ASSESSING CONSUMER DEMAND FOR GEORGIA LAVENDER-BASED PRODUCTS

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Introduction

Lavender is a versatile perennial that is durable, drought resistant, and deer resistant. Commercially, lavender can provide a host of products, including fresh cut flowers, dried bouquets, personal care products as well as culinary use and essential oils manufacturing. Globally, France produces the most lavender, and in the US, lavender has been predominantly grown in the western states. Still, lavender production is also well suited for a range of plant hardiness zones, which includes Georgia. At the same time, soil conditions in Georgia can present challenges to growers. Over the past few years, Georgia growers have been exploring the viability of growing lavender.

The purpose of this project is to help inform growers' decisions regarding the sales of lavender and lavender based products. Lavender is already commercially viable. However, Georgia growers are attempting to market the uniqueness of Georgia grown lavender to a more regional target market in the southeast. Given the wide availability of "global" lavender, it is not clear what price growers in Georgia could get for Georgia grown lavender and lavender based products.

To estimate consumer willingness to pay for lavender and lavender based products, we survey an online sample of consumers in Georgia and neighboring states. We compile their demographic information, shopping behavior, and preferences for various marketing strategies. We use the Double-bounded Dichotomous Choice contingent valuation method to estimate their willingness to pay for 3 products: lavender bundles, lavender oil and culinary lavender.

Across all three products, we find that willingness to pay varies largely by frequency of use of the products. Specifically, consumers that use the products a lot are willing to pay more

than those who are unfamiliar with or don't use the lavender product. Further, the majority market share has a lower willingness to pay.

The value-add products, culinary and oil, do not necessarily garner a higher willingness to pay. As such, growers may need to consider the marginal profitability of adding value add products. At the same time, as the number of growers increase, product differentiation may be important. Going forward, growers need to consider their target market strategy to identify optimal pricing and product differentiation strategies.

Data

We surveyed roughly one thousand people from five states in the Southeastern United States in the Fall of 2017 using an online survey service, Toluna USA, Inc. The survey design was pre-tested on several groups of graduate students before submitting the final design for IRB approval. The final survey takes approximately 15 minutes to complete. We obtained 951 completed surveys.

We asked respondents about their demographics, preferences for certain marketing tactics, and their willingness to pay for 3 lavender based products: lavender bouquets, lavender oil and culinary lavender (Appendix). The lavender bouquets contained 30 dried stems and we provided a picture as an example. The lavender oil was 0.5 ounces, which is a common size for such oils, and we provided a picture of non-branded bottle. The culinary lavender was also a 0.5 ounce jar and we provided a picture of a non-branded container.

The survey sample age ranged from 18 to 93 with the average age of 46 (Table 1). The majority of the sample was female (66 percent) and the primary household shopper (78 percent). The average education level (3.8) corresponded to having some college. There were an average

of 1.7 children per household and the average household income level (3.0) corresponded to $50k - $75k.

The majority of respondents were from Georgia (53 percent) and the remainder was evenly from Alabama, Florida, South Carolina and Tennessee. Since the target market of our growers is in-state, we emphasized greater response rate from Georgia. The 4 other states are those bordering Georgia

During survey pre-testing, several respondents reported being unfamiliar with the lavender-based products in our survey. This could have an impact on consumer interest therefore willingness to pay for such products. To evaluate consumer awareness of these lavender products, we asked a series of questions about how often the respondent purchased lavender bouquets, lavender oil and culinary lavender (Appendix).

As can be seen, around 10 percent of respondents didn't know about lavender bouquets, 5 percent didn't know about oil and 11 percent didn't know about culinary lavender (Table 2). The share of respondents that reported never purchasing the three products was 67, 48, and 68 percent respectively. A priori, it seems relevant to differentiate such consumers in our analysis of willingness to pay. With bouquets and culinary lavender, about 20 percent of the respondents reported purchasing these products. Around 46 percent of respondents reported purchasing lavender oil, much larger than the other products.

We also attempt to examine how various marketing tactics might affect respondents in our survey. One potential tactic we consider is the state marketing program, Georgia Grown, which seeks to promote Georgia grown and produced products. For the Georgia Grown program to be effective, consumers need to be aware of the program. To compare survey respondents, we measure how familiar they are with the program (Appendix). The majority of respondents (57

percent) had never heard of the program and over 16 percent had heard of the program but didn't know what it was. If we look at this same data for Georgia residents, 45 percent had never heard of the program and 20 percent had heard of it but didn't know what it was. So while out of state respondents are less familiar with the program, a significant share of in-state respondents are also unfamiliar with the program.

Another tactic for growers and sellers is to market their products at local farmers markets. Clearly, such a strategy only works if consumer shop frequently at farmers markets and have a sufficient willingness to pay. We ask how often respondents shop at farmers markets during the summer, the peak operating time for most markets. The majority of respondents shop at farmers markets at least one time a summer (78 percent). Importantly, nearly 20 percent shop at least 6 times a summer or more, which is roughly every other week.

