produce if they were properly educated on how aesthetically pleasing produce is heavily sprayed with pesticides (Bunn et al., 1990). Thompson and Kidwell (1998) also found results that supported the trade-off consumers were willing to make between production methods. With five fresh produce items (red delicious apples, broccoli, carrots, leaf lettuce, and tomatoes), consumers were more likely to choose a conventional product if the identical organic product had higher amounts of blemishing.

Yue et al. (2007) used survey observations from an interview where respondents were given pictures with blemished apples and the percentage amount of blemishes on those apples. Consumers are willing to pay more for more perfect conventional apples than highly blemished organic apples, even though organic production does have a positive effect on willingness-to-pay for apples for most people. Yue et al. (2009) supports Yue et al. (2007) with non-hypothetical data. Even when consumers were only given information on whether the apples were produced conventionally or organically and were not given any information on the percentage of blemishes on the apples, consumers were willing to make a trade-off for production method in order to have a more perfect apple. While these studies used hypothetical and non-hypothetical methods, results in the studies were similar.

Additionally, Yue et al. (2007) found that consumers are willing to purchase blemished conventional apples at a discounted price. Yue et al. (2009) found that consumers discounted their willingness-to-pay by about $0.14 per increase of blemishes in both conventional and organic productions, supporting the 2007 findings. Also, if an apple has a high percentage number of blemishes, the consumer will reject the apple completely. This again is supported in the 2009 study with non-hypothetical data where the authors found that consumers would be unwilling to purchase highly blemished apples regardless of the production method (Yue et al., 2009). Loebnitz et al. (2015) also found in a hypothetical study that respondents need the highest discounting on a spotted apple before they are willing to purchase it. From these studies, it can be seen that consumers are willing to accept and purchase blemished produce up to a certain blemishing level and price. However, no studies have been conducted that analyze

willingness-to-pay for blemished produce after educating consumers about wasting or not purchasing blemished produce.

Blemished Produce and Food Waste

Even though few studies connect food waste and blemished produce, the link between the two has been recognized as an important issue because "product acceptance is likely to increase the more consumers perceive a problem and feel responsibility for solving that problem" (Deckers, 2017, pg. 23). Experts and professionals agree that consumers are willing to pay more for blemished produce if they believe that their purchase contributes to reducing food waste (Deckers, 2017). Furthermore, if there is an increase in the awareness of food waste, then there will likely be an increased attraction for consumers to adopt misshapen produce (Deckers, 2017). Loebnitz et al. (2015), in a study in Denmark, determined how consumers' decision to purchase abnormally shaped foods was affected by whether they self-identified as being pro-environmental or not. After being asked their purchase intentions for various oddly shaped produce, participants were asked to rate on a Likert scale their pro-environmental self-identity and their awareness of abnormal fruits and vegetables being wasted. When combined, pro-environmental self-identity and problem awareness were significant predictors of consumers' purchase intentions. Additionally, people with greater pro-environmental self-identity were more willing to purchase abnormal foods when they become more aware, or gained knowledge, of the food waste issues. Overall, awareness of these foods being wasted, or food waste in general, had a significant effect on consumers' willingness-to-purchase (Loebnitz et al., 2015). Therefore, consumers are more likely to purchase suboptimal foods based upon their knowledge of food waste, but current

literature does not show consumer willingness-to-pay before and after being educated about the problem.

Other studies measure personal commitments to environmental sustainability and consumers' confidence in their ability to improve the environment, while also understanding consumer preferences for suboptimal foods at retail and household levels (de Hooge et al., 2017). Suboptimal foods defined in this study were foods that were misshapen or blemished (for produce), were expired (for milk and yogurt), or had package damaging (for juice and biscuits). Respondents were first asked questions regarding their environmental concerns, and they were then given a choice experiment involving optimal and suboptimal foods where they were asked to choose which one they would either choose to purchase (supermarket) or to consume (home). Those in the supermarket group were asked to choose a discount percentage at which they would purchase the suboptimal product; the home group was asked to choose the percentage at which it would be probable for them to consume the suboptimal product. Choosing the suboptimal product depended on what the actual product was (i.e. apple, milk, juice, etc), but in every product, consumers chose to purchase the suboptimal product less in the supermarket than to consume it at home. Regarding self-assessed environmental and food issues, those who committed more to environment sustainability were more likely to choose the suboptimal produce. Furthermore, those who reported a lower percentage of food waste than others and those who found the issue of food waste important were more likely to choose the suboptimal products. This suggests that educating consumers about food waste could help increase the purchase of suboptimal foods in the market and therefore reduce the amount of waste.

Aschemann-Witzel et al. (2017) also conducted a study in Denmark that identified consumers' considerations when purchasing discounted suboptimal foods to determine what factors they consider to purchase the foods (and to determine if the food will be wasted). In this study, the authors used an accompanied shopping interview where they asked consumers to speak their thoughts aloud while purchasing products. To ensure consumers would approach suboptimal foods, the researchers gave the respondents a shopping list of various items including fresh fruits and vegetables. The chosen supermarket chain had developed a strong policy of reducing the price for suboptimal foods and had a sticker that said "Stop Madspild", or "Stop Wasting Food" on the produce. In the accompanied shopping interview, when consumers were asked to speak their thoughts aloud as they shopped for the given list of items, respondents seemed very aware of suboptimal products while shopping, as they spoke about the observable quality cues and how the suboptimality would hinder use after transporting the product home. Consumers also spoke of food waste when they mentioned that either (1) they were not brought up to waste food or (2) they did not want to waste food because it is wasting money. Some spoke of the focus on food waste lately, but some consumers only mentioned that they were reluctant to purchase because they would waste it at home. However, they did not mention any form of ethical qualities (due to food waste), such as that they felt like it was the 'right thing to do', when purchasing. Additionally, the authors used an online survey and determined what group is price conscious when shopping to determine who would be more likely to purchase the discounted products. The survey asked questions to assess how respondents relate price to quality and how respondents search for price criterion. Respondents were asked to self-report their own

amounts of food waste and were asked to imagine themselves either at home or at the supermarket (depending on the assigned experimental group) and to choose between an optimal and suboptimal product for five food categories identical to that of the de Hooge et al. (2017) study (apple, cucumber, milk, yogurt, juice, and biscuits). They found that those who report less food waste and less wasteful behaviors were both more price conscious and less likely to choose the optimal product.

Positive interactions between blemished, misshapen, or abnormal fresh produce and knowledge of food waste issues and pro-environmental attitudes and behaviors is shown in past literature; however, no studies have been conducted that analyze consumers' actual total willingness-to-pay for blemished produce after they have been educated about how blemished produce contributes to food waste and the consequences of such food waste.

CHAPTER III

METHODOLOGY

Data and Experimental Auction

We examine our research questions using data collected from a Vickrey second price non-hypothetical auction on blemished sweet potatoes with five skinning injury levels ranging from 0% to 10%. A second price non-hypothetical auction is one where the highest bidder(s) win(s) the item up for auction but pays the amount of the second highest bid. It has been shown that this is an incentive compatible strategy because participants can do no better than to bid their true maximum willingness-to-pay. If a participant bids higher than her maximum willingness-to-pay, she increases the chances of winning and of paying more than her willingness-to-pay, but she does not increase the chance of winning and paying less than her willingness-to-pay. On the other hand, bidding a lower value than her true willingness-to-pay increases the chances that she misses out on winning the auction and paying less than her willingness-to-pay but does not lower the price she pays if she wins because the price is determined by the second-highest bid (Lusk and Shogren, 2007).

During the auction, participants bid on sweet potatoes (on a per-pound basis) with varying levels of "skinning," a type of blemishing in which some of the sweet potato skin is missing. Skinning injury during harvesting and distribution of sweet potatoes is fairly common. However, sweet potatoes that are arbitrarily determined by the retailer to be too

blemished, do not typically make it to the retailer shelves because visual appeal is important to sweet potato consumers (Nalley, 2004). These sweet potatoes are therefore wasted despite generally being safe to the consumer. We sorted the sweet potatoes that participants bid on into five categories given their percentages of skinning injury, which were estimated using imaging technology provided by the Department of Agricultural and Bioengineering at Mississippi State University: 0-<1 %, 1-3%, 3.1-5%, 5.1-7.5%, and 7.6-10%. All the sweet potatoes were Mississippi-grown, Beauregard, and U.S. No 1. By using the same grade and variety of sweet potato, we maintain relative consistency in size, firmness, textures, and shape among the products.

