Consumer response towards stall-free pork premiums at the restaurant level

by

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Abstract

Over time, consumer preference towards agriculture has changed. These changes include concerns about livestock production. In the pork industry, the use of gestation stalls has been a reoccurring topic for stakeholders. Gestation stalls are two-foot by seven-foot stalls housing gestating, or pregnant, sows. These stalls are regularly used in the pork-producing industry; however, many consumers have developed concern towards the limited mobility these stalls provide. To address these concerns, some U.S. states have implemented bans on gestation stalls, passed via ballot initiative or legislation. The process producers must go through to meet these improved welfare standards is capital-intensive. Improved welfare standards are an example of credence attributes, or attributes that are immeasurable by taste or physical appearance. Previous studies have addressed premiums at the retail or grocery store level and few at the restaurant level.

The aim of this thesis is to identify consumer responses towards premiums on gestation stall-free meal at the restaurant level. A survey was used to determine consumer preferences of purchasing a pork chop meal at a restaurant that sources pork from a place that is voluntarily using stall-free housing at different premium levels ($0, $2, $4, $6). Using a discrete binary logistic regression, we estimate the predicted probability of a consumer choosing a stall-free pork chop meal at the different premium levels. Our results show that as premiums increase, people are less likely to choose the stall-free meal. To target 50% of the population who will choose the stall-free restaurant meal, we expect the market may support premiums of up to $3.50 more for a meal that is stall-free.

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This thesis is dedicated in my mother, Lisa Eden, and grandmother, Loretta Eden, who both passed away before I was able to share this with them. Knowing their support knew no bounds, even from heaven, has been with me as I keep moving forward through loss. I thank the Lord every day for the love and care I shared with them for the 24 years and three days of my life. Every day is a new day of missing them in a different way; but most importantly, finding a new way to live knowing they are always with me in spirit.

Dedication

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Chapter 1 - Introduction and Motivation

Since the early 2000s, many consumers have increased their awareness and concern about how food is processed and raised. Within the livestock industry, animal welfare is a major concern among consumers. In pork production, the use of gestation stalls has been a reoccurring topic discussed among consumers, policy makers, and producers (Schulz & Tonsor, 2015; Seibert & Norwood, 2011). Gestation stalls measure two-feet by seven-feet allowing producers to monitor livestock individually on a larger scale. This housing method has been around for many years but has become more criticized in the media, with growing consumer concern with animal welfare. The main concern of these gestation stalls is the sows' inability to perform natural behaviors and socialize with others. Concern for the general welfare of sows housed in these systems may raise demand for pork raised in stall-free housing.

Different U.S. states and numerous food retail companies have proposed bans on the use of gestation stalls as the accepted form of sow housing. Florida, Arizona, Oregon, Colorado, California, Maine, Michigan, Ohio, and Rhode Island have banned the use of gestation stalls. Florida was the first state to pass and implement a ban (Springsteen, 2009; Schulz & Tonsor, 2015; Nocella, Hubbard, & Scarpa, 2010; Norwood & Lusk, 2011). During that time, members of the food supply chain (including Tyson, Cargill, McDonald's, Walmart, and Wendy's) created new standards to keep their conscious consumers content (Norwood & Lusk, 2011). For producers, a change in housing methods leads to a cost adjustment to convert a primarily stalled housing method into a stall-free one (Buhr, 2010). Not only will there be a significant cost to producers to convert, but the cost will also contribute to higher costs paid at the meat counter by consumers for pork produced in the stall-free system (Buhr, 2010; Tonsor, Olynk, & Wolf, 2009; Schulz and Tonsor, 2015; Nocella, Hubbard, and Scarpa, 2010). The issue of animal welfare and

the use of confinement stalls for gestation sows has been an ongoing issue and is part of California Proposition 12.

With changing consumer preferences, some restaurant menus have begun to resemble wine lists, which describe where the restaurant sources their meat and how it was raised. Such lists include credence attributes, or attributes immeasurable by taste or physical attributes (e.g., stall-free, natural, cage free). These types of attributes include third-party certifications or private labels to signal advanced welfare measures are used, therefore assuring consumers that high levels of animal welfare have been considered (Tonsor, Olynk, & Wolf, 2009; Faucitano, Martelli, Nannoni, & Widowski, 2017; Norwood & Lusk, 2011). Premiums are used to measure a variety of things including production costs and market demand. While it may be rational for some pork producing companies to take on higher production costs, it is mostly because of the opportunity to sell their goods at a price that covers their cost. The higher sale, or shelf, price allows for market diversification and proof that enough people are willing to pay for the higher priced good. Credence attributes are included under the categorical premium, most commonly covering animal welfare attributes. The higher cost for stall-free pork option is not measured by physical means, so it is included within the premium.

Research has been conducted on consumer demand and willingness to pay for improved welfare meat (Dickinson, Hobbs, & Bailey, 2003; Faucitano, Martelli, Nannoni, & Widowski, 2017; Grannis & Thilmany, 2001; Sanders, Moon, & Kuethe, 2007; Tonsor, Olynk, & Wolf, 2009; Nocella, Hubbard, & Scarpa, 2010). These studies have also looked at the level consumers would be willing to pay for stall-free pork at a grocery store, but little has been said about restaurant choices. Restaurants regulate meal prices based on what is included in the meal (i.e., entrée and sides). Detailed descriptions of the plate are commonly available and are not limited

to credence attributes (e.g., where, and how meat was raised). The descriptions menus provide become more elaborate depending on the suppliers' standard. When consumers are presented with an option of choosing stall-free or traditional pork, an estimation can be measured of how they react to a premium increase. It is the objective of this paper to estimate at what price are consumers willing to pay.

This thesis discusses the topic of gestation stalls in pork production, how animal welfare is measured as credence attributes, discusses previous studies on willingness to pay for different attributes at different levels. A survey is used determine how consumers respond to restaurant premiums that determine which characters have the potential for higher willingness to pay for stall-free pork chop meal. The purpose of this thesis is to identify consumer responses towards premiums on meals with gestation stall-free pork and the impact of bans at the restaurant level. Using a consumer survey, this research will (1) determine the consumer restaurant demand for pork raised in stall-free systems, (2) address the average willingness to pay premium for a restaurant meal of pork from stall-free systems, and (3) identify consumers who the stall-free option appeals to the most.

Chapter 2 - Literature Review

Gestation Stalls and Sow Welfare

Since 1969, gestation stalls have been considered a traditional form of sow housing (McGlone, 2013). Gestation stalls have been questioned regarding whether they are animal welfare friendly. It is believed that animal behavior underlies these concerns. Typical gestation stalls are two-foot by seven-foot stalls where sows are individually penned (Figure 1). Each sow has their own feeder and are provided with unlimited access to water. Their movement is restrained to standing up and lying down, which is seen as a concern for their welfare due to the inability to move about and perform natural behaviors. Group housing systems have been preferred, allowing for sows to move about and socialize with other sows. Many studies have been conducted to determine the logistics of each housing system.

Figure 1 Stalled gestation housing (from SimplySwine, 2014)

Gestation Stall Housing

Stall housing is widely used in the United States and Asia (Harris et al., 2006). The stalled system provides different benefits. Stalls provide improved management during artificial insemination, reduced labor intensity, requires less land, allows for individual feeding opportunities, decrease aggressive interactions, and injuries among sows (Harris et al., 2006; Jang, Hong, Jin, & Kim, 2017; Jeong et al., 2020). According to Buhr (2010), stalled systems allow for individual sow management, remove the potential for aggression and injury but limits the full movement of sows. Movement limitation, however, has shown an increase in potential for agnostic, or stereotypic behaviors, such as fence biting or sham chewing (Jang, Hong, Jin, & Kim, 2017; Tatemoto et al., 2020).

Group Housing

Group housing is the preferred housing method by consumers and industry stakeholders (Cunha et al., 2018; Jang, Hong, Jin, & Kim, 2018; Schulz & Tonsor, 2015; Seibert & Norwood, 2011). Group housing is a general term for a housing system that does not confine sows individually. This system allows for greater mobility, provision of enriching behavior, and reduction of stress hormones related to stereotypic behaviors (Buhr, 2010; Jeong et al., 2020). Individual group housing is influenced by group size, space allowance, and feeding systems (Jeong et al., 2020). Aside from improved sow behavior and mobility, there are negative tradeoffs with this housing system. Such tradeoffs result in more frequent lameness, injury, and dominant sow aggression tendencies (Cunha et al., 2018; Jeong et al., 2020; Buhr, 2010). Transitioning from stalled system to group housing incur economic costs for installation, repair, or welfare improving facilities (Jeong et al., 2020).

Summary of Housing Types

To determine the effectiveness of traditional stalled systems, researchers have analyzed whether this stall method is appropriate for housing pregnant sows. Research suggests minimal differences in the performance of sows in gestation stalls versus group housing (Cunha et al., 2018; Jang, Hong, Jin, & Kim, 2017; Jeong et al., 2020). Comparing each housing system to output (piglets), there is very little differences. Offspring characteristics (total piglets born, piglets born alive, mummies, and birth weight) were no different between housing types (Cunha et al., 2018; Jenong et al., 2020; Min et al., 2020). In a review of sow gestation housing methods, McGlone et al. (2004, p. 115) "found no clear studies among pregnant gilts or sows in terms of physiology, behavior, or productivity". Gestation stalls were thought to aid in efficient pork production by reducing operating costs while lowering consumer price at the meat counter (Tonsor, Olynk, & Wolf, 2009; Schulz & Tonsor, 2015). Transition from individual stalls to group housing in the swine industry is due to increased consumer pressure and animal welfare regulations and policies (Min et al., 2020). To improve the welfare of gestating sows, bans on stall housing have been implemented.

The Gestation Stall Ban

As of 2020, nine states have passed a ban on the use of gestation stalls. Those states include Florida, Arizona, Oregon, Colorado, California, Maine, Michigan, Ohio, and Rhode Island (Springsteen, 2009; Schulz & Tonsor, 2015; Humane Society of the United States (HSUS), 2013; Norwood & Lusk, 2011). Florida was the first U.S. state to ban the use of gestation stalls in 2002 and operationalized in 2008. Following Florida's movement, more states began to present ballot initiatives and legislation. A ballot initiative is a "proposal of a new law or constitutional amendment that is then placed on the ballot by petition, that is, by collecting

signatures of a certain number of citizens" (Springsteen, 2009, p. 439). Table 1 shows the series of states with a ban and how they addressed the ban, and Figure 2 shows where these states are located within the United States.