Finally, given that this study involves a product grown and produced in Georgia, we might expect that our survey respondents with preferences for local would have a higher willingness to pay. At the same time, the definition of local varies from person to person. That is, some people may view local as coming from a group of states in a region, (i.e. southeast). Others may view local as coming from their town. We might expect that the perception of what is local would have an impact on WTP since "Georgia Grown Lavender" may have a stronger connotation of local for some consumers.

Methods

To examine the willingness to pay (WTP) of survey respondents in our sample, we use a double-bound contingent valuation experiment (Hanemann et al 1991). For each product (bundles, oil, culinary), survey respondents were asked if they would be willing to pay some initial bid for the

lavender product. If the respondent rejected the initial bid, they were asked if they would be willing to pay for a lesser bid. If they accepted the initial bid, they were asked if they would be willing to pay for a higher bid. This lasted two rounds and then the survey ended.

We obtained a range of initial retail prices for each product from interviews with Georgia lavender growers. Based on those prices, we created 3 treatments for each product representing a low, average, and high price. The follow up bids for each of the treatment levels overlap as well (Table 3).

We randomly assigned survey participants to one of the three treatment levels for each product. There were roughly the same number of respondents for each treatment with a total of 951 respondents (Table 4). As expected, the low price initial bid ($8) had the largest acceptance at 46 percent and the high price initial bid ($16) had the lowest acceptance at 28 percent. Interestingly, if a respondent rejected the initial bid, they were more likely to reject the follow-up bid. If the respondent accepted the initial bid, they were more likely to accept the follow-up bid, accept in the high price treatment. Still, the follow-up accept and reject percentages were close in that treatment.

With culinary lavender, we had a fairly uniform distribution of treatments and we find similar results (Table 5). The low price initial bid had the highest acceptance and the high price initial bid had the lowest acceptance. Further, reject-reject and accept-accept were the most probable for each treatment.

The lavender oil (Table 6) tended to have a greater percentage of rejection for the follow-up bid on each treatment, with the exception of the high price treatment following an initial accept. With this group 27 percent accepted the initial bid and 60 percent accepted the higher follow-up bid.

We specify WTP for each person *i* for each of the *j* products as a linear function:

(1) $WTP_{ij} = z_i'\beta + \varepsilon_{ij}$,

where *z* identifies demographic characteristics and responses to survey questions, and $\varepsilon_{ij} \sim N(0, \sigma^2)$. We then use a person's response to the first bid (t^1) and second bid (t^2) to define WTP intervals. Defining a person's response (*Yes*, No) to each bid as {*response 1, response 2}*, we can infer the WTP for each person lies one of the four intervals:

{*Yes, No}:* $t^1 <$ WTP $< t^2$,

{*Yes, Yes}:* $t^2 <$ WTP $< \infty$,

{*No,Yes}:* $t^2 <$ WTP $< t^1$,

{*No,No}*:0 < WTP $< t^2$.

If we assume each bid follows the same valuation function, we can define these intervals as a likelihood function (Lopez-Feldman 2012), such that for each product we have:

$$(2)\ \sum_{i=1}^{N}\left[d_i^{yn} ln\left(\Phi\left(z_i'\frac{\beta}{\sigma}-\frac{t^1}{\sigma}\right)-\Phi\left(z_i'\frac{\beta}{\sigma}-\frac{t^2}{\sigma}\right)\right)+d_i^{yy} ln\left(\Phi\left(z_i'\frac{\beta}{\sigma}-\frac{t^2}{\sigma}\right)\right)+\right.$$

$$\left. d_i^{ny} ln\left(\Phi\left(z_i'\frac{\beta}{\sigma}-\frac{t^2}{\sigma}\right)-\Phi\left(z_i'\frac{\beta}{\sigma}-\frac{t^1}{\sigma}\right)\right)+d_i^{nn} ln\left(1-\Phi\left(z_i'\frac{\beta}{\sigma}-\frac{t^2}{\sigma}\right)\right)\right],$$

where d are indicator variables that take a value of one or zero depending on each person's responses and the superscript values (*y, n*) identify {*response 1, response 2}*. We estimate equation (2) using maximum likelihood to obtain $\hat{\beta}$ and $\hat{\sigma}$ [1].

Results

Initial results

[1] We use the comman *doubleb* in Stata 13 written by Lopez-Feldman to estimate our models.

We first estimate the WTP for each product without any covariates included in the model. The estimated WTP for each of the products is slightly below the average WTP of our 3 treatments (Table 7). This is also less than the average price currently being charged by growers and processors that we interviewed. The confidence interval for bundles suggests the majority of respondents WTP lies within roughly a $1 range around the average. Culinary lavender has a $0.46 range around the average and oil has a $0.90 range around the average.