The participants were recruited through advertisements and email lists from the general population in Starkville, Mississippi aged 18 years and older. To target the population who purchases sweet potatoes, the recruitment tools specified that the study would involve consumer decision-making for sweet potato purchases. They were provided with a $5 compensation for participating and a $30 endowment to bid in the auction.

Experimental Design

Throughout the course of two days in May 2016, we conducted six one hour-long experimental auction sessions. All sessions took place in the experimental economics laboratory in the Department of Agricultural Economics at Mississippi State University. Each session included between 6 and 18 participants, with a total of 49 participants.

At the beginning of each session, we gave participants a consent form and an ID label to ensure anonymity, and we reminded them that the experiment was voluntary and that they could leave at any time. After the consent form, participants were given written

instructions and a PowerPoint of example auctions explained by a moderator. Following the examples, there were two rounds of hypothetical practice auctions, one conducted using name-brand chips and one conducted using name-brand chocolate bars. The purpose of the practice rounds was for participants to understand what was being asked of them so that they would be more likely to bid values closest to their true willingness-to-pay. After the practice rounds, participants were given a true/false quiz to make sure they understood how a 2nd price auction worked and that they may be exchanging money for a good at the end of the experiment. The quiz provided immediate feedback, explaining why the participants' answers were correct or incorrect. After the quiz, the participants took part in three rounds of non-hypothetical bidding for sweet potatoes, where in each round they placed five bids, one bid each for sweet potatoes of each of the five skinning levels, as shown to them using photos on a computer screen. In the first round of bidding, the participants did not know the skinning percentages prior to bidding (known as blind) and were not otherwise signaled that they might vary in their skinning levels. In the second and third rounds, the participants were given information on the skinning percentage injuries prior to bidding (known as labelled). Examples of the blind and labelled auction rounds are shown in the Appendix as Figure 2 and Figure 3, respectively. After the second round and prior to the third round of bidding, we exposed participants to different information treatments related to food waste, as described below.

After the bidding, participants answered a survey (see Appendix A) that elicited demographic and behavioral variables, such as where the household primarily shops, and how much is spent on fresh fruits and vegetables. After completion of the survey, the moderator rolled a die to determine which of the three bidding rounds and which of the

five skinning levels was binding. Participants were then directed to a second room with another moderator to receive their purchased product, if applicable, and their cash earnings.

Treatments

We assigned each session to one of two different treatments groups. The six sessions allowed for three sessions of treatment one and three sessions of treatment two, where the sessions alternated and took place at different times of the day to control for any effect of the time of day on people's food choices.

In Treatment 1, before the third round of bidding, participants were given information on the link between aesthetic perceptions, grocery store standards, and food waste (FW Info). This information was given as follows:

> Aesthetic Perceptions, Grocery Store Standards, and Food Waste
>
> Each year, 20% of the fruits and vegetables grown in America are rejected from grocery stores because they do not meet cosmetic standards and are not considered attractive enough for grocery store displays. Cosmetically-challenged fruits and vegetables, despite having at least the same nutritional content, are typically sold to food processors at prices lower than fresh market prices or thrown back to the soil. When edible food is thrown back to the soil, all the resources that were used in growing this food are also thrown away- an issue that is contributing greatly to food waste and its various impacts. Skinning injury is very common when harvesting sweet potatoes. However, there's a certain threshold at which sweet potatoes with skinning injury are no longer sold for fresh consumption. Moreover, what is considered an allowable percentage of skinning is often determined arbitrarily by retailers.
> Sources: Meyers et al. (2015), Imperfect Produce.

In Treatment 2, prior to the third round of bidding, participants received the same food waste information as in Treatment 1 as well as additional information on the environmental impacts of food waste (FWE Info). The additional information on the environmental impacts of food waste was given as follows:

Environmental Impacts of Food Waste

Each year, about one third of all food produced for human consumption is wasted. Food waste has implications for the environment. Here are some highlights from a 2013 report by the Food & Agriculture Organization of the United Nations (FAO) on the impacts of food wastage on natural resources:

- The carbon footprint resulting from wasted food is 3.3 Gigatonnes of CO_2 equivalent- higher than the carbon footprint of any single country except China and the USA.
- 250 km^3 of ground and surface water are used to grow wasted food- 3.6 times as much as is used in the USA for all purposes and more than is used by any single country.
- The amount of land used to produce wasted food is nearly 1.4 billion hectares- an area larger than that of any country except Russia.
- Production of wasted food is a major threat to biodiversity worldwide.

The experimental design is summarized in Table 1.

Table 1 Experimental Design Summary

Treatment	Round	Blemishing Percent	Information
1,2	1	Blind	No
1,2	2	Labelled	No
1	3	Labelled	Food Waste (FW)
2	3	Labelled	Food Waste and Environmental (FWE)

Sample Representativeness

As mentioned, participants answered a sociodemographic and behavioral survey at the end of each session. The sample, as shown in Table 2, was comparable to the populations of Mississippi and of the United States in terms of household size (persons per household), and number of children (less than 18 years old) in the household. The average household size of the total sample was 2.5 individuals, which was representative of Mississippi (2.6) and national (2.6) statistics, with an average of 0.4 children under the age of 18, which was somewhat lower than Mississippi (0.7) and national statistics (0.6).

However, the sample had more females, was more likely to be married, younger, more educated, and more likely to be employed and have a lower income than the Mississippi and national populations, probably because the study was held on a university campus. Namely, the sample consisted of 65.3% females, which was slightly higher than Mississippi (51.5%) and national statistics (50.8%). Regarding marriage, 59.2% reported that they were married, a proportion close to the Mississippi (44.3%) and national (47.5%) populations. The majority (53%) of our sample was between the ages of 18 to 29; however, only 16.8% of the Mississippi population and only 16.6% of the national population is in this age group. Furthermore, 4.1% of our sample was 60 years of age or older, much lower than both Mississippi (21.2%) and national (21.3%) populations. Regarding education, the sample consisted of 20.4% with a high school degree or some college and 79.6% with bachelor's degree or graduate school degree, whereas 82.3% of Mississippians and 86.7% of United States citizens have a high school degree or some college and 20.7% of Mississippians and 29.8% of the national population have a bachelor's degree or graduate school degree.

In terms of employment, 93.9% of our sample were either full-time or part-time employed, which was higher than both Mississippi (51.9%) and national (58.4%) statistics. Only 6.1% of our sample was either unemployed or not in the labor force, whereas 47.7% of the Mississippi population and 41.2% of the national populations are either unemployed or not in the labor force. In terms of income, the majority (72.9%) of our sample had a yearly household income of $49,999 or less, whereas 58.6% of the Mississippi and 45.4% of the national populations were in this income group. About 14.6% of our sample had a yearly household income of $50,000 to $99,999, while 27.2%

of the Mississippi and 30% of the national populations were in this income group. About 8.3% of our sample had an income of $100,000 to $149,999 and 4.2% had an income of $150,000 or more, whereas 9.2% and 5% of the Mississippi and 13.5% and 11.1% of the national population were in these respective income groups.

Table 2 Demographic and Other Characteristics of Experimental Auction Participants

Variable	Category	Sample (n=49)		Study population [a,b,c]		US population [a,c]	
		Mean	Percent	Mean	Percent	Mean	Percent
Age	18 to 29 years of age		53.0		16.8		16.6
	30 to 39 years of age		22.4		12.5		13.2
	40 to 49 years of age		12.2		12.3		12.6
	50 to 59 years of age		8.2		12.9		13.5
	60 years of age or older		4.1		21.2		21.3
Education	High School degree/ some college		20.4		82.3		86.7
	Bachelor's or Graduate degree		79.6		20.7		29.8
Household size	Persons per household	2.5		2.6		2.6	
Gender	Female		65.3		51.5		50.8
	Male		34.7		48.5		49.2
Marital status	Married		59.2		44.3		47.5
	Not married		40.8		55.7		52.5
Children	Children (<18) per household	0.4		0.7		0.6	
Household income/year	$49,999 or less		72.9		58.6		45.4
	$50,000-$99,999		14.6		27.2		30.0
	$100,000-$149,999		8.3		9.2		13.5
	$150,000 or more		4.2		5.0		11.1
Employment	Full- or part-time employed		93.9		51.9		58.4
	Unemployed or not in labor force		6.1		47.7		41.2
Primary grocery shopper	Yes		95.9				

Note: n denotes the number of participants.