Table 1. Current U.S. states with a gestation stall ban

State	How	Date Ban Passed	Date of Ban
Florida	Ballot Initiative	2002	2008
Arizona	Ballot Initiative	2006	2012
Oregon	Legislation	2007	2012
Colorado	Legislation	2008	2018
California	Ballot Initiative	2008	2015
Maine	Legislation	2009	2011
Michigan	Legislation	2009	2019
Ohio	Legislation	2010	2025
Rhode Island	Legislation	2012	2013

Source: Adapted from Springsteen 2009; Schulz & Tonsor 2015; HSUS 2013

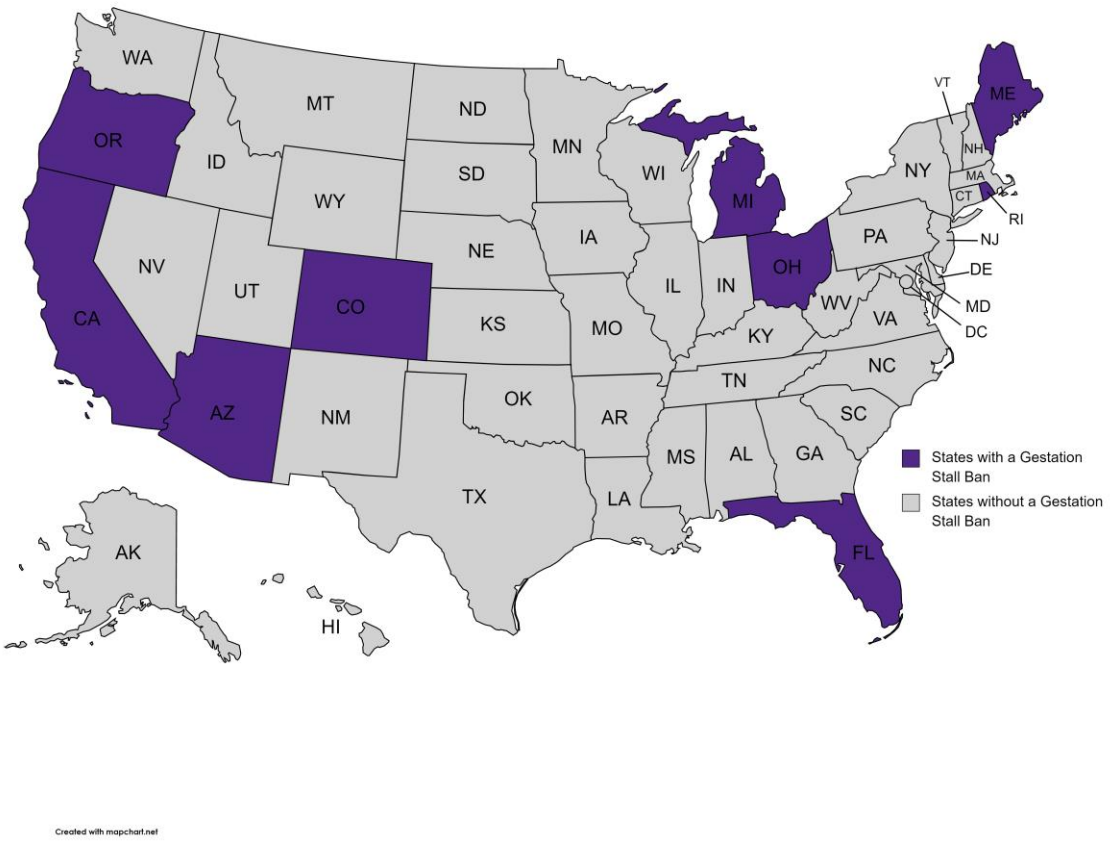

Figure 2 Map of U.S. states with a gestation stall ban

Voting Behavior and Political Implications

It is important to understand whether consumers are willing to pay for stall free pork and at what price. This matches the concept of consumers "voting with their wallets" rather than at the ballot box (Tonsor & Wolf, 2011). Perhaps government involvement reaches a national ban on gestation stalls. A ban on this scale would likely increase costs for all consumers, including those who never expressed a willingness to pay. This potentially forces consumers out of the pork purchasing market, and producers out of production (Buhr, 2010; Hartmann & Simons, 2015; Norwood & Lusk, 2011). Governmental intervention may increase costs at both the producer and consumer level, closing market opportunities for both (Hartmann & Simons, 2015). Getting the government involved in regulating farm animal welfare comes at a cost which may not be fully recognized by consumers based on their preferences (Mergenthaler & Schröter, 2020). Presently, there has been discussion regarding California Proposition 12.

California Proposition 12 is the most recent ballot initiative passed in 2018 prohibiting the use of confinement systems and all sales of products from egg-laying hens, veal calves and gestating sows (California Department of Food and Agriculture (CDFA), 2021). In 2008, California voters passed the first initiative Proposition 2 that required livestock to be allowed to perform natural behaviors (standing up and turning around) in their cages (CALmatters, 2018). For restaurants and vendors, Proposition 12 prohibits food service owners and operators from engaging in sourcing product from places that use confinement systems (CDFA, 2020). California's Legislative Analyst's Office (CLAO) (2018) predicts consumer prices to increase, reduction in state government revenues, and increased state oversight costs. Considering these predictions, the implementation of Proposition 12 impacts more than California producers, but producers across the U.S. and abroad.

Economic feasibility for producers

The economic feasibility for producers to convert to a stall free market occurs if the compensation received as premiums were secured (Tonsor, Olynk, & Wolf, 2009; Seibert & Norwood, 2011). From a productivity standpoint, there has not been clear evidence suggesting that one form of sow housing, group versus stall, has better productivity measures (Buhr, 2010). Aside from farm productivity, some consumers still push for the removal of gestation stalls. Consumer calls for change present higher cost for producers that would only be fully offset if consumer demand were sufficient (Faucitano et al., 2017; Seibert & Norwood, 2011; CLAO, 2018). In considering whether consumers would pay for their preferences, we look at voting behavior and monetary support of credence attributes, such as stall-free pork.

Stall Free Pork as a Credence Attribute

Credence attributes are characteristics of products that cannot be directly experienced or identified by physical observation (Yang & Renwick, 2019; Buhr, 2010). They are an option for consumers based on individual interest and a feeling of social responsibility. These attributes are commonly related to production methods. It has been recognized that some consumers have empathy for farm animals and whether to eat them (Hartmann & Simons, 2015). Understanding the consumer point of view on these attributes would aid in providing producers with information on how they may want to adjust their production methods based on whether their apparent sense of empathy matches their willingness to pay (Hartmann & Simons, 2015; Nocella, Hubbard, & Scarpa, 2010). Applying willingness to pay predictions provides producers with an idea of what premium credence attribute, such as stall-free production, may provide them. Credence attributes should be priced to signal quality because the premium would signal a higher quality good (Alfnes & Sharma, 2010; Seibert & Norwood, 2011).

Past Economic Research

Consumer sensitivity to food production practices regarding animal welfare is a challenge for the food production system. The exact measure of consumer demand for the removal of gestation stalls is difficult to identify even if stall-free pork is preferred.

Consumer preferences and willingness to pay

Willingness to pay estimates can tell us how much consumers are willing to pay and help inform how much producers may receive. This estimate aids in deciding whether a transition towards more animal welfare friendly practices is profitable. The main concern is whether the price difference suggested by votes, if instituted, are supported by consumers in purchasing decisions (Tonsor & Wolf, 2011). Consumers have proved to have higher willingness to pay for issues and participate in markets that match (Grannis & Thilmany, 2001; Lillywhite & Simonsen, 2014). If consumer concern is enforced and given labels and direct marketing of those concerns hold true, then consumers would be more likely to support their demands (Grannis & Thilmany, 2001; Nocella, Hubbard, & Scarpa, 2010; Seibert & Norwood, 2011). However, consumer preferences or demands are not always met, leading to a disconnect between saying their preferences and monetarily supporting their claims (Grannis & Thilmany, 2001).

When a consumer makes the decisions to purchase a good, there are several factors that contribute to their final decision. Numerous studies have been conducted to determine consumer demand and willingness to pay for improved transparency, or information readily available for consumers (e.g., natural, locally sourced/produced, stall free) (Tonsor, Olynk, & Wolf, 2009; Faucitano et al., 2017). Changes in consumer attitudes are increasing demand for various attributes (Lillywhite & Simonsen, 2014). As consumer tastes and preferences become more defined and differentiated, it provides market opportunities among various stakeholders along the

food supply chain (Lillywhite & Simonsen, 2014). Idealistically, consumer demand for stall free pork suggests they would be willing to pay producers by accepting higher prices. However, there is no complete evidence suggesting how much they are willing to pay and if it is enough to fully compensate producer cost (Schulz & Tonsor, 2015).

Consumer demand and willingness to pay at the grocery store level

At the grocery store level, there has been product differentiation available for purchase, typically addressed through different labels (Nocella, Hubbard, & Scarpa, 2010). In today's grocery stores, there are a wide range of products available at different premium levels, especially among beef products (Grannis & Thilmany, 2001). Each brand, or label, stakes a claim for a particular customer base due to their specific preferences. Grocery store shoppers have shown increased interest in natural products as well at attributes that include no small or crowded pens, no antibiotics, no growth hormones, environmentally friendly and protective management practices, and local sourcing (Grannis & Thilmany, 2001; Seibert & Norwood, 2011). Many restaurants have begun to offer these substitutes.

Consumer demand and willingness to pay at the restaurant level

Like many grocery stores and food retail operations, restaurants are on the front line of meeting consumer tastes and preferences. As consumers demand more transparency in production practices, many menus have begun to include lengthier descriptions of the meal. The difference is means consumers have choices in restaurants. For the purposes of this research, we look at the generic definition of a restaurant to include convenience and luxury options; rather any place to eat outside of the home.

With advanced consumer preferences (ingredient sourcing, naturalness, animal welfare issues), many restaurants and producers could meet specialized markets (Alfnes & Sharma,

2010; Norwood & Lusk, 2011). These types of opportunities differentiate the market, allowing consumer demands to be met while restaurants and producers obtain, on average, a higher premium (Alfnes & Sharma, 2010). Restaurant level research has mostly been around naturalness and locality of ingredients (Lillywhite & Simonsen, 2014). Past research suggests consumers require labels to feel informed of their purchasing decisions. In a restaurant setting, consumers obtain descriptions from the menu; and the more descriptions that are available suggest a 27% increase in sales (Alfnes & Sharma, 2010; Wansink, Painter and Van Ittersum 2001).