Based on these results, it seems growers and processors are currently charging a price for their products that are on par with consumer WTP, if not a little more. From a marketing perspective, there is likely to be greater opportunity in segmenting the market for lavender products. As such, we further explore various segments for each product.

Bundles

For lavender bundles, younger people had a significantly higher WTP, but the quadratic term was not significant and was excluded in the final model specification (Table 8, column 1). Interestingly, Georgia residents did not have a higher WTP for the lavender bundles. Neither did primary shoppers.

We identify people who did not know what lavender bundles were when asked about their frequency of purchase. Specifically, the variable *unknown* is a dummy variable that takes the value 1 when the person responded that they didn't know what the product was. As can be seen, people who didn't know what lavender bundles were had a significantly lower WTP. For the *purchase frequency* variable, we combined those who didn't know about the product with those who *never* buy the product. The resulting *purchase freq* variable increases as reported purchase frequency increases. This is statistically significant and suggests a $1.59 increase in

WTP for each step in purchase frequency. Overall, these results indicate that product awareness plays an important role in WTP.

The *GA Grown* variable is a rank of how aware people are of the Georgia Grown marketing program. As awareness increases, peoples WTP also grows significantly. This does not represent a causal effect, but rather highlights that certain segments of consumers have varying WTP. In this case, consumers that are more familiar with programs to enhance Georgia agriculture.

Another segment we evaluate are people that shop more frequently at farmers markets. We find that as the reported level of participation increases, so does the WTP for lavender bundles. Again, this is not causal, but identifies a relevant market segment. We lose 48 observations due to missing values in our fully specified model, but the Log-Likelihood increases, suggesting a better specified model. Further, the WTP estimate does not change from our basic model.

We next predict the WTP for each person and plot the WTP distribution (Figure 1, top panel). While the average WTP is $9.92, it appears the distribution is not normally distributed. The kernel density is skewed to the right, with some people having a WTP greater than $22. At the same time, we find some people with a WTP below $3. We take this same data and plot the cumulative WTP at an interval of prices (Figure 1, bottom panel). Up 90 percent of our sample is willing to pay $6 for the lavender bundles. However, as we increase WTP to $8, we drop to under 60 percent of the sample and at $10, we drop to under 30 percent. Altogether, these results suggest certain people have a much higher WTP for the product, but overall, general demand is fairly elastic at around $8.

We break down the WTP histogram by purchase frequency (Figure 2). As expected, those who never purchase lavender bundles have a kernel distribution skewed to the right. Further, the peak density is around 20 percent, indicating more evenly distributed WTP for this group. As we increase the purchase frequency, the skewness shifts until those who buy lavender bundles the most are largely grouped in the highest WTP. Further, with those purchasing lavender 5 – 11 times a year, there is a large percentage of people, roughly 50 percent.

Culinary

We find similar results with culinary lavender as we do with bouquets (Table 8, column 2). People who didn't know what culinary lavender was do not have a different WTP, but as their purchase frequency increases, so does their WTP. An interesting finding is that as peoples definition of local expands, so does their WTP for culinary lavender. This may be that a broader definition of local is more closely associated with higher quality lavender. Finally, we identify a modest but significant income effect. This could suggest that culinary lavender is more of a luxury item.

The WTP is not different from our basic model, and we lose 39 observations due to missing values in our fully specified model. The Log-Likelihood also shows a better specified model.

The plot of the WTP distribution is skewed to the right, with a high over $12 and a low below $2 (Figure 3, top panel). While around 85 percent of the sample is willing to pay $3 for the culinary lavender that percentage drops below 30 percent as WTP goes to $5. (Figure 3, bottom panel). Much like bouquets, this reveals a highly elastic demand near the average WTP. The share of people willing to pay $9 or more is less than 5 percent.

The histograms broken out by purchase frequency again demonstrate the various market segments that exist with culinary lavender (Figure 4). Further, the density of the distributions is much more peaked for each category, suggesting that these segments have WTP values that are clustered closer around the median.

Oil

Age does not affect WTP for oil, nor does consumer knowledge of lavender oil (Table 8, column 3). Like the previous products, purchase frequency does increase the WTP, as does knowledge of Georgia Grown and shopping at farmers markets. Again, we identify a significant income effect. The WTP is not different from our basic model, and we lose 40 observations due to missing values in our fully specified model. The Log-Likelihood also shows a better specified model.

The plot of the WTP distribution is skewed like the other products (Figure 4, top panel), but has what looks like a slight bimodal distribution. In fact, the share of WTP drops from 90 percent to 60 percent as the WTP increases from $4 to $6. But it remains fairly constant around 60 percent as we go from $6 to $8 (Figure 4, bottom panel). As the WTP goes to $10, the share only drops to 35 percent. Much like bouquets, this reveals a highly inelastic demand near the average WTP. The share of people willing to pay $9 or more is less than 5 percent.