[a] Source: 2014 American Community Survey (ACS).

[b] Population statistics for Mississippi.

[c] Employment categories available in the ACS: Employed civilian labor force or armed forces, Unemployed civilian labor force, Not in labor force.

Econometric Model

Panel data have two dimensions of variation; cross sectional and intertemporal. Using panel data has several benefits such as "obtaining a large sample, giving more degrees of freedom, more variability, more information, and less multicollinearity among the variables" (Pillai, 2016, p.6). When conducting experimental auctions, pseudo-panel data are most often collected, as the auction follows individuals across time as additional information is learned, generally referred to as treatment effects (Lusk and Shogren, 2007). Our experimental auction collected pseudo-panel data as we followed 49 participants across three consecutive rounds of bidding, each separated from the next by different information treatments. Because all 49 participants partook in each of the 3 rounds, the data is a balanced panel.

Using these data, we estimate the following model:

$$WTP_{ij} = \beta_1 + \beta_{l,for\ l\neq 1}\left(Blind \times NoInfo \times Blemish_{l,for\ l\neq 1}\right) + \beta_{l+5}(Labelled \times NoInfo \times Blemish_l) + \beta_{l+10}(Labelled \times FWInfo \times Blemish_l) + \beta_{l+15}(Labelled \times FWEInfo \times Blemish_l) + \boldsymbol{X'}_k\boldsymbol{\theta}_K + e_i + u_{ij} \quad (1)$$

where WTP_{ij} is the bid of participant *i* in round *j*, *l* is an indicator for the skinning category defined by a percentage skinning level and is in the set {1,2,3,4,5} representing the 0-<1%, 1-3%, 3.1%-5%, 5.1-7.5%, and 7.6-10% skinning injury levels, respectively, $\boldsymbol{X}_k$ is a $k \times 1$ vector of *K* sociodemographic and behavioral variables, $\boldsymbol{\theta}_k$ represents a conformable vector of parameters for these variables, u_i represents an unobserved time-invariant individual component, and e_{ij} is the typical idiosyncratic error term that is assumed to have a mean of zero and to be contemporaneously uncorrelated with the

independent variables. The other variables are interactions between treatment, round, and percentage of skinning dummy variables, the parameters of which we use to test our hypotheses. Since including all treatment-round-blemishing level interactions would create a collinearity with the constant, the interaction between round 1 (blind and no info) and the 0-<1% percentage level is omitted as the base. We summarize all variables used in the model in Table 3. Because consumers who spend a larger amount on fresh produce might be more willing to accept blemished produce, we included a behavioral variable that was a dummy variable indicating whether the participant typically spends at least $25 on fresh produce per food shopping trip, as elicited from the post-experiment survey. This variable equaled 1 if the consumer reported that he spent at least $25 on fresh produce per food shopping trip and 0 if he spent less than $25. We also asked consumers whether they were aware of any commercial brand of cosmetically-challenged fresh produce, since consumers who are aware of ugly produce brands might be more likely to be aware of the issue of blemished produce being wasted and perhaps more likely to purchase blemished produce. This dummy variable equaled 1 if the consumer reported to be aware of ugly produce brands and 0 if not aware.

Table 3 Description of Variables Used in the Econometric Model

Variable	Type	Description
WTP_{ij}	Continuous	Consumer *i*'s bid for a pound of sweet potatoes with blemishing j
Treatment Variables[a]		
Blind×NoInfo×Blemish$_l$	Discrete/Binary	=1 if No Labels, No Information, and Blemish l for $l \neq 1$, =0 =0 otherwise
Labelled×NoInfo×Blemish$_l$	Discrete/Binary	=1 if Labels, No Information, and Blemish l =0 otherwise
Labelled×FWInfo×Blemish$_l$	Discrete/Binary	=1 if Labels, Food Waste Information, and Blemish l =0 otherwise
Labelled×FWEInfo×Blemish$_l$	Discrete/Binary	=1 if Labels, Food Waste and Environmental Information, and Blemish l =0 otherwise
Sociodemographic and Behavioral Variables		
Female×Ugly	Continuous	=1 if female and l=3,4,5, =0 otherwise
Female	Discrete/Binary	=1 if female, =0 otherwise
Income×Ugly	Continuous	Income (in thousands of US$) if l=3,4,5
Income	Continuous	Income (in thousands of US $)
Income×Income	Continuous	Income squared
Bachelor's Degree×Ugly	Discrete/Binary	=1 if has at least a Bachelor's Degree and l=3,4,5, =0 otherwise
Bachelor's Degree×Ugly	Discrete/Binary	=1 if has at least a Bachelor's Degree, =0 otherwise
Graduate School Degree	Discrete/Binary	=1 if has Master's or PhD Degree, =0 otherwise
Household Size	Continuous	Number of children in household under 18 years old
Married	Discrete/Binary	=1 if married, =0 otherwise

Table 3 (continued)

Spends $25+ on Fresh Produce/Trip	Discrete/Binary	=1 if spends $25 or more on fresh produce per food shopping trip =0 otherwise
Aware of "ugly" fresh produce brands	Discrete/Binary	=1 if aware of cosmetically-challenged fresh produce brand, =0 otherwise

[a]Blind×NoInfo×$Blemish_1$ used as base in econometric model

With experimental auction data, it is important to first check if there is any censoring in the data because if censoring is ignored then the model estimates could be overestimated (Lusk and Shogren, 2007). Right censoring occurs when the true value of the dependent variable lies above a threshold value, but the researcher observes only the threshold value. For example, people may not bid above an existing market price for a good (because that's the price at which they can buy the good once they leave the experiment) even though their value for the good is greater than the market price. Left censoring occurs when the dependent variable lies below the threshold value observed by the researcher, for example, a bid of $0 because negative bids are not permitted (Lusk and Shogren, 2007). We checked for left censoring of $0 bids in our data, but as seen in Table 4, there was little to no evidence of censoring, as the percentage of $0 bids was less than 5%, even for the highest skinning level.

There are several approaches for estimating models from panel data. If there was no unobserved heterogeneity of preferences across participants within a time period or across time periods within a participant, we could estimate the model by pooled ordinary least squares, where all explanatory variables are assumed to be exogenous and uncorrelated with the unobserved effect. However, if there was unobserved heterogeneity and we used pooled ordinary least squares, our composite term $(u_i + e_{ij})$ would be serially correlated with itself over time, giving us inefficient estimates. Panel data models, however, allow us to account for this unobserved heterogeneity in our data (Hsiao, 2003). In a fixed effects panel data model, the unobserved heterogeneity, u_i, is assumed to be correlated with the independent variables and is simply an estimable, respondent-specific constant term. In a random effects model, u_i is assumed to be

uncorrelated with all explanatory variables and becomes part of a respondent-specific composite error term, $(u_i + e_{ij})$. Because fixed effects models include an estimable, respondent-specific, time-invariant constant, other respondent-specific, time-invariant variables such as demographics cannot be included in the model because of collinearity (Wooldridge, 2006). The random effects model, on the other hand, does not preclude inclusion of respondent-specific variables such as demographics. We therefore estimate a random effects model after testing for the presence of random effects (compared to lack of random effects, in which case pooled ordinary least squares could be used).

To determine if a random effects model or a pooled ordinary least squares model should be used, we use a Breusch-Pagan Lagrange multiplier test, where the null hypothesis is that there are no random effects, using the following model:

$$\chi^2 = nR^2 \tag{2}$$

where *n* is the sample size and R^2 is the R^2 of the regression of squared residuals calculated from the predicted residuals of the OLS regression. Specifically, the null hypothesis of this test is that the variance of the error term is equal to zero, or that everyone has the same intercept and a pooled regression can be used. The p-value of χ^2 was <0.001; therefore, we reject the null hypothesis and estimate a random effects model with generalized least squares.