Monthly demand surveys have accounted for consumer tradeoff patterns when concerning what is ranked as important. These surveys have monitored consumer decision-making characteristics within forced trade-off scenarios (Tonsor, 2021; Tonsor, 2020; Lusk, 2018; Norwood & Murray, 2018). From February 2020 and January 2021 of Tonsor's Meat Demand Monitor (MDM), taste, food safety, freshness and price attributes were consistently ranked among welfare concerns. Additionally, Lusk (2018), Norwood and Murry's (2018) Food Demand Survey (FooDs) reported similar concerns. Further research has been conducted on the importance of different attributes (Lillywhite & Simonsen, 2014; Sanders, Moon, & Keuthe, 2007; Nocella, Hubbard, & Scarpa, 2010; Dickenson, Hobbs, & Bailey, 2003; Faucitano, et al., 2017). Tonsor's (2021) MDM reported that ranking of animal welfare was predominately less than the top four important purchasing decisions: Taste, Freshness, Safety, and Price. This was consistent with Lusk (2018), Norwood and Murray (2018) findings in FooDs. However, welfare still is a concern among consumers, and the addressing of these concerns require more time and effort to meet their market specification among the different levels of the food supply chain.

Chapter 3 - Data, Methods, and Results

Survey Design

A web-based food consumption survey was conducted by Dr. Glynn Tonsor from March 26, 2019 to March 29, 2019 tracking consumer preferences and sentiments on various aspects of food consumed at home and away from home. Approval from the Kansas State University IRB was obtained and can be found in appendix A. Within this survey, the main question of focus was based on restaurant preferences and how restaurant food was sourced. A total of 3,343 responses were collected, 1,301 having been directed to the specific question and responded in its entirely for the subject of this research.

The survey included questions regarding consumer preferences and sentiments on safety, quality, and price of food consumed at home and away from home. Most research has identified consumer preferences at the retail level and those that conducted research at the restaurant level look at naturalness and locality of meat (Grannis & Thilmany, 2001; Lillywhite & Simonsen, 2014; Alfnes & Sharma, 2010). Since gestation stall use has been a major concern in pork production, identifying characteristics of individual preference towards stall-free pork was a motivator. Identifying consumer preferences has the potential to define ideal premium levels that match consumer preferences, marketing channels, and producer market opportunities.

This thesis looks at one question regarding restaurant sourcing of pork. Figure 3 reports how the question was asked. Each survey participant was randomly assigned a variation of prices for the question. These prices were based on Longhorn Steakhouse's two-8oz pork chop meal including a salad and one side dish valued at $16.29. Premiums of $0, $2, $4, and $6 were added to the option that sources their meat from a stall free producer. Appendix B shows all the random prices survey participants may have seen. Of those surveyed, 51.96% chose the stall-free option.

Within these options, participants were randomly assigned premium levels where 23.14% saw no premium, 27.9% saw a $2 premium, 23.29% saw a $4 premium, and 25.67% saw the $6 premium on the stall-free option.

Q44b Nationally U.S. consumers currently have the ability to be a patron in restaurants that vary in how their food is sourced. Suppose the next time you are selecting a restaurant to have dinner at, you are faced with the following options. Which restaurant would you eat at?
○ Restaurant that sources pork from producers who do not use stalls but operate in a state where stalls are allowed and average dinner meal prices are $10.29
○ Restaurant that sources pork from producers who do use stalls and average dinner meal prices are $8.29

Figure 3 Multiple choice question example for question 44b

Data Analysis

Demographic Analysis

Table 2 presents the sociodemographic characteristics of the survey sample and compares the sample to the 2019 U.S. census. In the survey sample, there were more females (51.58%) than males in the survey and which closely resembles the female population (50.8%) within the United States census report. There was a gap in survey participants 65 years old and over in our respondents (3.77%) compared to the U.S. census population (16.5%). People identifying as white where prevalent (78.48%), which is slightly over but still a close representative of the U.S. population. Other ethnicities including Black or African American (11.53%); American Indian and Alaska Native (1.46%); Asian (4.77%); Native Hawaiian and Other Pacific Islander (0.23%). Most race identities were close to the respective U.S. census reports. Within the survey, individuals of Hispanic, Latino, or Spanish origins were identified within a separate question to race where they could pick their “alternative” race. Hispanic, Latino or Spanish origin were the most underrepresented in the data. The number of respondents in having attended postsecondary education, or education above high school level education, were higher in our respondents

(97.46%) than the U.S. census data (88%), and even more with a bachelor's degree or higher (46.2%). Education and income are expected to be higher due to survey distribution methods.

Table 2 Survey sample versus U.S. census

Demographic Characteristics	United States	Survey Respondents
Age and Gender (%)		
Persons 65 years and over	16.50	3.77
Female	50.80	51.58
Ethnicity (%)		
White	76.30	78.48
Black or African American	13.40	11.53
American Indian and Alaska Native	1.30	1.46
Asian	5.90	4.77
Native Hawaiian and Other Pacific Islander	0.20	0.23
Hispanic or Latino*	18.50	12.76
Education (%)		
High school graduate or higher	88.00	97.46
Bachelor's degree or higher	32.10	46.2
Household size (members)	2.62	2.61
Median Household income ($)	62,843	50,000**
Population (people)	328,239,523	1,301***
States with a gestation stall ban (%)	31****	33
States without a gestation stall ban (%)	69****	67

Note: United States demographics are obtained from 2019 U.S. Census and are available online at https://www.census.gov/quickfacts/fact/table/US#
**Respondents who are of Hispanic, Latino, or Spanish origin may also select another race*
***Based on our study's income bracket, $40,000 - $59,999 included the median household income option*
****Respondents who answered survey question 44b in its entirety*
*****Self calculations based on reported states with a gestation stall ban and the 2019 U.S. census report*

Figure 4 shows the response rate of choosing the stall-free option by premium level. For no difference in price ($0 premium), 68.11% of the survey respondents chose the stall-free option. At the highest premium level, more respondents chose the stalled option (59.28%). This follows the definition of demand whereas prices increase, more participants are less likely to purchase the more expensive option. Survey respondents were further divided into residents living in a state with a gestation stall ban (33.14%) versus those without a ban (66.59%).

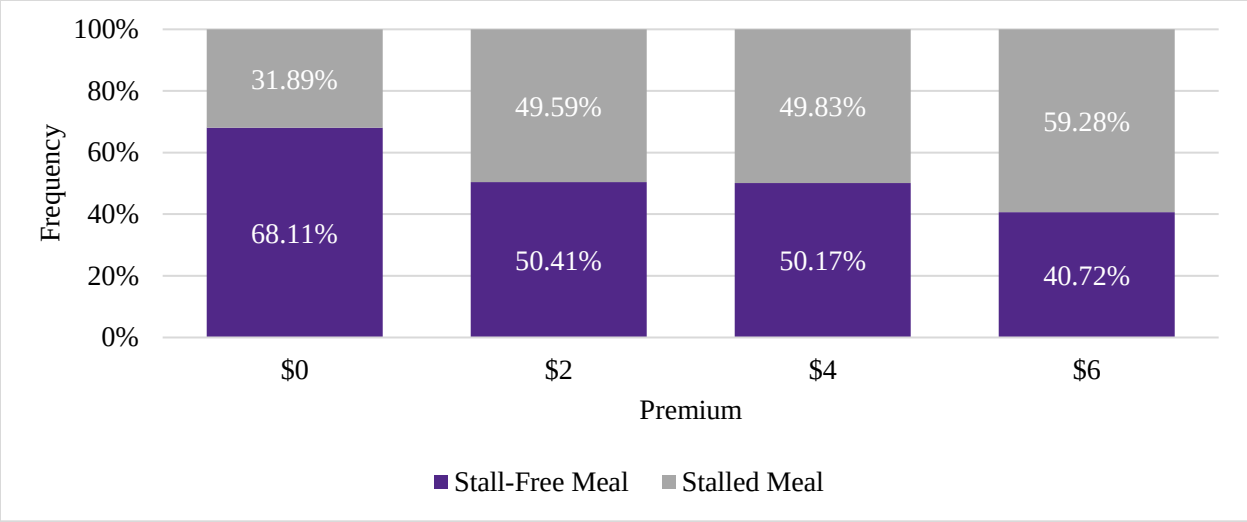

Figure 4 Frequency of meal choice at different premium levels

Descriptive Statistics

Continuous demographic characteristics in the survey are shown in Table 3. Few participants were over the age of 65 (3.77%), which is lower than the U.S. Census, report; however, most were between 55-64 years old (29.98%). Following age, most participants have some form of education between high school and a bachelor's degree, where 46.2% have a bachelor's degree or higher. Average household size was 2.61 people, which aligns closely with the U.S. census report. Reported household income before taxes was to be less than $59,999 (64.95%), where the average income was between $40,000-$59,999.

Table 3 Summary statistics of continuous variables in the survey

	Mean	Std. Dev.	Frequency	Percent
Age	1.55	0.57		
18-44 years of age			628	48.27
45-64 years of age			624	47.96
65-year-old and over			49	3.77
Household size	2.61	1.25		
One			251	19.29
Two			468	35.97
Three			257	19.75
Four			183	14.07
Five or More			142	10.91
Education	3.63	1.44		
Less than High School			33	2.54
High School/GED			309	23.75
Some College			358	27.52
Associates			169	12.99
Bachelor's			289	22.21
Master's			118	9.07
Professional Degree			25	1.92
Income	1.41	0.60		
Less than $59,000			845	64.95
Between $60,000 and $119,000			377	28.98
Over $120,000			79	6.07
Stalled Meal Prices				
$8.29	16.06	5.58	239	18.37
$12.29			273	20.98
$16.29			283	21.75
$20.29			242	18.60
$24.29			264	20.29

Discontinuous variables statistics can be found in Table 4. The choice variable is defined by their preference for the stall-free or traditional pork chop meal. If they chose the stall-free meal, they were assigned a 1, and 0 otherwise. Additional binary discrete variables include vegan or vegetarian, have worked on a farm or ranch, currently farm or ranch for a living, are female, have children under 12 years of age in their household, currently on food stamps, and have received food stamps; 0 otherwise.