The histograms broken out by purchase frequency again demonstrate the various market segments that exist with culinary lavender (Figure 4). The peaks of the density are not as high as culinary lavender, but higher than the bouquets.

Discussion

The results of our analysis reveal that WTP varies across product type and purchase frequency. Consumers that seldom or never purchase a product have a lower willingness to pay. Intuitively, this suggests that familiarity with the product may result in higher personal valuation. In some cases, our survey respondents had no idea what the lavender product was.

These findings suggest that educating consumers about lavender and lavender-based products could have an immediate impact on WTP. In the case of culinary lavender and lavender oil, this may be especially relevant as people may not have any idea about how to use these products in their lives. In addition, marketing tactics that increase purchase frequency with existing users could also be beneficial. This could include provide strategies for how to more often use lavender. As an example, one grower we spoke with discussed how culinary lavender is often used as a substitute for rosemary in recipes or as part of a tea packet. Absent such growth in frequency of use, we find a sharp drop in the share of the market that is willing to pay more than the estimated WTP.

Literature Cited

Hanemann, M., Loomis, J., & Kanninen, B.: Statistical efficiency of double-bounded dichotomous choice contingent valuation, American Journal of Agricultural Economics, 73, (1991), 1255–63.

Lopez-Feldman, A. (2012). Introduction to contingent valuation using Stata.

Tables

Table 1. Demographic variable summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
age	951	45.96	16.16	18	93
female	770	0.67	--	--	--
shopper	951	0.79	--	--	--
educ	951	3.85	1.60	1	8
children	936	1.71	1.06	1	11
income	949	3.22	2.42	0	12
AL	951	0.12	--	--	--
FL	951	0.12	--	--	--
GA	951	0.53	--	--	--
SC	951	0.12	--	--	--
TN	951	0.11	--	--	--

Table 2. Marketing variable statistics

		Variable	Obs	Mean
Purchase Frequency	Bouquet	I don't know what this is	938	0.093
		Never	938	0.670
		1 - 4 times a year	938	0.146
		5 - 11 times a year	938	0.058
		12 or more times a year	938	0.034
	Oil	I don't know what this is	945	0.054
		Never	945	0.486
		1 - 4 times a year	945	0.305
		5 - 11 times a year	945	0.108
		12 or more times a year	945	0.048
	Culinary	I don't know what this is	947	0.112
		Never	947	0.682
		1 - 4 times a year	947	0.120
		5 - 11 times a year	947	0.061
		12 or more times a year	947	0.024
	GA Grown	I haven't heard of it	940	0.571
		I've heard of it, but don't know what it is	940	0.165
		Somewhat familiar with the program	940	0.128
		I am familiar with the program	940	0.072
		I am very familiar with the program	940	0.064
	Farmers Mkts	0 times a summer	951	0.227
		1 - 2 times a summer	951	0.309
		3 - 5 times a summer	951	0.266
		6 - 12 times a summer	951	0.131
		13 times or more a summer	951	0.066
	Local	The town you live in	951	0.144
		The county you live in	951	0.204
		The region you live in	951	0.299
		The state you live in	951	0.217
		The southeast	951	0.062
		The United States	951	0.075

Table 3. Survey experiment treatment prices

			Follow-up Bid	
Product	**Treatment**	**Initial Bid**	***Reject***	***Accept***
Bundles	Low	$ 8	$ 6	$ 10
	Average	$ 12	$ 10	$ 14
	High	$ 16	$ 14	$ 18
Culinary	Low	$ 4	$ 3	$ 5
	Average	$ 6	$ 5	$ 7
	High	$ 8	$ 7	$ 9
Oil	Low	$ 8	$ 6	$ 10
	Average	$ 12	$ 10	$ 14
	High	$ 16	$ 14	$ 18

Table 4. Bouquet experiment results summary

n	Initial Bid	Decision/%		Follow-up Bid	Decision/%	
321	$ 8.00	Reject	54%	$ 6.00	Reject	56%
					Accept	44%
		Accept	46%	$ 10.00	Reject	46%
					Accept	54%
320	$ 12.00	Reject	62%	$ 10.00	Reject	68%
					Accept	32%
		Accept	38%	$ 14.00	Reject	42%
					Accept	58%
309	$ 16.00	Reject	72%	$ 14.00	Reject	83%
					Accept	17%
		Accept	28%	$ 18.00	Reject	52%
					Accept	48%