Hypotheses

Using the parameters estimated from equation 1, we test four hypotheses of interest related to our labelling and information treatments. First, we hypothesize that

consumers' willingness-to-pay for blemished sweet potatoes is affected by consumers knowing the level of blemishing in fresh produce:

H_1: After learning the blemishing levels, consumer willingness-to-pay will decrease or increase, depending on blemishing level. That is, $\beta_{l+5} < 0 \; or \; \beta_{l+5} > 0$ for $l = 1$ and $\beta_{l+5} < \beta_l \; or \; \beta_{l+5} > \beta_l$ for $l = 2$ through 5.

Our primary interest, however, is in how the provision of information to consumers might affect their purchase decisions, with the ultimate end of reducing food waste. In each of these tests, we hypothesize that the bid values submitted by educated consumers will be greater than those submitted before consumers were educated:

H_2: Given that consumers know the blemishing levels, consumer willingness-to-pay will increase after learning about the link between aesthetic perceptions, grocery store standards, and food waste. That is, $\beta_{l+10} - \beta_{l+5} > 0$ for $l = 1$ through 5.

H_3: Given that consumers know the blemishing levels, consumer willingness-to-pay will increase after learning about both the link between aesthetic perceptions, grocery store standards, and food waste and about the environmental impacts of food waste. That is, $\beta_{l+15} - \beta_{l+5} > 0$ for $l = 1$ through 5.

H_4: Given that consumers know the blemishing levels and the link between aesthetic perceptions, grocery store standards, and food waste, consumer willingness-to-pay will increase after learning about the environmental impacts of food waste alone. That is, $\beta_{l+15} - \beta_{l+10} > 0$ for $l = 1$ through 5.

CHAPTER IV

RESULTS AND DISCUSSION

Summary Statistics

Figure 1 shows the average bids on a per-pound basis for all blemishing levels per round (blind, labelled, and labelled plus information) and treatment. This figure suggests that after going from blind to labelled rounds, or after learning the blemishing levels of the sweet potatoes, consumers appeared to increase their average bids in all treatments. They also appeared to increase their bids after receiving information about the link between aesthetic perceptions, grocery store standards, and food waste (treatment 1), and further increase their bids after receiving this information plus additional information on the environmental impacts of food waste (treatment 2). Table 4 breaks down average bids and their associated standard deviations by treatment, round, and blemishing level. It also shows that the percentage of zero bids for each blemishing level in each round and each treatment was either zero or low, and thus there is no censoring in the auction data. Both Figure 1 and Table 4 point to differences in bids in the different treatment groups. In this chapter, we investigate whether these differences are statistically significant.

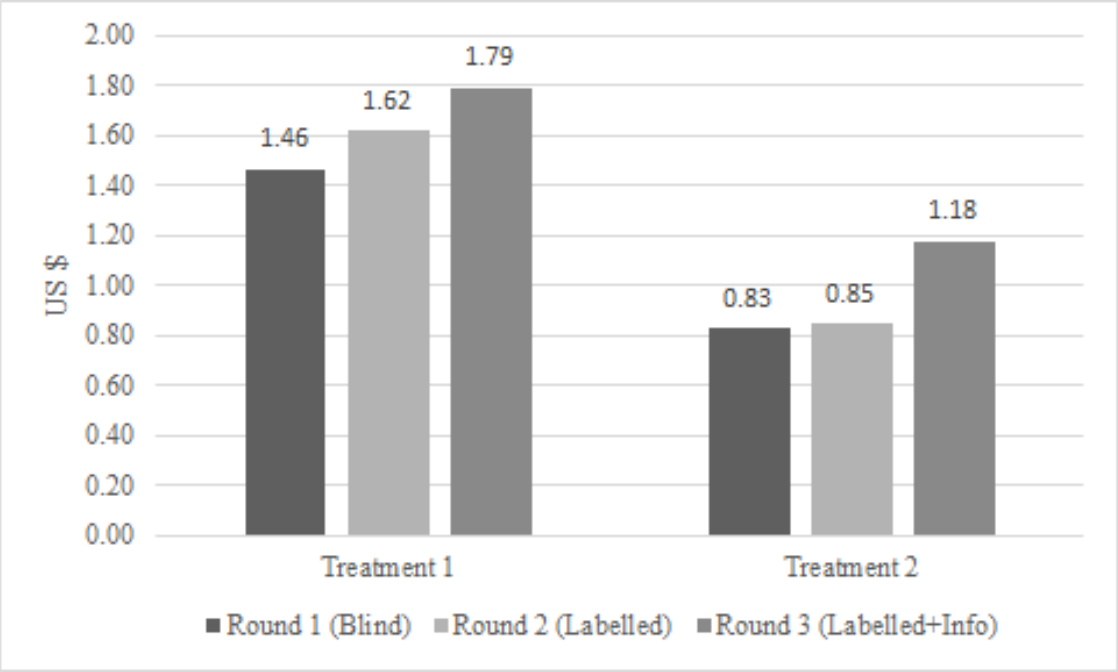

Figure 1 Average Bids for all Blemishing Levels Per Round and Treatment

Table 4 Summary Statistics of Bids (in US$) and Percentage of Zero Bids

		Treatment 1 (n=24)			Treatment 2 (n=25)		
	Blemishing Percent	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3
Mean	0-<1	1.93	2.26	2.27	1.08	1.21	1.54
	1-3	1.66	1.94	2.05	0.91	1.03	1.35
	3.1-5	1.34	1.62	1.80	0.75	0.79	1.16
	5.1-7.5	1.26	1.29	1.54	0.71	0.65	1.01
	7.5-10	1.12	0.99	1.27	0.68	0.52	0.83
	All	1.46	1.62	1.79	0.83	0.85	1.18
Standard deviation	0-<1	1.31	1.51	1.66	0.60	0.68	1.22
	1-3	1.04	1.38	1.49	0.59	0.66	1.09
	3.1-5	1.07	1.24	1.41	0.57	0.59	0.98
	5.1-7.5	1.09	1.01	1.26	0.54	0.50	0.91
	7.5-10	1.12	0.84	1.05	0.63	0.44	0.66
	All	1.15	1.28	1.41	0.60	0.62	1.00
Percentage of zero bids	0-<1	0.00	0.00	0.00	0.00	0.00	0.00
	1-3	0.00	0.00	0.00	4.00	0.00	0.00
	3.1-5	0.00	0.00	0.00	4.00	4.17	0.00
	5.1-7.5	0.00	0.00	0.00	4.00	4.17	0.00
	7.5-10	0.00	0.00	0.00	4.00	4.17	0.00
	All	0.00	0.00	0.00	3.20	2.46	0.00

Note: n denotes the number of participants.

Random Effects Linear Model

As can be seen in Table 5, we estimated Equation (1) using all round-treatment-blemishing level interactions and our sociodemographic and behavioral variables. Table 5 reports the random effects linear parameter estimates and their statistical significance for each blemishing level. The top of Table 5 shows the results for the treatment variables using Blind×NoInfo×Blemish$_1$ as the omitted base, whereas the bottom half of the table shows the results for the sociodemographic and behavioral variables. The bottom portion of the table shows the value of σ_u, or the standard deviation of the unobserved time-invariant individual component, the value of σ_e, or the standard deviation of the error term and the value of ρ, or the fraction of the variance due to u_i.

There are different types of information that we can infer from the parameter estimates in Table 5. Because the dependent variable the model in Table 5 corresponds to the participants' bids in US dollars, the parameter estimates can be interpreted as the effect of the independent variable on willingness-to-pay. If the variable is categorical, the effect is interpreted relative to the omitted base. If the variable is continuous, the effect is relative to a one unit change. Graduate school, for example, is a categorical variable implying that consumers who have a Master's or PhD degree are willing to pay a $0.50 per-pound premium for sweet potatoes relative to consumers who do not have a Master's or PhD degree. Household size, on the other hand, is a continuous variable, meaning that consumers are willing to pay $0.46 more per pound for sweet potatoes for each additional member living in the household.