Table 4 Summary statistics of discontinuous variables in the survey

	Mean	Std. Dev.	Frequency	Percent
Meal Choice	0.52	0.50		
Stalled meal			625	48.04
Stall-Free meal			676	51.96
Household Shopper	1.45	0.79		
Primary Shopper			957	73.56
Not Primary Shopper			101	7.76
Shopping duties split			243	18.68
Marital Status	1.71	0.58		
Single			461	35.43
Married			756	58.11
Separated			84	6.46
Vegan or Vegetarian	0.07	0.25		
Yes			1,212	93.16
No			89	6.84
Worked on a Farm or Ranch	0.19	0.39		
Yes			244	18.75
No			1,057	81.25
Currently Farm or Ranch for a Living	0.04	0.19		
Yes			51	3.92
No			1,250	96.08
Gender	0.52	0.50		
Female			671	51.58
Male			630	48.42
Children Under 12 years of age	2.36	0.78		
Yes			333	25.6
No			968	74.4
Received Food Stamps	0.37	0.48		
Yes			481	36.97
No			820	63.03
Currently on Food Stamps	0.17	0.38		
Yes			225	17.29
No			1,076	82.71
Hispanic, Latino, or Spanish Origin	0.13	0.33		
Yes			166	12.76
No			1,135	87.24
Race	1.47	1.14		
White			1,021	78.48
Black/African American			150	11.53
American Indian or Alaskan Native			19	1.46

Asian (Asian Indian, Chinese, Filipino, Japanese, Korean, and Vietnamese)			62	4.77
Islander (Native Hawaiian, Guamanian or Chamorro, Samoan, and Other Pacific Islander)			3	0.23
Other			46	3.54
Liberal or Conservative	2.23	0.97		
Liberal			368	28.29
Moderate			395	30.36
Conservative			411	31.59
I don't know			127	9.76
Political Party	2.29	1.29		
Democratic			471	36.2
Republican			414	31.82
Tea Party			21	1.61
Independent			353	27.13
Other (e.g., Green)			42	3.23

In the survey, 51.96% of participants chose the stall-free meal over the stall raised meal. Of the total survey population, 6.84% were vegan and vegetarians. People who worked on a farm or ranch and currently farm or ranch for a living were 18.75% and 3.92% respectively. Females were 51.58% of the total population, which was like current U.S. census reports. About 25.6% had children under the age of 12. Individuals who received food stamps and are currently on food stamps were 36.97% and 17.29% respectively. Most survey participants were primary household shoppers (73.56%) or had split shopping responsibilities (18.68%). There were no divorced or widowed participants in our sample, but the majority were married (58.11%) or single (35.43%). Political affiliation was divided into Democrat, Republican, Independent, and Tea Party or other (e.g., Green). Most were Democrats at 36.2% of the sample, followed by 31.82%, 27.13%, and 4.84%, for Republican, Independent, and Tea Party, respectively. Declared conservatives included 31.59%, followed by moderate (30.36%), and liberal (28.29%). The

survey's sociodemographic questions and the frequency distribution across states with and without a ban, can be found in appendix D.

Methods

The overall goal of this thesis is to examine different consumer characteristics and the impact varying levels of premiums have on their choice for stall-free versus stall-raised pork chops at the restaurant level. Using sociodemographic questions, characteristics are identified that have an increased willingness to pay for stall-free meal at a higher premium level. To determine which variables to use, a correlation analysis is used to determine the relationship different sociodemographic variables have with each other regarding the choice of a stall-free meal.

Correlations and linear relationship

All key sociodemographic questions had the correlation measured. The correlations were estimated to eliminate variables that would impact results in our analysis and perhaps create multicollinearity issues. Highly correlated variables were determined to be between (+/-) 0.5 and (+/-) 0.9999, medium correlated variables between (+/-) 0.3 and (+/-) 0.4999, and low correlated variables between 0 and (+/-) 0.2999. Variables under the low correlated were used in the analysis. Variables that are positively correlated are expected to have a positive relationship (or directly related) with each other while those that are negatively correlated (or negatively related) have a negative relationship with each other.

The relationship between people currently on food stamps and those who have received food stamps (0.59) were highly-positively correlated. In the medium-positively correlated group, the age group, 18-44 years old and household size (0.33), and well as those with Hispanic, Latino, and Spanish origin and "Other" race (0.30), were related. Highly-negatively correlated

variables were primary shopper and shared shopping responsibilities (-0.80); age group 18-44 years old and 45-64 years old (-0.93); household income below $59,999 and income between $60,000-$199,999 (-0.87); the White and Black African American races (-0.69); and Democrats and Republican variables (-0.51). Medium-negatively correlated variable includes primary shoppers and non-primary shoppers (-0.48); income less than $59,999 and income above $120,000 (-0.35); the White and Asian races (-0.43); White and Other races (-0.37); Democrats and Independents (-0.46); and Republicans and Independents (-0.42).

These variables vary in their relationship due to linearity. To prevent close, redundant constraints, one was chosen to prevent closely correlated variables. The variables chose were vegan or vegetarians; shared shopping responsibilities; worked on a farm or ranch; farm or ranch for a living; female; ages 45–64-year-olds; received food stamps; Bachelor's degree or higher; Hispanic, Latino, or Spanish; White; and Democrats. This correlation table can be found in appendix C.

Determining statistically insignificant variables

A discrete binary limited dependent model is used to examine the probability of selecting a stall-free pork chop meal at a restaurant. The binary choice of individual *i* is represented by a random variable, y_i, that if selecting the stall-free meal, they take on the value of 1; and if they select the stalled meal, they take on the value 0. The function for y_i is written with the probability function referenced from McLeod (2018),

$$F(y_i) = P_i^{y_i}(1 - P_i)^{1-y_i} \qquad y_i = 0,1$$

and

$$y_i = \begin{cases} 1 \; with \; probability \; choosing \; p \\ 0 \; with \; probability \; choosing \; 1 - p \end{cases}$$

Choice is defined when y_i=1 for choosing the stall-free pork chop meal and y_i=0 when they chose the stall-raised pork chop meal. The premium variable is based on the price difference individual participants saw between the stall-free and stalled meal. Each participant saw this variable as an added premium to the stall-free meal. For this variable, x=0 if there was no difference in price, x=2 if there was a two-dollar difference, x=4 for a four-dollar difference, and x=6 for a six-dollar difference. Additional discrete variables were assigned a 1 if they were true or selected yes if that characteristic applied to them; 0 otherwise. For each variable, a logistic regression model was estimated to find the probability of choosing a stall-free meal at different premium levels. The first equation defines the predicted probability of choosing a stall-free pork chop meal with the lowly correlated variables.

Equation 1

$$\widehat{Choice}_x = \beta_0 + \beta_1 premium + \beta_2 stateswithban + \beta_3 veg + \beta_4 shareshop + \beta_5 wrkdfarm + \beta_6 liveranch + \beta_7 agemiddle + \beta_8 rfstamps + \beta_9 bachelorsplus + \beta_{10} midincome + \beta_{11} ushispanic + \beta_{12} uswhite + \beta_{13} democratic + \varepsilon$$

Equation 1 uses variables that did not have a correlation coefficient greater than 0.3 (less than -0.3). It is used to determine which variables were statistically insignificant and omit them from future analysis (Table 5). Variables that are statistically significant will be used in an additional logistic regression. Although the variable, “people living in states with a gestation stall ban”, is not statistically significant, it is kept, differentiating whether a state-wide ban changes consumer preference towards choosing stall-free meal. The statistically significant variables were run in an additional logistic regression (Equation 2).

Table 5 Lowly correlated sociodemographic variables and their significance level

Decision	Coefficient	Std. Err.	z	P > |z|	[95% Conf.	Interval]
Premium	-0.16	0.03	-6.23	0.00	-0.21	-0.11
Live in states with a gestation stall ban	0.16	0.12	1.29	0.20	-0.08	0.40
Vegan/Vegetarian	-0.62	0.25	-2.51	0.01	-1.10	-0.13
Share shopping responsibilities	-0.12	0.15	-0.81	0.42	-0.41	0.17
Worked on a farm or ranch	0.05	0.16	0.33	0.74	-0.25	0.36
Currently farm or ranch for a living	0.22	0.33	0.69	0.49	-0.41	0.86
Gender	-0.23	0.12	-1.95	0.05	-0.46	0.00
Ages 45 to 64 years old	0.03	0.12	0.26	0.79	-0.20	0.27
Received food stamps	0.13	0.13	1.07	0.29	-0.11	0.38
Bachelor's degree or higher	0.08	0.12	0.63	0.53	-0.16	0.31
Income between $60,000-$119,999	0.08	0.13	0.58	0.56	-0.18	0.34
Hispanic origin	-0.13	0.18	-0.74	0.46	-0.48	0.22
White	-0.21	0.15	-1.40	0.16	-0.50	0.08
Democratic	-0.39	0.12	-3.15	0.00	-0.62	-0.15
_cons	0.88	0.21	4.28	0.00	0.48	1.29

Equation 2

$$\widehat{Choice}_x = \beta_0 + \beta_1 premium + \beta_2 stateswithban + \beta_3 veg + \beta_4 gender + \beta_5 democratic + \varepsilon$$

Table 6 shows the results for the logistic regression with five variables; the premium, people who live in states with a gestation stall ban, selected they were vegan or vegetarians, female, and a Democrat. Since vegans and vegetarians factually do not purchase (or consume) pork for themselves, the regression was run again, omitting that variable, to determine whether vegans or vegetarians impact the rest of the choices (Equation 3). Table 7 shows the output for

the third regression; finding that the vegan or vegetarian variables do not change the other variables drastically, it is removed from further analysis because individually, vegans and vegetarians do not actively participate in purchase pork. The variables that are analyzed further will include the premium, people who live in states with a gestation stall ban, are female, and are Democrats.