Table 5. Culinary experiment results summary

n	Initial Bid	Decision/%		Follow-up Bid	Decision/%	
320	$ 4.00	Reject	38%	$ 3.00	Reject	73%
					Accept	27%
		Accept	62%	$ 5.00	Reject	40%
					Accept	60%
317	$ 6.00	Reject	51%	$ 5.00	Reject	72%
					Accept	28%
		Accept	48%	$ 7.00	Reject	44%
					Accept	56%
314	$ 8.00	Reject	63%	$ 7.00	Reject	84%
					Accept	16%
		Accept	37%	$ 9.00	Reject	43%
					Accept	57%

Table 6. Oil experiment results summary

n	Initial Bid	Decision/%		Follow-up Bid	Decision/%	
314	$ 8.00	Reject	54%	$ 6.00	Reject	59%
					Accept	41%
		Accept	46%	$ 10.00	Reject	54%
					Accept	46%
322	$ 12.00	Reject	65%	$ 10.00	Reject	72%
					Accept	28%
		Accept	35%	$ 14.00	Reject	53%
					Accept	47%
315	$ 16.00	Reject	73%	$ 14.00	Reject	88%
					Accept	12%
		Accept	27%	$ 18.00	Reject	40%
					Accept	60%

Table 7. Basic model estimates

	Product		
variable	Bouquets	Culinary	Oil
WTP	9.971***	5.556***	9.508***
CI	[9.540 - 10.40]	[5.324 - 5.788]	[9.058 - 9.959]
Observations	949	948	950
Log Lik	-1281	-1273	-1251
*** p<0.001, ** p<0.01, * p<0.05			

Table 8. Full model results

	Product		
	Bouquets	Culinary	Oil
age	-0.0677***	-0.0325***	-0.0207
	(0.00)	(0.00)	(0.15)
GA resident	0.299	-0.136	0.18
	(0.49)	(0.58)	(0.67)
shopper	-0.735	0.00251	0.396
	(0.15)	(0.99)	(0.44)
unknown	-1.675*	-0.63	-0.936
	(0.03)	(0.10)	(0.38)
purchase freq	1.589***	0.707***	2.066***
	(0.00)	(0.00)	0.00
GA Grown	0.943***	0.372**	0.836***
	(0.00)	(0.00)	(0.00)
farmers mkts	0.668***	0.457***	0.615**
	(0.00)	(0.00)	(0.00)
local	0.287	0.190*	0.0644
	(0.06)	(0.03)	(0.67)
education	-0.034	-0.136	-0.137
	(0.82)	(0.12)	(0.37)
children	-0.264	0.225	0.276
	(0.23)	(0.06)	(0.18)
income	0.223	0.151*	0.282*
	(0.06)	(0.03)	(0.02)
constant	8.615***	4.169***	4.787***
	0.00	(0.00)	(0.00)
WTP	9.920***	5.561***	9.449***
	(0.21)	(0.12)	(0.21)
Observations	901	909	910
Log Lik	-1101	-1120	-1073
*** p<0.001, ** p<0.01, * p<0.05			