Table 5 Determinants of Willingness-to-Pay: Random Effects Linear Estimates

	Parameter	Robust Standard Error
Treatment Variables[a]		
Blind×*NoInfo*×*Blemish*$_2$	-0.218***	0.085
Blind×*NoInfo*×*Blemish*$_3$	-0.509***	0.117
Blind×*NoInfo*×*Blemish*$_4$	-0.567***	0.119
Blind×*NoInfo*×*Blemish*$_5$	-0.642***	0.105
Labelled×*NoInfo*×*Blemish*$_1$	0.230***	0.058
Labelled×*NoInfo*×*Blemish*$_2$	-0.018	0.058
Labelled×*NoInfo*×*Blemish*$_3$	-0.352***	0.089
Labelled×*NoInfo*×*Blemish*$_4$	-0.585***	0.103
Labelled×*NoInfo*×*Blemish*$_5$	-0.791***	0.119
Labelled×*FWInfo*×*Blemish*$_1$	0.413**	0.163
Labelled×*FWInfo*×*Blemish*$_2$	0.190	0.117
Labelled×*FWInfo*×*Blemish*$_3$	-0.074	0.127
Labelled×*FWInfo*×*Blemish*$_4$	-0.325**	0.128
Labelled×*FWInfo*×*Blemish*$_5$	-0.589***	0.146
Labelled×*FWEInfo*×*Blemish*$_1$	0.407**	0.181
Labelled×*FWEInfo*×*Blemish*$_2$	0.222	0.149
Labelled×*FWEInfo*×*Blemish*$_3$	-0.065	0.158
Labelled×*FWEInfo*×*Blemish*$_4$	-0.211	0.145
Labelled×*FWEInfo*×*Blemish*$_5$	-0.395***	0.095
Sociodemographic & Behavioral Variables		
Female×Ugly	-0.211	0.139
Female	1.039***	0.301
Income×Ugly	0.003**	0.001
Income	-0.024***	0.009
Income×Income	1.228x10-4**	0.000
Bachelor's Degree×Ugly	0.247	0.153
Bachelor's Degree	-0.599**	0.235
Graduate School Degree	0.502**	0.210
Household Size	0.461***	0.102
Married	-0.787***	0.177
Spends $25+ on Fresh Produce/Trip	0.645***	0.184
Aware of "ugly" fresh produce brands	0.378	0.243
Constant	0.259	0.325

Table 5 (continued)

σ_u	0.603***
σ_e	0.454
P	0.638

[a] Blind×NoInfo×Blemish$_1$ used as base.
***, **, * Denote statistical significance at the 1%, 5%, and 10%, respectively.

From the parameter estimates, we can calculate total willingness-to-pay if we hold certain variables constant. As shown in Table 6, by setting all treatment variables equal to zero and holding all demographics at their means, we estimate that before knowing the labelling or any food waste information, consumers are willing to pay \$1.51, \$1.30, and \$1.05 per pound at the 0-<1%, 1-3%, and 3.1-5% blemishing levels, respectively. Similarly, consumers are willing to pay \$0.95 and \$0.87 per pound at the 5.1-7.5% and 7.6-10% blemishing levels. These results give an exact estimate of what consumers view as their maximum willingness-to-pay for these types of products, an aspect that the current literature is lacking, but more importantly, they show that consumers discounted their willingness-to-pay for highly blemished produce (7.6-10%) by up to 40%, relative to none or slightly blemished produce. They also show that consumers' willingness-to-pay for the highly blemished produce is non-zero. Finally, using the estimated parameters in Table 5, we can calculate the price premiums or discounts for all of our information treatments and test our hypotheses, which is where we will focus the discussion of our results. For each hypothesis, we use linear Wald tests to test for statistically significant differences between the estimated coefficients. We summarize these results in Table 7.

Table 6 Total Willingness-to-Pay (in US$) Across Rounds, Treatments, and Labelling and Information Treatments

	Blemishing Percentages				
	0-<1	1-3	3.1-5	5.1-7.5	7.6-10
Blind×NoInfo	1.514	1.296	1.005	0.948	0.872
Labelled×NoInfo	1.744	1.496	1.162	0.929	0.723
Labelled×FWInfo	1.927	1.704	1.440	1.189	0.925
Labelled×FWEInfo	1.921	1.736	1.449	1.303	1.119

Labelling and Information Treatments

Table 7 shows the premiums or discounts on a per-pound basis that consumers placed for the labelling and information treatments for each of the blemishing levels, and whether these premiums or discounts are statistically significant.

As mentioned in the methodology chapter, our first hypothesis (H_1) is that after learning the blemishing levels of the fresh produce, consumer willingness-to-pay will decrease or increase, depending on blemishing levels. That is, $\beta_{l+5} < 0 \; or \; \beta_{l+5} > 0$ for $l = 1$, and $\beta_{l+5} < \beta_l \; or \; \beta_{l+5} > \beta_l$ for $l = 2$ through 5. As shown in Table 7, after learning the blemishing levels (i.e. labelled rounds), relative to when they did not know them (i.e. blind rounds), consumers placed statistically significant per-pound premiums of \$0.23, \$0.20, and \$0.16 for sweet potatoes with little (<1%) to no blemishing, 1-3% and 3.1-5%, respectively. Labelling did not have a statistically significant effect on sweet potatoes with 5.1-7.5% blemishing; however, after learning the blemishing level of highly blemished sweet potatoes (7.5-10%), consumers expressed a price discount of \$0.15 per-pound relative to when they did not know the blemishing level. From our results, we can see that consumers do place premiums after learning the blemishing levels of more aesthetically pleasing (less blemished) produce but place price discounts after

learning the blemishing levels of less aesthetically pleasing (more blemished) produce. Therefore, with the exception of the 5.1-7.5% blemishing level, our findings support our first hypothesis.

Our second hypothesis (H_2) is that, given that consumers know the blemishing levels, consumer willingness-to-pay will increase after learning about the link between aesthetic perceptions, grocery store standards, and food waste. That is, $\beta_{l+10} - \beta_{l+5} > 0$ for $l = 1$ through 5. As shown in Table 7, we found that providing consumers with information about how aesthetic preferences contribute to food waste does have a positive and statistically significant effect on willingness-to-pay for blemished produce above the 1% blemishing level. Consumers placed a \$0.21, \$0.28, \$0.26, and \$0.20 per-pound premium for blemishing levels of 1-3%, 3.1-5%, 5.1-7.5%, and 7.6-10%, respectively, after learning this information. Therefore, with the exception of the 0-<1% blemishing level, our findings support this hypothesis. While de Hooge et al. (2017) finds that making European consumers aware of the amounts of food wasted globally has no statistically significant effect on consumers deciding to purchase suboptimal foods blemished apples and cucumbers, our results show that after being educated on food waste due to aesthetic preferences, consumers are willing to pay a per-pound premium for blemished sweet potatoes, even at the highest level of blemishing. Our results are supported by Loebnitz et al. (2015) who finds that awareness of the food waste problem contributes to the likelihood of purchasing suboptimal foods. Our results suggest that consumers may need a direct link on how their decisions contribute to food waste in order to change their food waste behaviors.

Table 7 Summary of Price Premiums/Discounts (in US$) for Labelling and Information Treatments

Hypothesis	Blemishing Percent 0-<1	1-3	3.1-5	5.1-7.5	7.5-10
H_1: After learning the blemishing levels, consumer WTP will decrease or increase, depending on blemishing level.	0.230***	0.200***	0.157**	-0.019	-0.149**
Given that consumers know the blemishing levels:					
H_2: After learning about food waste, consumer WTP will increase.	0.182	0.209*	0.278**	0.261**	0.202**
H_3: After learning about food waste and its environmental impacts, consumer WTP will increase further.	0.177	0.241	0.287**	0.375***	0.396***
H_4: After learning about the environmental impacts of food waste alone, consumer WTP will increase, given that consumers know the relationship between aesthetic preferences and food waste.	-0.005	0.032	0.009	0.114	0.194

***, **, * Denote significance at the 1%, 5%, 10% level respectively.

Our third hypothesis (H_3) is that, given that consumers know the blemishing levels, consumer willingness-to-pay will increase after learning about both the information on the link between aesthetic perceptions, grocery store standards, and food waste as well as information on the environmental impacts of food waste. That is, $\beta_{l+15} - \beta_{l+5} > 0$ for $l = 1$ through 5. Providing consumers with both sets of information had a positive and statistically significant effect on willingness-to-pay for blemished produce at all blemishing levels. As shown in Table 7, consumers placed at least a $0.25 per-pound premium after learning this information for all blemishing levels in this treatment. Consumers placed per-pound premiums of $0.28, $0.38, and $0.40 for the blemishing levels of 3.1-5%, 5.1-7.5%, and of 7.6-10%, respectively. Overall, our results show that after being educated on food waste due to aesthetic preferences and its environmental impacts, consumers are willing to pay a premium for sweet potatoes with more blemishing relative to when they did not know this information. Although these premiums are close in magnitude to the premiums due to the food waste information alone, our findings support our third hypothesis, except for the lower blemishing levels from 0-3%. Moreover, they are consistent with Loebnitz et al. (2015) who find in that consumers with a high pro-environmental self-identity are more likely to purchase abnormal produce after gaining greater knowledge about food waste issues.