Table 6 Lowly correlated and statistically significant sociodemographic variables

Decision	Coefficient	Std. Err.	z	P > |z|	[95% Conf. Interval]	
Premium	-0.16	0.03	-6.26	0.00	-0.21	-0.11
Live in states with a gestation stall ban	0.15	0.12	1.21	0.23	-0.09	0.38
Vegan/Vegetarian	-0.49	0.23	-2.15	0.03	-0.94	-0.04
Gender	-0.22	0.11	-1.97	0.05	-0.45	0.00*
Democratic	-0.34	0.12	-2.90	0.00	-0.58	-0.11
_cons	0.80	0.13	6.20	0.00	0.55	1.05

*gender resides within the 95% confidence interval between -0.45 and -0.001

Equation 3

$$\widehat{Choice}_x = \beta_0 + \beta_1 premium + \beta_2 stateswithban + \beta_3 gender + \beta_4 democratic + \varepsilon$$

Table 7 Final sociodemographic variables

Decision	Coefficient	Std. Err.	z	P > |z|	[95% Conf. Interval]	
Premium	-0.17	0.03	-6.40	0.00	-0.22	-0.11
Live in states with a gestation stall ban	0.14	0.12	1.12	0.26	-0.10	0.37
Gender	-0.22	0.11	-1.96	0.05	-0.44	0.00
Democratic	-0.34	0.12	-2.86	0.00	-0.57	-0.11
_cons	0.78	0.13	6.06	0.00	0.52	1.03

*gender resides within the 95% confidence interval between -0.45 and -0.001

Determining predicted probability and predicted margins

To further the analysis of these variables, fixing predicted probabilities and margins are conducted using a standard logistic regression model from Greene (2003). The probability of choosing the stall-free restaurant meal is dependent, or choice, variable placed by the left-hand

side of the equation. The right-hand side addresses the impact additional variables hold on the predicted probability of choosing the stall-free meal, in this case independent variables.

$$P(y_{ij} = 1 \mid x) = \frac{e^{x'\beta}}{1+ e^{x'\beta}} = \Lambda(x'\beta)$$

The predicted probability of choosing a stall-free meal with respect to premium is shown in Table 8 using Equation 1. The reported values are the same as the previous table (Table 7). Key things to look at are the sign of the coefficient, p-value, and the 95% Confidence interval. Premiums have a negative sign, which means as premiums increase, fewer people are inclined to purchase a stall-free pork chop meal given by the log-odds, or probability, of choosing the stall-free meal at higher premiums. The sign on the variable "living in states with a gestation stall ban" is positive, suggesting that as premiums increase, the probability of someone living in a state with a gestation stall ban may choose the stall-free premium at a higher level. As noted previously, the p-value is not statistically significant but kept determining later if living in a state with a gestation stall ban has a higher willingness to pay for a stall-free meal. Both the gender and democratic variables are negative; therefore, as premiums increase, they are less likely to choose the stall-free meal. They are also statistically significant with a p-value greater than 0.05.

Table 8 Predicted probability of choosing a stall-free meal given premium and different sociodemographic characteristics

Decision	**Coefficient**	**Std. Err.**	**z**	**P > |z|**	**[95% Conf. Interval]**	
Premium	-0.17	0.03	-6.40	0.00	-0.22	-0.11
Live in states with a gestation stall ban	0.14	0.12	1.12	0.26	-0.10	0.37
Gender	-0.22	0.11	-1.96	0.05	-0.44	0.00
Democratic	-0.34	0.12	-2.86	0.00	-0.57	-0.11
_cons	0.78	0.13	6.06	0.00	0.52	1.03

Marginal effects are used to quantify how the predicted probability change with different variables. To calculate the standard marginal effect for the binary independent variables (*d*), the following standard marginal effect equation where $\bar{x}_{(d)}$ denotes the means of all other variables in the model.

$$\text{Marginal Effect} = \text{Prob}[\text{Y} = 1 \,|\bar{\text{x}}_{(\text{d})}, \text{d} = 1] - \text{Prob}[\text{Y} = 1 \,|\bar{\text{x}}_{(\text{d})}, \text{d} = 0] \,,$$

The models are adjusted to seek the reaction different variables have on choice of a stall-free meal. The delta-method standard errors (std. err.) treat the independent variables or at which the response is evaluated as given or fixed. This method obtains appropriate standard errors of any function within the model's parameters (Pitblado, 2021; Margins, 2019).

The predicted margin results are shown in Table 9. For people living in states with a gestation stall ban (represented by a 1), fifty-four percent of the population's choice would choose the stall-free meal. Forty-nine percent would select the stall-free meal if they are female and forty-seven percent if will chose the stall-free meal if they are Democrats. All margins are significant and reside withing the 95% confidence interval (does not include zero).

Table 9 Predicted probability of margins for different sociodemographic variables

		Delta-method				
	Margin	**Std. Err.**	**z**	**P > |z|**	**[95% Conf. Interval]**	
Live in states with a gestation stall ban						
0	0.51	0.02	30.55	0.00	0.48	0.54
1	0.54	0.02	23.08	0.00	0.50	0.59
Gender						
0	0.55	0.02	28.15	0.00	0.51	0.59
1	0.49	0.02	26.08	0.00	0.46	0.53
Democratic						
0	0.55	0.02	32.33	0.00	0.52	0.58
1	0.47	0.02	20.66	0.00	0.42	0.51

Results

First to identify how sociodemographic variables impact the choice of a stall-free meal, looking at how premiums impact choice is the first step.

Relationship and Marginal Effect of Premiums on Stall-free Meals

To determine the relationship premiums, have on deciding to purchase a stall-free meal, the following logistic regression is used:

Equation 4

$$\widehat{Choice}_x = \beta_0 + \beta_1 premium$$

Table 10 shows the results for this regression. The sign on the coefficient is the directional relationship between the variable, premium, and choice, choosing the stall-free meal. Premium is negatively related to choosing a stall-free meal. For each $1 increase in premium, a 0.17 decline in the log-odds (probability) of people choosing a stall-free pork chop meal.

Table 10 Discrete binary logit model results on premium impact on choice

Decision	Coefficient	Std. Err.	z	P>z	[95% Conf. Interval]	
Premium	-0.17	0.03	-6.41	0.00	-0.22	-0.11
_cons	0.58	0.10	6.00	0.00	0.39	0.77

The marginal effect, in this case, is measured to estimate the "share" of the population that would select the stall-free meal at different premium levels. The margin results are shown in Table 11. At the zero-premium level (or no price difference in stall-free and stalled pork), 64% people to choose the stall-free option. When the premium level was at $6, 40% chose the stall-free meal. Overall, as premiums increase, fewer people are expected to purchase a stall-free pork meal. The 95% confidence interval does not include zero for premiums $0, $2, $4, and $6.

Figure 5 is the graphical representation of this marginal effect of premiums on choosing a stall-free meal.

Table 11 Predicted marginal effect of premium on choosing a stall-free meal from the survey

		Delta-method Margin	Std. Err.	z	P > |z|	[95% Conf.	Interval]
Premium ($)							
	0	0.64	0.02	28.77	0.00	0.60	0.69
	2	0.56	0.02	36.47	0.00	0.53	0.59
	4	0.48	0.02	31.34	0.00	0.45	0.51
	6	0.40	0.02	17.62	0.00	0.35	0.44

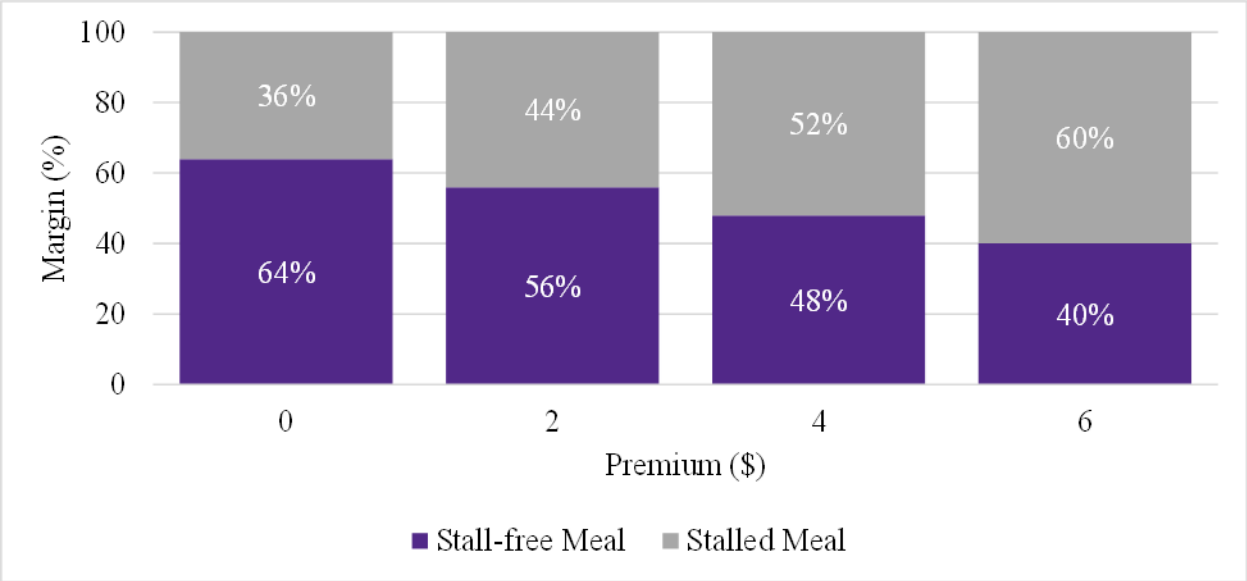

Figure 5 Marginal effect of premiums on choosing a stall-free meal

Predicted margins estimate the impact variables have on choice. In this case, it estimates the percent of the population who would choose the stall-free meal at different premium levels. Survey participants only saw premium levels of $0, $2, $4, or $6. Predicted margins also can estimate additional premium levels. Using price increments of $0.25, it provides the opportunity to see what percent of the population would choose the stall-free meal at varying premium levels. Table 12 shows the output of expanded predicted margins up to $6 and can be seen graphically

in Figure 6. The prices are all withing the 95% confidence interval. Fifty percent of the population is expected to purchase a stall-free meal at with a $3.50 premium.