Figures

Figure 1. Bouquet willingness to pay histogram

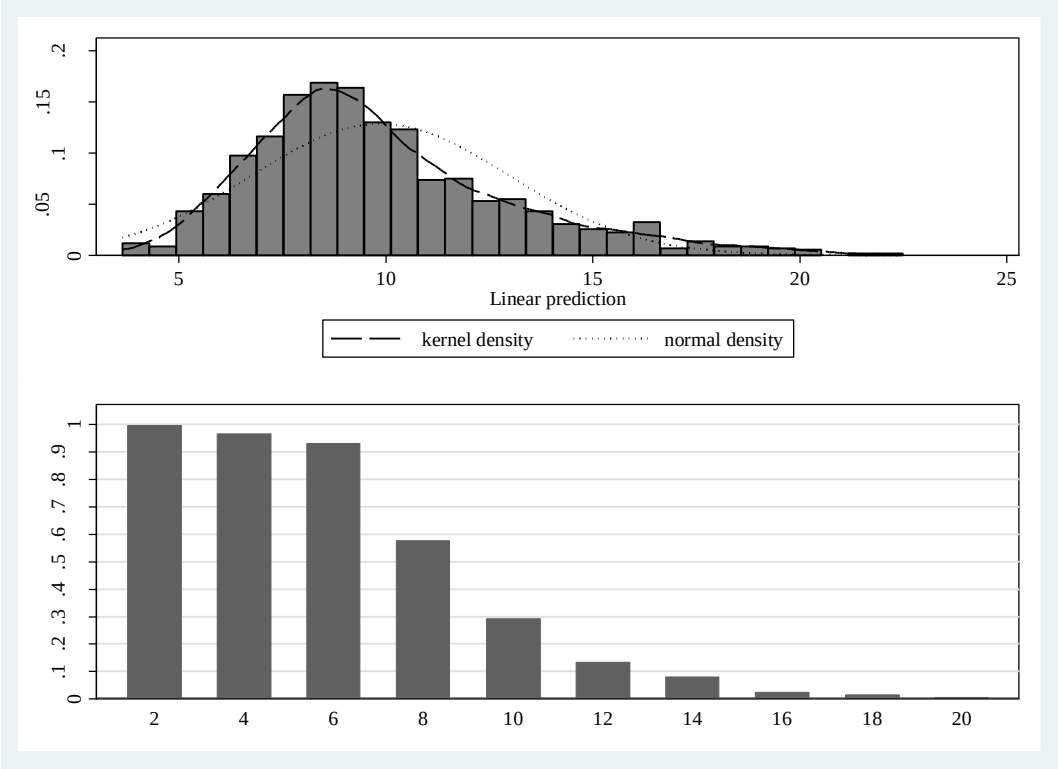
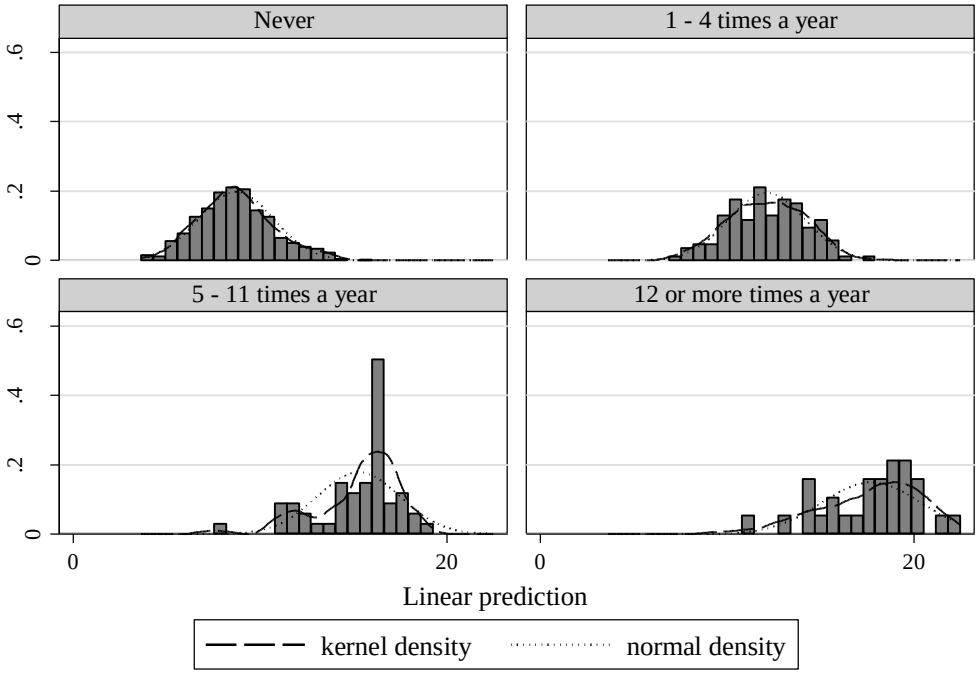