Our fourth hypothesis (H_4) regarding the information treatments is that, given that consumers know the blemishing levels and the link between aesthetic perceptions, grocery store standards and food waste, consumer willingness-to-pay will increase after consumers learn about the environmental impacts of food waste alone. That is, $\beta_{l+15} - \beta_{l+10} > 0$ for $l = 1$ through 5. However, as shown in Table 7, educating consumers

about the environmental impacts of food waste alone did not have a statistically significant effect on willingness-to-pay at any level of blemishing; thus, our results do not support our fourth hypothesis. Our findings suggest that those consumers who might have a desire to improve the environment around them might still need the connection of how their choices in the market contribute to food waste and the environmental impacts of such food waste rather than just the knowledge about environmental impacts from food waste alone.

Taken as a whole, these results in Table 7 suggest that some of the labelling and information treatments considered here have the potential to influence consumer decision making when purchasing fresh produce.

Sociodemographic and Behavioral Characteristics

Recall that one of the goals of this paper is to determine a sociodemographic and behavioral profile for those who are willing to pay price premiums for sweet potatoes of various levels of blemishing. Furthermore, sweet potato producers wanted to know at what level consumers begin to discount or disregard blemished sweet potatoes in the market. From our hypotheses tests, we found that there was a behavioral change for most of our hypotheses at skinning levels above 3%; therefore, we suggest that consumers begin to differentiate the products between aesthetically pleasing and blemished produce, or "ugly" produce, at the 3% skinning injury level. To test what profile of consumers are willing to pay a premium for this "ugly" produce, we interacted each of our demographic and behavioral variables with a dummy variable called ugly that equaled 1 if the sweet potatoes were above the 3% skinning injury level and a dummy variable called cute that equaled 1 if the sweet potatoes were below the 3% skinning injury level. We then tested

if there was a difference across the willingness-to-pay between these dummy variable-demographic/ behavioral variable interactions for each of our demographics. When we tested for the differences, we found that most of the interactions were not close to being significant at the 5% level with the exception of the income interaction (which was significant) and the interactions with female and having a bachelor's degree (significant at the 13% and 11% level, respectively); therefore, we included these in our regression equation. However, because the variables with the highly blemished produce and the variables regarding the more aesthetically pleasing produce are statistically different from each other, we will interpret the coefficients as they are estimated. Regarding gender, as shown in Table 5, females relative to men provide a $1.04 per-pound premium for more aesthetically pleasing sweet potatoes, while providing an $0.83 per-pound premium for highly blemished produce. Even though females provide a higher premium for aesthetically pleasing produce than for highly blemished produce, females, relative to men, still provide a premium for highly blemished produce. Past studies regarding blemished produce do not differentiate between levels of blemishing, but ours does, which could show that females are willing to accept and to pay more than men for sweet potatoes up to a certain blemishing point. Income appeared to have a nonlinear effect on willingness-to-pay. For more aesthetically pleasing produce, income had a negative marginal effect on willingness-to-pay but as income increased by $10,000, the marginal effect of income became less negative until income reached approximately $100,000, where the marginal effect then became positive. The same story exists with highly blemished produce, except the effect does not become positive until an income of approximately $110,000. These findings are different from past studies where income

was not statistically significant in the purchase of blemished produce (Bunn et al., 1990; de Hooge et al., 2017; Yue et al., 2009). Our study differentiates between levels of blemishing, which could contribute to our findings. Finally, we found that those who have at least a bachelor's degree discount aesthetically pleasing sweet potatoes by about $0.60 per pound and discount highly blemished produce by about $0.35 per pound compared to those who do not. Our findings are not consistent with past studies where a higher education level was not statistically significant in choosing blemished produce (Bunn et al., 1990; de Hooge et al., 2017); however, our project analyzed various blemishing levels to estimate a specific level that consumers might have associated with as highly blemished, which the other studies did not do.

The results from this study are also valuable to sweet potato farmers who are interested in the profile of consumers who are willing to pay more for sweet potatoes. We use the parameters shown in Table 5 to examine this profile of consumers. Regarding education, as mentioned, those with a bachelor's degree discounted sweet potatoes compared to those who do not have a bachelor's degree; however, those with a Master's or PhD degree provide a $0.50 per-pound premium for sweet potatoes. Regarding household characteristics, we found that willingness-to-pay for sweet potatoes increases by about $0.46 per pound as the household increases by one. However, those who were married discounted sweet potatoes by about $0.78 per pound compared to those who are not. Furthermore, those who spend at least $25 on fresh produce per food trip provided a $0.65 per-pound premium for sweet potatoes. Overall, we found that, regardless of the skinning injury level, those who provide a premium for sweet potatoes are females (relative to men), those who have an income above $100,000, those with a Master's or

PhD degree, those with larger household sizes, and those who spend at least $25 on fresh produce per food trip. Those who discount sweet potatoes, regardless of the skinning injury level, are those with a Bachelor's degree, those who have an income below $100,000, and those who are married.

CHAPTER V

SUMMARY, CONLUSIONS, AND IMPLICATIONS

Summary

Food waste is becoming an increasingly discussed topic as more information about its magnitude and associated impacts becomes available. Because it is a relatively new research topic, there are different definitions of food waste—one being food that is fit for human consumption, but discarded anyway (United Nations, 2013)—yet despite its definition, it is potentially preventable. Consumers in developed countries waste approximately 222 million tons of food per year (United Nations, 2011). This waste has large environmental, social, and economic costs. In America alone, over $218 billion is spent growing, processing, transporting, and disposing food that is never eaten (ReFED, 2016). Moreover, if global food waste was a country, it would be the third largest greenhouse gas emitter after China and the United States (United Nations, 2013). Unfortunately, much of the food waste in developed countries comes from consumers' desire to have aesthetically pleasing produce (Aschemann-Witzel et al., 2015). Farmers and retailers believe that consumers will not purchase blemished produce and will therefore discard blemished produce which results in great costs to retailers and producers (Kantor et al., 1997). Farmers and retailers cater to this desire; however, consumers may be uninformed about the consequences of wasting this food.

We used a non-hypothetical second price auction with U.S. No. 1 sweet potatoes with five different blemishing levels ranging from 0-10% to investigate whether consumer preferences for produce of various blemishing levels are affected by (1) labelling of blemishing levels, (2) information on the link between aesthetic perceptions, grocery store standards, and food waste, (3) the same information plus information on the environmental impacts of food waste, and (4) information on the environmental impacts of food waste alone. In the experimental auction, we asked consumers to bid their maximum willingness-to-pay for each of the skinning injury levels on a per-pound basis. We had three rounds of bidding where round 1 was blind, meaning that participants did not know the skinning injury level. Round 2 was labelled, meaning that participants knew the skinning injury levels from labels that we provided. Round 3 was labelled plus information, meaning that participants knew the skinning injury and knew the information from our two treatments. During round 3 of treatment 1, participants were provided information about the link between aesthetic perceptions, grocery store standards, and food waste. During round 3 of treatment 2, participants were provided with the same information as in treatment 1 and information about the environmental impacts of food waste.

Our results show that consumers provide premiums for blemished sweet potatoes below the 5% skinning injury level but discount the products at the highest blemishing level when they know the skinning injury level relative to when they do not. We also find that consumers provide premiums for blemished produce above the 1% skinning injury level when being educated about the link between aesthetic perceptions, grocery store standards, and food waste. Furthermore, consumers provide premiums for blemished

produce above the 3% skinning injury level after receiving both information about the link between aesthetic perceptions, grocery store standards, and food waste and about the environmental impacts of food waste. However, the environmental impact alone had no statistically significant effect on willingness-to-pay.