Table 12 Expanded predicted marginal effect of premiums on choosing a stall-free meal

		Delta-method				[95% Conf. Interval]	
		Margin	**Std. Err.**	**z**	**P > |z|**		
Premium ($)							
	0.00	0.64	0.02	28.77	0.00	0.60	0.69
	0.25	0.63	0.02	29.60	0.00	0.59	0.67
	0.50	0.62	0.02	30.50	0.00	0.58	0.66
	0.75	0.61	0.02	31.47	0.00	0.57	0.65
	1.00	0.60	0.02	32.49	0.00	0.57	0.64
	1.25	0.59	0.02	33.55	0.00	0.56	0.63
	1.50	0.58	0.02	34.60	0.00	0.55	0.62
	1.75	0.57	0.02	35.60	0.00	0.54	0.60
	2.00	0.56	0.02	36.47	0.00	0.53	0.59
	2.25	0.55	0.01	37.14	0.00	0.52	0.58
	2.50	0.54	0.01	37.50	0.00	0.51	0.57
	2.75	0.53	0.01	37.49	0.00	0.50	0.56
	3.00	0.52	0.01	37.03	0.00	0.49	0.55
	3.25	0.51	0.01	36.13	0.00	0.48	0.54
	3.50	0.50	0.01	34.82	0.00	0.47	0.53
	3.75	0.49	0.01	33.19	0.00	0.46	0.52
	4.00	0.48	0.02	31.34	0.00	0.45	0.51
	4.25	0.47	0.02	29.39	0.00	0.44	0.50
	4.50	0.46	0.02	27.41	0.00	0.43	0.49
	4.75	0.45	0.02	25.49	0.00	0.41	0.48
	5.00	0.44	0.02	23.67	0.00	0.40	0.48
	5.25	0.43	0.02	21.96	0.00	0.39	0.47
	5.50	0.42	0.02	20.38	0.00	0.38	0.46
	5.75	0.41	0.02	18.94	0.00	0.37	0.45
	6.00	0.40	0.02	17.62	0.00	0.35	0.44

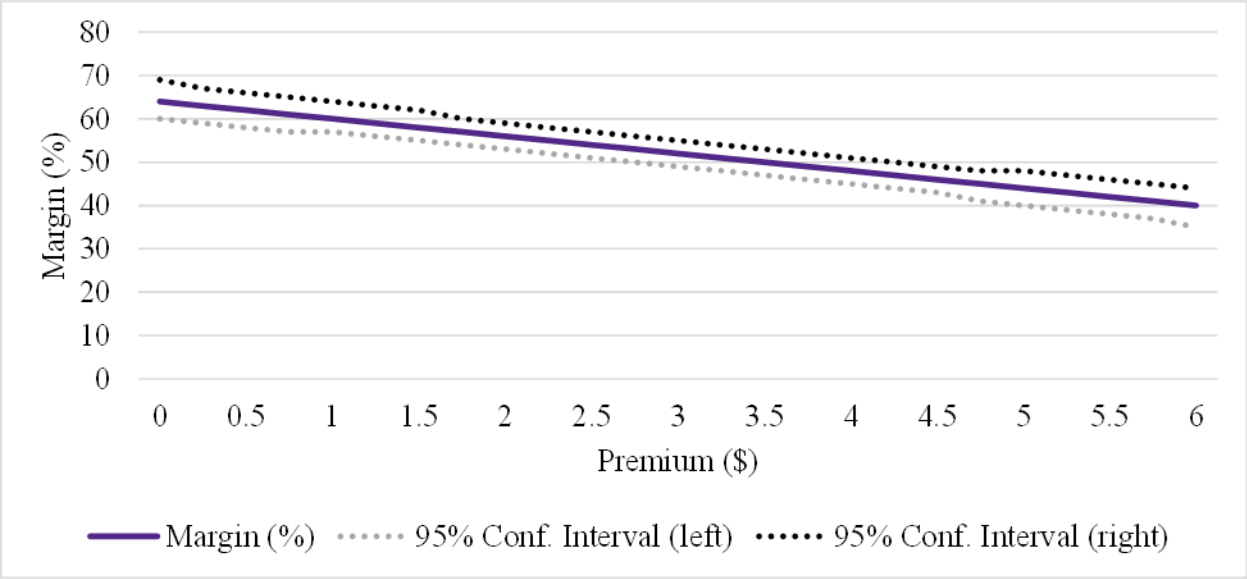

Figure 6 Predicted marginal effect of premiums on choice of stall-free meal

Relationship and Marginal Effect of Premiums on Stall-free Meals with Different Sociodemographic Variables

After looking at the impact premiums have on choosing a stall-free meal, additional variables are added to determine the relationship they have with premium and choice. The following logistic regression is used to measure the impact premiums, living in states with a gestation stall ban, gender (female), and democrats have on choice.

Equation 5

$$\widehat{Choice}_x = \beta_0 + \beta_1 premium + \beta_2 stateswithban + \beta_3 gender + \beta_4 democratic$$

The relationship between individuals living in a state with a gestation ban and choosing the stall-free meal is positively correlated; however, is not statistically significant (Table 13). This fails the null hypothesis where consumers living in states with gestation stall bans and those without a ban have the same demand for a stall-free meal. Additionally, if residents in states with bans have higher pork prices (due to transportation and stocking expenses), this would suggest an

economic welfare decline for those consumers because their demand for a stall-free meal is not greater than those who live in states without a ban. Comparing the results to the original predicted probability regression, the respective variable signs are the same, as well as the p-values and 95% confidence intervals.

Table 13 Discrete binary logit model for the impact premiums has on choosing a stall-free meal with different sociodemographic variables

Decision	Coefficient	Std. Err.	z	P > |z|	[95% Conf.	Interval]
Premium	-0.17	0.03	-6.40	0.00	-0.22	-0.11
Live in states with a gestation stall ban	0.14	0.12	1.12	0.26	-0.10	0.37
Gender	-0.22	0.11	-1.96	0.05	-0.44	0.00
Democratic	-0.34	0.12	-2.86	0.00	-0.57	-0.11
_cons	0.78	0.13	6.06	0.00	0.52	1.03

The marginal effects are like the predicted probability regression (Table 8) where 64% would choose the stall-free meal at no additional premium and decreases to 40% at the $6 premium level (Table 14, Figure 7). The confidence interval range increases but otherwise is like the first model. When the predicted margin is expanded, 50% of the population is expected to choose the stall-free meal with a $3.50 premium (Table 15, Figure 8).

Table 14 Predicted marginal effect of premiums on choosing a stall-free meal from the survey with different sociodemographic variables

		Delta-method Margin	Std. Err.	z	P>z	[95% Conf.	Interval]
Premium ($)							
	0	0.64	0.02	28.68	0.00	0.60	0.69
	2	0.56	0.02	36.32	0.00	0.53	0.59
	4	0.48	0.02	31.16	0.00	0.45	0.51
	6	0.40	0.02	17.51	0.00	0.35	0.44

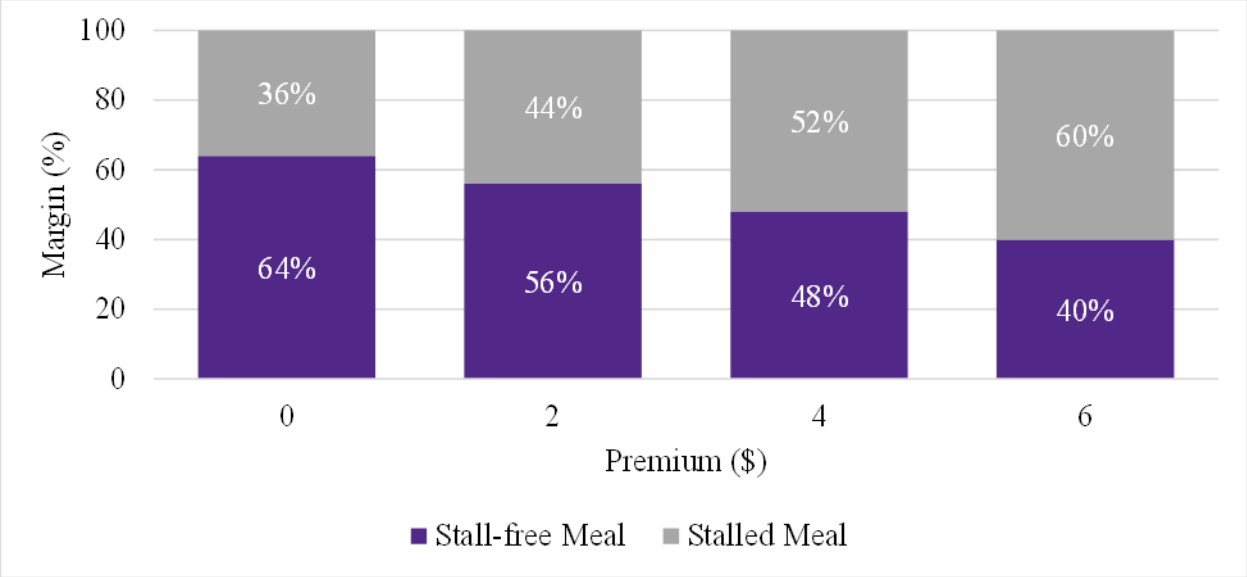

Figure 7 Marginal effect of premium on choice of a stall-free meal with different sociodemographic characteristics

Table 15 Expanded predicted marginal effect of premiums on choosing a stall-free meal with different sociodemographic variables

		Delta-method					
		Margin	**Std. Err.**	**z**	**P > |z|**	**[95% Conf.**	**Interval]**
Premium ($)							
	0.00	0.64	0.02	28.68	0.00	0.60	0.69
	0.25	0.63	0.02	29.50	0.00	0.59	0.67
	0.50	0.62	0.02	30.40	0.00	0.58	0.66
	0.75	0.61	0.02	31.36	0.00	0.57	0.65
	1.00	0.60	0.02	32.38	0.00	0.57	0.64
	1.25	0.59	0.02	33.42	0.00	0.56	0.63
	1.50	0.58	0.02	34.47	0.00	0.55	0.62
	1.75	0.57	0.02	35.46	0.00	0.54	0.60
	2.00	0.56	0.02	36.32	0.00	0.53	0.59
	2.25	0.55	0.01	36.98	0.00	0.52	0.58
	2.50	0.54	0.01	37.34	0.00	0.51	0.57
	2.75	0.53	0.01	37.32	0.00	0.50	0.56
	3.00	0.52	0.01	36.86	0.00	0.49	0.55
	3.25	0.51	0.01	35.95	0.00	0.48	0.54
	3.50	0.50	0.01	34.64	0.00	0.47	0.53
	3.75	0.49	0.01	33.01	0.00	0.46	0.52
	4.00	0.48	0.02	31.16	0.00	0.45	0.51
	4.25	0.47	0.02	29.22	0.00	0.44	0.50
	4.50	0.46	0.02	27.25	0.00	0.43	0.49

	4.75	0.45	0.02	25.34	0.00	0.41	0.48
	5.00	0.44	0.02	23.52	0.00	0.40	0.48
	5.25	0.43	0.02	21.82	0.00	0.39	0.47
	5.50	0.42	0.02	20.25	0.00	0.38	0.46
	5.75	0.41	0.02	18.82	0.00	0.37	0.45
	6.00	0.40	0.02	17.51	0.00	0.35	0.44