Figure 2. Bouquet willingness to pay histogram by purchase frequency



Graphs by freq_bouquet

Figure 3. Culinary willingness to pay histogram

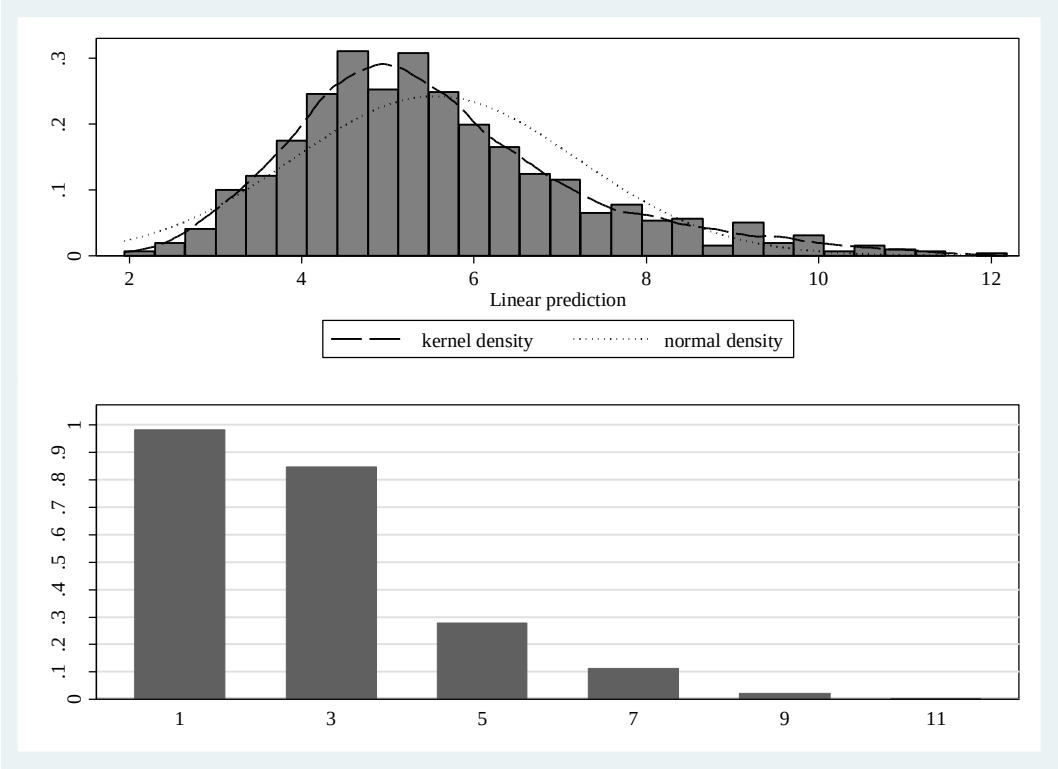
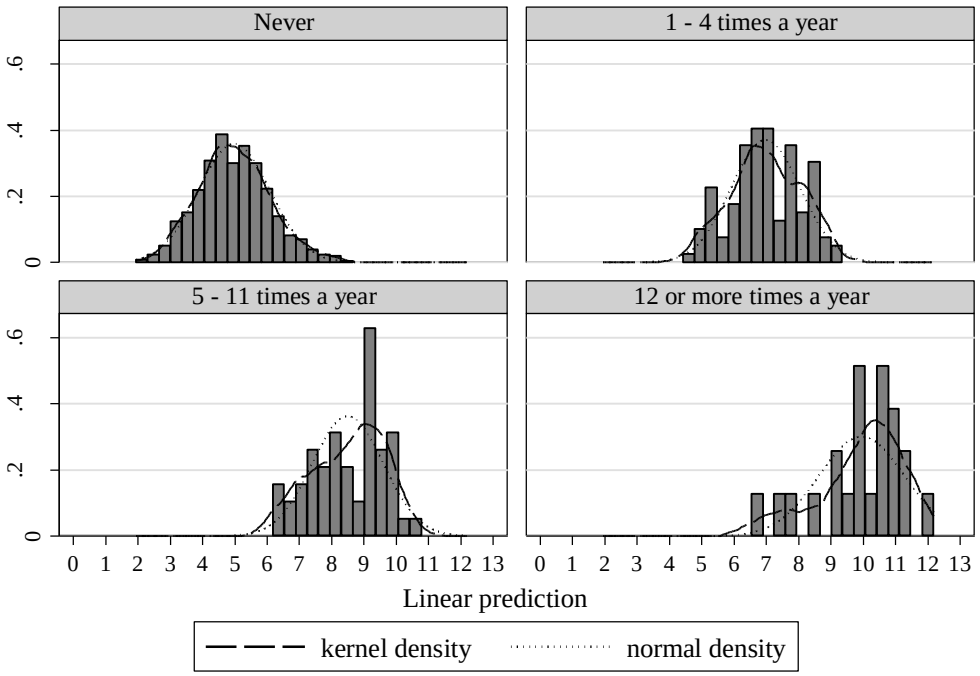