Industry Implications

As stated by Deckers (2017, pg.17), "…adoption of misshapen produce is a relatively new area for improving supply chain efficiency," and thus it is important that we search for the level of blemishing that consumers will accept and find the factors that drive consumer demand for this type of product. In our application, we found that there is a behavioral change in consumers' purchasing decisions around the 3% skinning injury level for sweet potatoes, suggesting that this may be a reasonable threshold at which consumers start differentiating optimal from sub-optimal sweet potatoes. While different products and types of blemishing (e.g misshapen produce) may have different results and should be studied accordingly, farmers and retailers could use our results as they negotiate the possibility of infiltrating the blemished produce market. Some have suggested to add the blemished produce to the perfect produce by "including suboptimal products in the retailer's standard assortment [to potentially] generate increased purchase likelihoods of such products over time" (de Hooge et al., 2017, pg.89). However, given that we identified a behavioral change around the 3% skinning level and find that consumers are still willing to purchase the blemished produce, another possibility is to differentiate the products. The success of differentiating blemished and perfect produce has been seen in the past by producer and organizational initiatives and campaigns such as that of France's third largest supermarket chain, Intermarché, which sold blemished or

misshapen produce branded as Inglorious at a 30% discount causing store traffic to increase by 24%. American organizational campaigns have also helped influence this market through campaigns like Ugly Fruits and Vegetables, a social media campaign that currently has over 84,000 followers on Twitter. Other American companies such as Imperfect Produce in the West Coast and Hungry Harvest in the East Coast source 'ugly' produce directly from farms and deliver them to customers at a discounted price. The success of these initiatives shows that there may be a market for various types of blemished and misshapen produce, and our study shows that there may be a specific threshold at which consumers consider produce as 'ugly'.

Either strategy to introduce blemished produce into the market should be based on a detailed benefit-cost analysis. A potential cost to retailers is that introducing blemished produce into an American grocery store could potentially harm the grocery store's brand if the introduction is not done properly. Studies have found that American consumers seem to associate blemishing or damages in produce with unhealthy characteristics (Vanderwaal, 2017) or potential contamination (Creusen and Schoormans, 2005). Thus, finding the drivers behind this market for blemished produce could allow farmers and retailers to "find the highest value possible for every part of a product," (Deckers, 2017, pg. 30) and potentially increase net revenues for both farmers and retailers. While we have found that consumers respond to food waste information, understanding ways to make sure that consumers would accept blemished fresh produce and will purchase it regularly is essential in introducing it into the American supermarket.

Little is known about what drives consumers to purchase these products (Loebnitz et al., 2015). One possible explanation of the past exclusion of blemished produce is that

consumers do not understand how their choices of denying blemished produce contributes to food waste and its externalities. Since willingness-to-pay increased after receiving the information about the link between aesthetic perceptions, grocery store standards, and food waste and about the environmental impact of food waste, we suggest that consumers may be lacking full information when purchasing produce in the market. We found that consumers responded to this information at the highest blemishing levels; therefore, our study could help retailers in creating displays that will encourage consumers to purchase blemished fresh produce. Because "retailers have direct contact with consumers and… have the task to inform consumers about the product in terms of quality and health," (Deckers, 2017, pg.32), retailers could market the highly blemished produce with advertisements of food waste and its environmental impacts in order to help reduce the amount of blemished produce that is wasted, and, in combination with information about their own marginal costs of selling blemished produce, retailers and producers could use our results (on willingness-to-pay or consumer demand) to analyze market prices and profitability scenarios. These prices could be used to differentiate between the more aesthetically pleasing produce and highly blemished produce, a pricing strategy that has been successful in the past.

Past studies have also found that social media interventions via Facebook pages could help reduce food waste (Young et al., 2017); therefore, governmental and non-governmental organizations, such as USDA or the Ugly Fruits and Vegetables movement, could use our results to develop food waste campaigns that effectively target individuals through social media.

Policy Implications

From both our results and past studies (Whitehair et al., 2013; Qi and Roe, 2017), we know that consumers do respond to information about food waste and the effects of food waste. Different stakeholders could use this information to design consumer awareness campaigns to educate consumers about food waste. In 2015, the United States Department of Agriculture (USDA) and the United States Environmental Protection Agency (EPA) created the first ever national initiative to create measures to reduce food waste. The United States 2030 Food Loss and Waste Reduction Goal called for a joint effort between the United States governmental agencies, private organizations, charitable and faith-based organizations to reduce food waste by 50 percent by the year 2030. This initiative was sparked by different measures that the USDA and EPA have already taken, including the U.S. Food Waste Challenge and the EPA's Food Recovery Challenge, both of which encouraged participants to reduce food waste and to share methods of doing so (USDA, 2015). This reduction goal was set to "present a major environmental, social and public health opportunity for the U.S.," according to the EPA Administrator Gina McCarthy (USDA, 2015). The USDA Secretary says that this reduction will help America become a leader in "efficient use of natural resources, cutting environmental pollution and promoting innovative approaches for reducing food loss and waste" (USDA, 2015). This initiative was inspired by a goal set by the United Nations to improve the sustainable development measures of its member countries and to halve food waste by 2025 (Stuart, 2009). Therefore, our findings may be helpful to the USDA and EPA in potentially designing more efficient efforts to minimize food waste. Understanding that consumers react to knowledge about how aesthetic perceptions and

grocery store standards contribute to food waste, as well as the environmental impacts of food waste, would allow for governmental agencies to better understand how to create more efforts to meet their reduction goal. Having this knowledge would also help for producers and retailers to better understand how to advertise blemished produce in order to raise revenue, reduce costs, and reduce waste. However, these efforts should also be based on a benefit-cost analysis as it is possible that a national policy to educate about food waste may not necessarily produce a net benefit (Koester, 2014).

Limitations and Suggestions for Future Research

One limitation of our study is a relatively small sample size (49), which could have affected the representativeness of our sample and the stability of our estimates. Furthermore, during our experiment, the sweet potato images were not shown in random order and thus we do not know if the order of the skinning injury levels affected willingness-to-pay. Going from least to most blemished could have potentially influenced the reduction in willingness-to-pay across skinning levels. We also know that past studies look heavily at consumers' self-identity with pro-environmental behaviors (de Hooge et al., 2017; Loebnitz et al., 2015), but our study does not address the consumers' self-identity with any types of pro-environmental behaviors. It is possible that a self-identity with pro-environmental behaviors could have potentially had an impact on our fourth hypothesis about providing information on the environmental impact of food waste.

Looking ahead, future research could replicate this experiment with an increased sample size, vary the order of the images to account for any ordering effects, and seek to identify those with pro-environmental behaviors while assessing their willingness-to-pay for blemished produce that might otherwise be wasted. Future research could also

include field experiments to capture the best way to introduce blemished produce to American consumers in the most effective and efficient way.

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APPENDIX A

EXPERIMENTAL AUCTION PROCEDURES

Survey

Thank you for your submitting your auction bids! While we determine the auction results, please answer the following short survey to the best of your ability. All responses will be kept confidential.

Important definitions

Fresh produce: Fresh fruits and vegetables.
Household: Please consider your "household" to include those with whom you currently make food purchasing decisions together. Therefore, if you live with roommates or housemates with whom you do not regularly make food purchasing decisions, they should not be considered part of your household. Your "household" may include only yourself.

How likely do you think it is that the results of this survey will influence decisions in Mississippi that might affect food waste?

- ○ Very unlikely
- ○ Unlikely
- ○ Neutral
- ○ Likely
- ○ Very likely

Are you the **primary** grocery shopper for your household?

- ○ Yes
- ○ No

Even though you are not the primary grocery shopper for your household, please answer the following questions as best as you can.

How often does your household buy **fresh fruits and vegetables**? Please exclude any canned, frozen, and/or processed fruits and vegetables.

- ○ Less than once per month
- ○ Once per month
- ○ Twice per month
- ○ Three times per month
- ○ Four times per month
- ○ More than four times per month

How much, on average, does your household spend on fresh fruits and vegetables **per food shopping trip**?

- ○ $0-$24
- ○ $25 - $49
- ○ $50 - $74
- ○ $75 - $99
- ○ $100 or more

On average, how many times **in the last month** have you purchased any fresh fruits and vegetables from the following locations? If you have not purchased any fresh fruits and vegetables at a given location during the last month, enter zero.