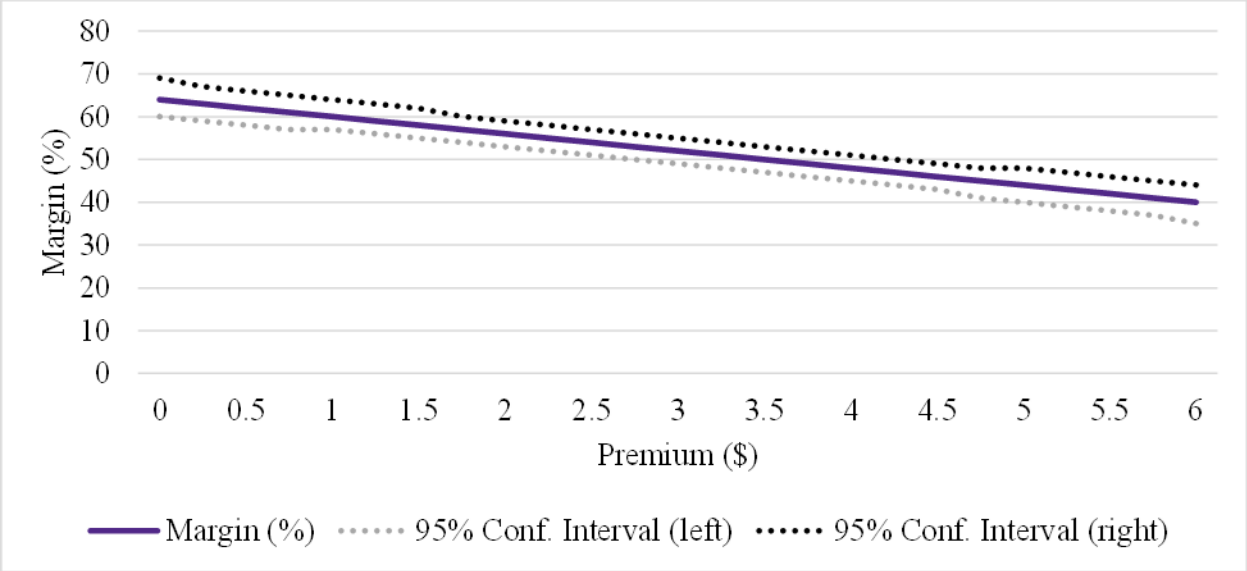

Figure 8 Predicted marginal effect of premiums on choosing a stall-free meal with different sociodemographic characteristics

Measuring the Statistical Difference Between Sociodemographic Variables

Once the sociodemographic variables were regressed and the marginal effect is measured, we wanted to see how different the characteristics are from each other. The predicted margin probability results from before are the same as the marginal results as the margin results found in Table 16. Predicted probability margins for different sociodemographic variables.

Table 16 Predicted margins for choosing the stall-free meal across sociodemographic variables

		Margin	Delta-method Std. Err.	t	P > |t|	[95% Conf.	Interval]
Live in states with a gestation stall ban							
	0	0.51	0.02	30.52	0.00	0.48	0.54
	1	0.54	0.02	22.97	0.00	0.49	0.59
Gender							
	0	0.55	0.02	28.02	0.00	0.51	0.59
	1	0.49	0.02	26.10	0.00	0.46	0.53
Democratic							
	0	0.55	0.02	32.24	0.00	0.52	0.58
	1	0.47	0.02	20.66	0.00	0.42	0.51

In addition to the overall marginal effect, we looked to see whether the difference is significant. Table 17 shows the sociodemographic variable differences. People who live in states with a ban include zero within the 95% confidence interval. This suggests that people living in states with a gestation stall ban do not hold the same demand for a stall-free meal as states without a ban. The 95% confidence interval for gender also includes zero, which suggests that females and males do not demand stall-free meals differently.

As a separate sensitivity assessment, we also examined how responses differed across base meal prices. We found premium conclusions were not statistically different when using a base meal price of $8.29 (the lowest presented) and $24.29 (the highest presented). Accordingly, we believe premium effects are insensitive to the base meal price level assigned to a given respondent.

Table 17 Predicted marginal differences for choosing a stall-free meal for different sociodemographic variables

	df	F	P > |F|
Live in states with a gestation stall ban	1	1.24	0.26
Gender	1	3.84	0.05
Democratic	1	8.24	0.00
Denominator	1296		

	Contrast	Delta-method Std. Err.	[95% Conf. Interval]	
Live in states with a gestation stall ban				
(1 vs 0)	0.03	0.03	-0.02	0.09
Gender				
(1 vs 0)	-0.05	0.03	-0.11	0.00
Democratic				
(1 vs 0)	-0.08	0.03	-0.14	-0.03

Summary of Results

As premiums increase, people are less-likely to purchase stall-free meals at higher prices. The probability of choosing a stall-free meal is not significantly different for people living in a state with a gestation stall ban versus a state without a ban. If 50% of the population is a target for pursuing stall-free meals, then a premium of $3.50 would be pursued. This is the same when adding sociodemographic variables, people who live in a state with a ban, gender, and democrats. It is expected that for people living in a state with a gestation stall ban, 54% would choose the stall free meal; 49% would choose if they are females, and 47% if they are a democrat. All sociodemographic variables are not significantly different than their counterparts.

Chapter 4 - Conclusion and Implications

This thesis looked at consumer response and willingness to pay for additional premium levels for a restaurant meal. Most survey participants were primary household shoppers (73.56) and between the ages 55-64 years of age (29.98%). Those with a bachelor's degree or higher included 46.2% of the survey population. Majority were married (58.11%) or single (35.43%) with an average household size of 2.61 people and 25.6% reported having children under 12. Reported household income before taxes was to be less than $59,999 (64.95%). Democrats and Republicans together took over 68.02% of the political affiliation where the rest were reported Independents, Tea Party or other. The survey also reported that over half (51.96%) of the participants chose the stall-free meal option over the traditionally raised meal. Vegan or vegetarians were only 6.84%. An additional dietary response included whether they received or currently were on food stamps. Those who have received food stamps included 39.97% and 17.29% were currently on food stamps.

Using the web-based survey, a discrete binary limited dependent model including three different sociodemographic variables was estimated to identify how consumers respond to added premiums on a stall-free pork chop meal. The model estimates a negative relationship between a stall-free pork chop meal and the premium variable, indicating that as the premium for a stall-free meal increases, fewer people are expected to purchase it. Between living in a state with a gestation stall ban and without, the probability of selecting a stall-free meal is not significantly different, meaning that people who live in a state with a gestation stall ban are not different (than residents in other states) in purchasing stall-free meals at higher prices. The gender variable was surprising that females and males were not different in purchasing stall-free meals where we expected females to have a higher difference in purchasing stall-free pork.

The issue of confinement for farm animals is not going away anytime soon. New provisions, such as California's Proposition 12, are oncoming leaving consumers and producers to react. Grocery stores have already begun to implement labels addressing consumer concerns towards animal welfare and have identified an additional premium level consumer are willing to pay. Restaurants have also addressed and adapted to consumer preferences with wine list-like meat menus that source from places with stated higher welfare standards. Some consumers have a willingness to pay for such standards. However, results here suggest consumer demand is the same for those living in a state with a state-wide ban on gestation stalls as those living in states with traditional housing methods. Once California Proposition 12 is implemented, Californian consumers would be left with reduced choices of pork products and may potentially leave the pork market altogether.

A producer's decision to transition to stall-free management systems is complex. The change is only ideal if the product can receive elevated revenue stemming from potential consumer demand enhancement, which would offset their transition costs. Any cost associated with production is at least partially distributed to the consumer as well. That is, the cost of transition to stall-free systems for producers is distributed with economic implications for both the producer and consumer. Ultimately this thesis provides some new input that could be used in a broader, more encompassing benefit-cost assessment of the possible transition to stall-free production.

As costs increase for producers, consumers find higher prices at the meat counter. Consumer positioning by vote needs to be met with their wallets. Consider the vegan and vegetarian population. Factually, those consumers do not consume pork, but still could vote on

legislation that impacts the meat production industry. If votes exceeded wallet expectations, certain markets may be eliminated for both consumer and producers.

Each restaurant has opportunities and limitations when entering specialized welfare markets, such as the stall-free option. Restaurants differ based on their specialty. Between fast food and specialized restaurants or kitchens, the level at which they can meet higher welfare expectations are based on their customer base. Many fast-food chains have already implemented standards towards gestation stall removal. The conscious decision they must make is the point at which meal prices match consumer expectation. Specialty restaurants or kitchens have a greater opportunity than fast-food restaurants, however, are limited based on the population demographics around them.

This data was collected prior to the Covid-19 pandemic and implementation of California Proposition 12. Given the current movement with California Proposition 12, if the survey was replicated and sent out again, there are some expected changes towards the tolerance for higher premiums. Prior to Covid-19, California consumers were ready for the impact of prohibiting all sales of stalled meat protein. With the pandemic, some consumers altered behavior to buy necessities at a lower-cost and high volumes while other consumers may have stood by individual personification of viewpoints and continued to pay more for goods that are “better”. Determining the exact impact of the global pandemic on the stall-free market is further challenging given the fact that during the recession, many household incomes increased due to federal stimulus checks.

Moving forward, an analysis on post-pandemic may be interesting to determine how much choices towards stall-free like markets could change. Additionally, adjusting the survey to differentiate restaurant types (fast food versus dine-in) would be an extension to refine insights

and identify how consumer segments potentially differ in their preferences and expectations at different meal price levels across restaurant types.

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Appendix A - IRB Letter of Approval

KANSAS STATE UNIVERSITY | University Research Compliance Office

TO: Dr. Glynn Tonsor
Agricultural Economics
331-A Waters Hall

Proposal Number: 9695

FROM: Rick Scheidt, Chair
Committee on Research Involving Human Subjects

DATE: 03/20/2019

RE: Proposal Entitled, "Food Consumption, March 2019 Survey"

The Committee on Research Involving Human Subjects / Institutional Review Board (IRB) for Kansas State University has reviewed the proposal identified above and has determined that it is EXEMPT from further IRB review. This exemption applies only to the proposal - as written – and currently on file with the IRB. Any change potentially affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Based upon information provided to the IRB, this activity is exempt under the criteria set forth in the Federal Policy for the Protection of Human Subjects, **45 CFR §46.101, paragraph b, category: 2, subsection: i.**

Certain research is exempt from the requirements of HHS/OHRP regulations. A determination that research is exempt does not imply that investigators have no ethical responsibilities to subjects in such research; it means only that the regulatory requirements related to IRB review, informed consent, and assurance of compliance do not apply to the research.

Any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Committee on Research Involving Human Subjects, the University Research Compliance Office, and if the subjects are KSU students, to the Director of the Student Health Center.