- ○ Supermarket or supercenter _____
- ○ Farmers' market _____
- ○ Roadside or farm stand _____
- ○ Community Supported Agriculture (CSA) subscription_____
- ○ Online _____

In how many of those trips, regardless of location, did you purchase at least one item of **organic** fresh fruits and vegetables?

- ○ None of the trips
- ○ In some, but less than half of all trips
- ○ More than half, but not every trip
- ○ Every trip

The following is a hypothetical scenario:

Suppose you are about to buy a box of fresh fruits and vegetables. Picture in your head **boxes A and B**, each filled with any given combination of seasonal fresh fruits and vegetables. The two boxes have exactly the same produce items and weight 9 lbs. each. However, produce in **box A** has the shape, size, and visual standards you would typically find in the fresh produce section of supermarkets, and sells for **$15.70**, while produce in **box B** does not have the shape, size, or aesthetic appeal required to be displayed by most supermarkets.

Will you be willing to purchase box B if the price is <u>$10.99</u> (a 30% discount)?

- ○ Yes
- ○ No

Will you be willing to purchase **box B**, the same 9 lbs. box of cosmetically-challenged produce that was just described, if the price is **<u>$12.56</u> (a 20% discount)**?

- ○ Yes
- ○ No

Will you be willing to purchase **box B**, the same 9 lbs. box of cosmetically-challenged produce that was just described, if the price is **<u>$7.85</u> (a 50% discount)**?

- ○ Yes
- ○ No

Before today's session, were you aware that fresh produce that does not meet certain cosmetic standards is rejected by food retailers such as supermarkets or grocery stores?

- ○ Yes
- ○ No

Are you **aware** of any commercial brand of cosmetically-challenged fresh produce?

- ○ Yes
- ○ No

What is your age?

- ○ Years _____

Are you male or female?

- ○ Male
- ○ Female

Are you currently married?

- ○ Yes
- ○ No

Which of the following best describes your highest level of **education**?

- ○ I have not graduated high school
- ○ I have graduated high school
- ○ Some college
- ○ I have graduated from a two-year college
- ○ I have graduated from a four-year college or university
- ○ Some graduate school
- ○ I have a master's degree
- ○ I have a doctoral degree

How many people **including you** reside in your household on a regular basis?

_____

How many people **under the age of 18** reside in your household on a regular basis?

_____

Which of these best describes your **employment** status?

- ○ Unemployed
- ○ Stay-at-home parent
- ○ Part-time employed
- ○ Full-time employed
- ○ Retired

Please indicate the range of your household's yearly before-tax **income**.

- ○ Less than $30,000
- ○ $30,000-$39,999
- ○ $40,000-$49,999
- ○ $50,000-$59,999
- ○ $60,000-$69,999
- ○ $70,000-$79,999
- ○ $80,000-$89,999
- ○ $90,000-$99,999
- ○ $100,000-$149,999
- ○ More than $150,000

You can provide here any additional comments about today’s experience:

_____

ROUND 1. After carefully examining each image, please indicate the **maximum** amount that you would be willing to pay for **1 pound (lb.)** of each of the following items. Write the amount of your bid (in dollars and cents) in the box next to each image. Please be sure to write a bid for each product listed.

Option A

Option B

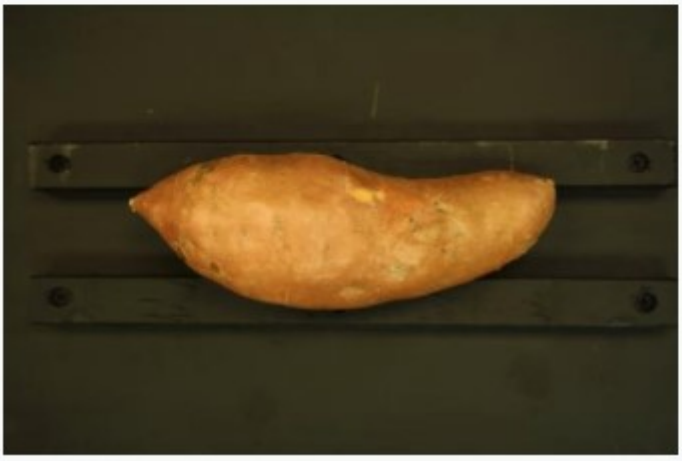

Figure 2 Example of Image for Participants when Bidding on Blind Sweet Potatoes

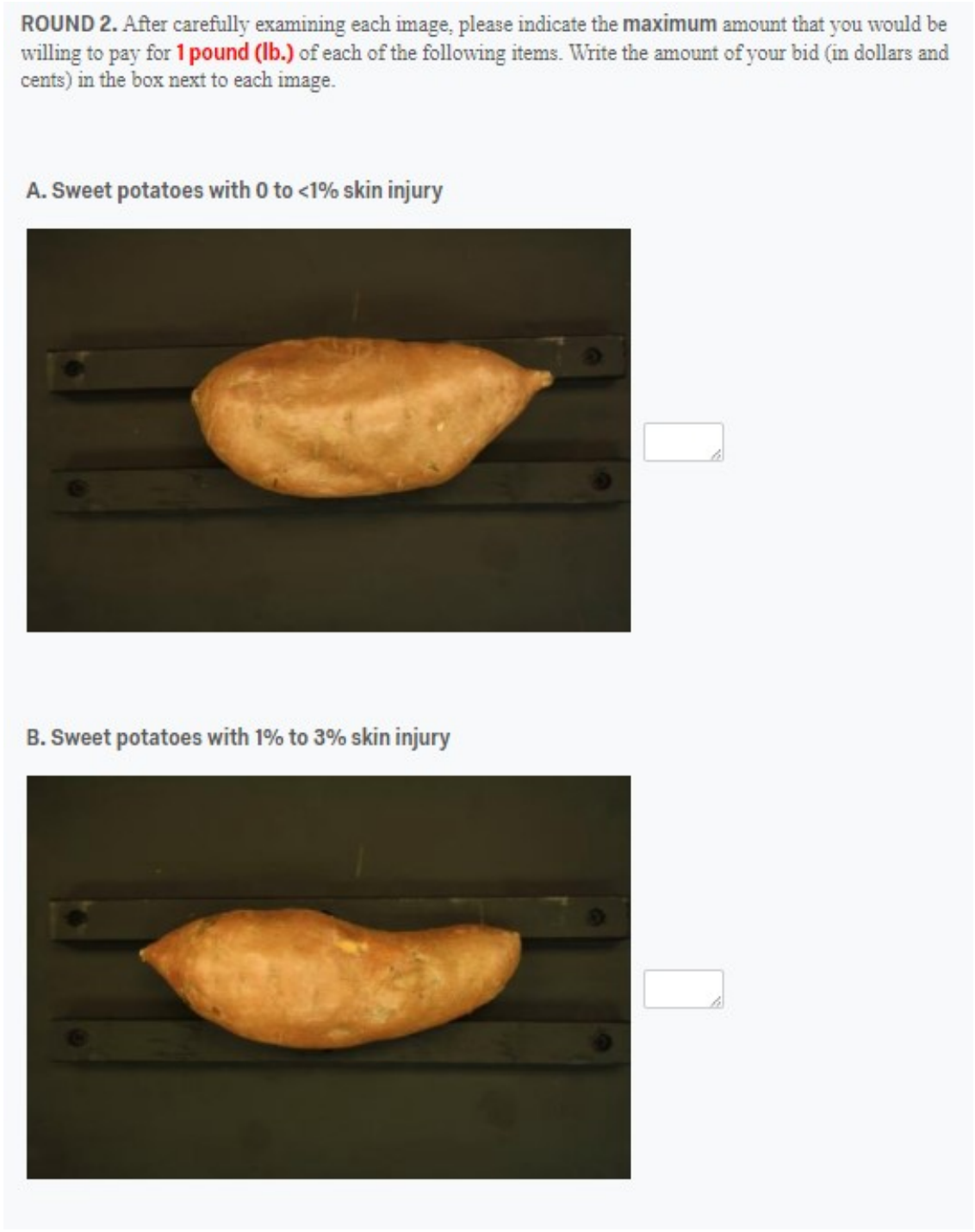

Figure 3 Example of Image for Participants when Bidding on Labelled Sweet Potatoes