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comply@k-state.edu | k-state.edu/research/comply

Appendix B - Price Options for Q44b

	Premium on Stall Free Meal ($)			
Meal Prices ($)	0	2	4	6
8.29	8.29	10.29	12.29	14.29
12.29	12.29	14.29	16.29	18.29
16.29	16.29	18.29	20.29	22.29
20.29	20.29	22.29	24.29	26.29
24.29	24.29	26.29	28.29	30.29

Appendix C - Survey Sociodemographic Results Distributed by States with and without a Gestation Stall Ban

	Live in a state without a ban		Live a state with a ban	
	Freq.	Percent	Freq.	Percent
Q55: Are you a vegetarian or a vegan?				
No	813	62.49%	399	30.67%
Yes	53	4.07%	36	2.77%
				1301
Q56: Are you the primary shopper for food in your household?				
Yes	633	48.65%	324	24.90%
No	68	5.23%	33	2.54%
Equal	165	12.68%	78	6.00%
				1301
Q57: Have you ever worked on a farm or ranch?				
No	688	52.88%	369	28.36%
Yes	178	13.68%	66	5.07%
				1301
Q58: Do you currently farm or ranch for a living?				
No	829	63.72%	421	32.36%
Yes	37	2.84%	14	1.08%
				1301
Q59: What is your gender?				
Female	451	34.67%	220	16.91%
Male	415	31.90%	215	16.53%
Q60: What is your current age?				
18 - 24 years old	92	7.07%	53	4.07%
25 - 34 years old	154	11.84%	89	6.84%
35 - 44 years old	152	11.68%	88	6.76%
45 - 54 years old	165	12.68%	69	5.30%
55 - 64 years old	272	20.91%	118	9.07%
65 - 74 years old	0	0.00%	0	0.00%
74 years or older	31	2.38%	18	1.38%
				1301
Q61: What is your current marital status?				
Single, Never Married	297	22.83%	164	12.61%
Married	508	39.05%	248	19.06%
Separated	61	4.69%	23	1.77%
Divorced	0	0.00%	0	0.00%
Widowed	0	0.00%	0	0.00%
				1301
Q62: How many people (including yourself) live in your household?				
1	175	13.45%	76	5.84%
2	315	24.21%	153	11.76%

3	163	12.53%	94	7.23%
4	121	9.30%	62	4.77%
5 or more	92	7.07%	50	3.84%
				1301
Q63: Are there children under the age of 12 living in your household?				
No children (single household)	175	13.45%	76	5.84%
No	222	17.06%	111	8.53%
Yes	469	36.05%	248	19.06%
				1301
Q66: Have you ever received food stamps?				
No	530	40.74%	290	22.29%
Yes	336	25.83%	145	11.15%
				1301
Q67: Are you currently on food stamps?				
No	698	53.65%	378	29.05%
Yes	168	12.91%	57	4.38%
				1301
Q68: In what US state do you live?				
Alabama	20	1.54%	0	0.00%
Alaska	4	0.31%	0	0.00%
Arizona	0	0.00%	31	2.38%
Arkansas	13	1.00%	0	0.00%
California	0	0.00%	160	12.30%
Colorado	0	0.00%	22	1.69%
Connecticut	14	1.08%	0	0.00%
Delaware	5	0.38%	0	0.00%
District of Columbia	2	0.15%	0	0.00%
Florida	0	0.00%	92	7.07%
Georgia	42	3.23%	0	0.00%
Hawaii	4	0.31%	0	0.00%
Idaho	11	0.85%	0	0.00%
Illinois	48	3.69%	0	0.00%
Indiana	27	2.08%	0	0.00%
Iowa	9	0.69%	0	0.00%
Kansas	11	0.85%	0	0.00%
Kentucky	21	1.61%	0	0.00%
Louisiana	13	1.00%	0	0.00%
Maine	0	0.00%	3	0.23%
Maryland	15	1.15%	0	0.00%
Massachusetts	20	1.54%	0	0.00%
Michigan	0	0.00%	46	3.54%
Minnesota	19	1.46%	0	0.00%
Mississippi	11	0.85%	0	0.00%
Missouri	25	1.92%	0	0.00%
Montana	4	0.31%	0	0.00%
Nebraska	8	0.61%	0	0.00%

Nevada	14	1.08%	0	0.00%
New Hampshire	5	0.38%	0	0.00%
New Jersey	31	2.38%	0	0.00%
New Mexico	17	1.31%	0	0.00%
New York	91	6.99%	0	0.00%
North Carolina	40	3.07%	0	0.00%
North Dakota	3	0.23%	0	0.00%
Ohio	0	0.00%	57	4.38%
Oklahoma	13	1.00%	0	0.00%
Oregon	0	0.00%	18	1.38%
Pennsylvania	54	4.15%	0	0.00%
Rhode Island	0	0.00%	6	0.46%
South Carolina	22	1.69%	0	0.00%
South Dakota	2	0.15%	0	0.00%
Tennessee	24	1.84%	0	0.00%
Texas	102	7.84%	0	0.00%
Utah	12	0.92%	0	0.00%
Vermont	2	0.15%	0	0.00%
Virginia	23	1.77%	0	0.00%
Washington	31	2.38%	0	0.00%
West Virginia	14	1.08%	0	0.00%
Wisconsin	19	1.46%	0	0.00%
Wyoming	1	0.08%	0	0.00%
				1301

Q69: What is the highest level of education you have completed?

Less than High School	24	1.84%	9	0.69%
High School/GED	222	17.06%	87	6.69%
Some College	240	18.45%	118	9.07%
2-Year College Degree (Associates)	114	8.76%	55	4.23%
4-Year college Degree (BA, BS)	180	13.84%	109	8.38%
Master's Degree	71	5.46%	47	3.61%
Professional Degree (PhD., J.D., M.D., etc.)	15	1.15%	10	0.77%
				1301

Q 70: What is your approximate annual household income before taxes?

Less than $20,000	24	1.84%	9	0.69%
$20,000 - $39,999	222	17.06%	87	6.69%
$40,000 - $59,999	240	18.45%	118	9.07%
$60,000 - $79,999	114	8.76%	55	4.23%
$80,000 - $99,999	180	13.84%	109	8.38%
$100,000 - $119,999	71	5.46%	47	3.61%
$120,000 - $139,999	15	1.15%	10	0.77%
$140,000 = $159,999	0	0.00%	0	0.00%
$160,000 or greater	0	0.00%	0	0.00%
				1301

Q71: Are you of Hispanic, Latino, or Spanish origin?				
No, not of Hispanic, Latino, or Spanish origin	781	60.03%	354	27.21%
Yes, Mexican, Mexican Am., Chicano	32	2.46%	42	3.23%
Yes, Puerto Rican	27	2.08%	11	0.85%
Yes, Cuban	5	0.38%	11	0.85%
Yes, another Hispanic, Latino, or Spanish origin	21	1.61%	17	1.31%
				1301
Q72: What is your race?				
White	694	53.34%	327	25.13%
Black or African American	111	8.53%	39	3.00%
American Indian or Alaskan Native	14	1.08%	5	0.38%
Asian Indian	8	0.61%	4	0.31%
Chinese	4	0.31%	8	0.61%
Filipino	2	0.15%	9	0.69%
Japanese	4	0.31%	6	0.46%
Korean	6	0.46%	5	0.38%
Vietnamese	2	0.15%	4	0.31%
Native Hawaiian	1	0.08%	0	0.00%
Guamanian or Chamorro	0	0.00%	1	0.08%
Samoan	0	0.00%	0	0.00%
Other Pacific Islander	0	0.00%	1	0.08%
Other	20	1.54%	26	2.00%
				1301
Q73: When it comes to politics, do you usually think of yourself as liberal or conservative?				
Extremely liberal	104	7.99%	47	3.61%
Slightly liberal	127	9.76%	90	6.92%
Moderate or middle of the road	259	19.91%	136	10.45%
Slightly conservative	164	12.61%	66	5.07%
Extremely conservative	121	9.30%	60	4.61%
I don't know	91	6.99%	36	2.77%
				1301
Q74: Which political party do you most identify with?				
Democratic	289	22.21%	182	13.99%
Republican	280	21.52%	134	10.30%
Tea Party	15	1.15%	6	0.46%
I am an independent	257	19.75%	96	7.38%
Other (e.g., Green)	25	1.92%	17	1.31%
				1301

Appendix D - Narrow Correlation of Variables

	Choice	Premium	People living in states with a gestation stall ban	Vegan or vegetarian	Share shopping responsibilities
Choice	1.00				
Premium	-0.18	1.00			
People living in states with a gestation stall ban	0.03	-0.01	1.00		
Vegan or vegetarian	-0.07	0.07	0.04	1.00	
Share shopping responsibilities	-0.02	0.00	-0.01	-0.06	1.00
Worked on a farm or ranch	0.02	-0.07	-0.07	0.13	-0.01
Currently farm or ranch for a living	0.00	-0.01	-0.03	0.29	-0.05
Gender	-0.05	0.00	-0.01	-0.01	-0.11
45-64 years of age	-0.01	0.05	-0.07	-0.10	0.02
Received food stamps	0.01	0.00	-0.05	0.10	-0.09
Bachelor's degree or higher	0.00	0.05	0.07	0.05	-0.02
Income between $60,000 and $119,000	0.01	0.00	0.04	0.03	0.02
Hispanic origin	-0.02	-0.02	0.09	0.08	-0.02
White	-0.02	0.00	-0.06	-0.09	0.05
Democratic	-0.08	0.02	0.08	-0.01	0.00

	Worked on a farm or ranch	Currently farm or ranch for a living	Gender	45-64 years of age	Received food stamps
Worked on a farm or ranch	1.00				
Currently farm or ranch for a living	0.29	1.00			
Gender	-0.11	0.02	1.00		

45-64 years of age	0.03	-0.13	0.06	1.00	
Received food stamps	0.09	0.09	0.06	-0.09	1.00
Bachelor's degree or higher	-0.03	0.04	-0.01	0.04	-0.21
Income between $60,000 and $119,000	-0.09	-0.06	-0.04	-0.01	-0.25
Hispanic origin	0.01	0.12	0.01	-0.14	0.01
White	0.04	-0.12	0.07	0.24	-0.04
Democratic	-0.05	0.03	0.01	-0.03	0.03

	Bachelor's degree or higher	Income between $60,000 and $119,000	Hispanic origin	White	Democratic
Bachelor's degree or higher	1.00				
Income between $60,000 and $119,000	0.19	1.00			
Hispanic origin	0.02	0.00	1.00		
White	0.01	-0.01	-0.20	1.00	
Democratic	0.07	0.00	0.08	-0.20	1.00