Figure 4. Culinary willingness to pay histogram by purchase frequency



Graphs by freq_bake

Figure 5. Oil willingness to pay histogram

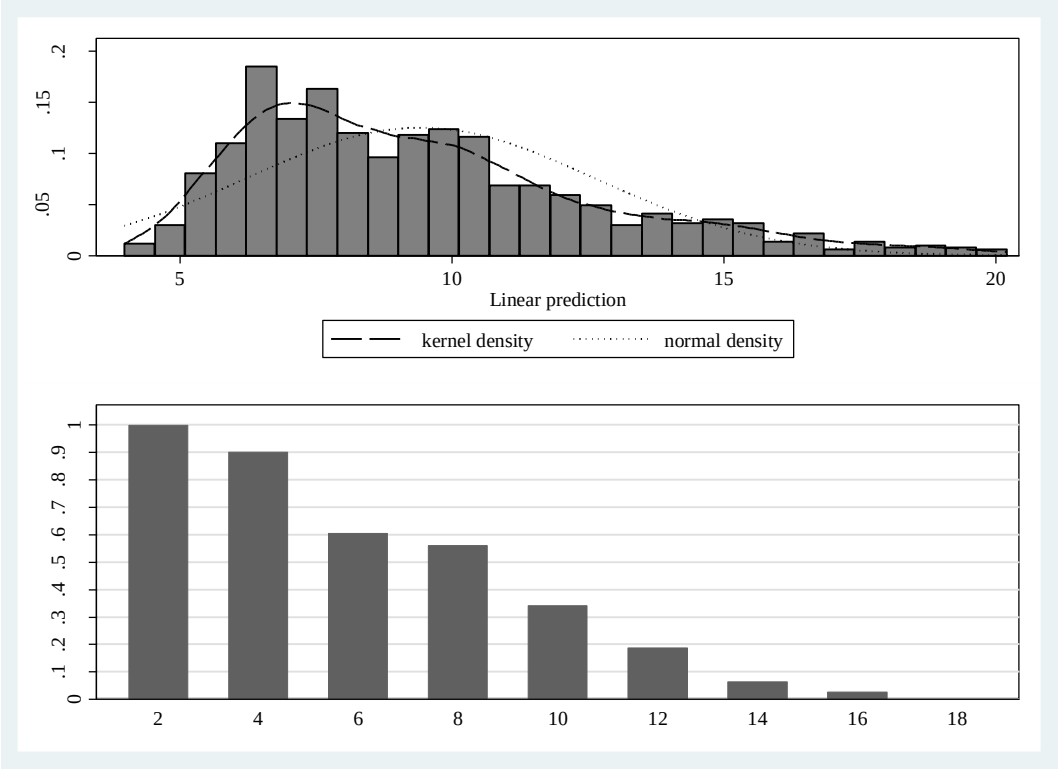
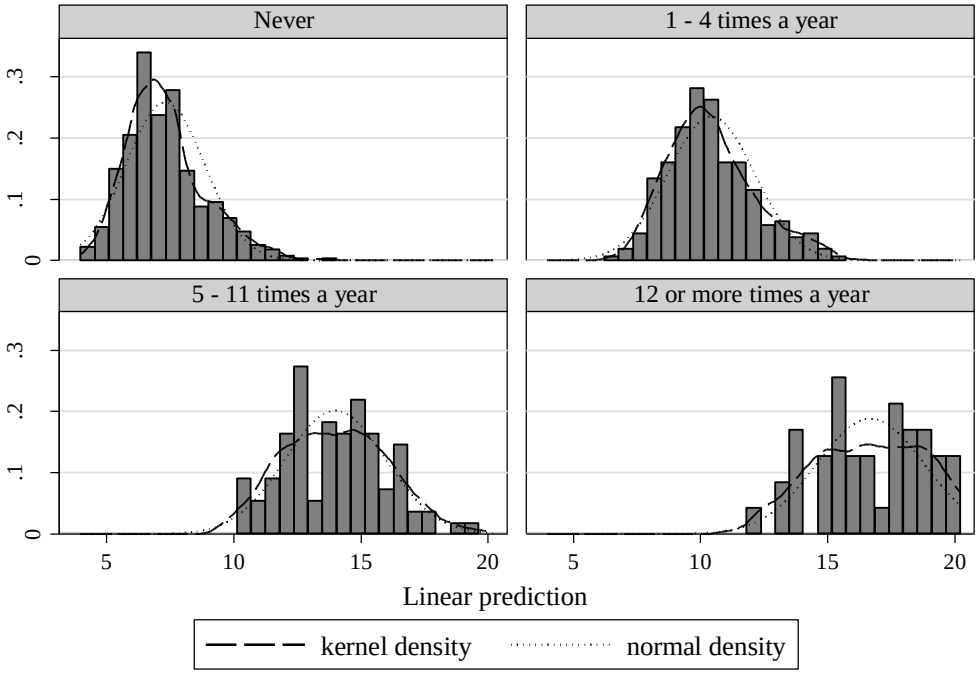


Figure 6. Oil willingness to pay histogram by purchase frequency



Appendix

Variable	Description
Education	Less than high school
	High school or GED
	Some college
	2-year college degree
	4-yr college degree
	Master's degree
	Doctoral degree
	Professional degree (JD, MD)
Income	Less than $25,000
	$25,001 - $50,000
	$50,001 - $75,000
	$75,001 - $100,000
	$100,001 - $125,000
	$125,001 - $150,000
	$150,001 - $175,000
	$175,001 - $200,000
	$200,001 - $225,000
	$225,001 - $250,000
	$250,001 or more
State Residence	AL, GA, FL, SC, TN
Purchase Frequency	*How often do you buy...<product>*
	I don't know what this is
	Never
	1 - 4 times a year
	5 - 11 times a year
	12 or more times a year
Georgia Grown	*How familiar are you with the Georgia Grown Marketing program?*
	I haven't heard of it
	I've heard of it, but don't know what it is
	Somewhat familiar with the program
	I am familiar with the program
	I am very familiar with the program
Farmers Market	*How often do you shop at farmers markets during the summer?*
	0 times a summer
	1 - 2 times a summer
	3 - 5 times a summer
	6 - 12 times a summer
	13 times or more a summer
Local	*What is the largest geographic area that you would consider food to be called locally grown?*
	The town you live in
	The county you live in
	The region you live in (e.g. Piedmont, South Georgia, Coastal Plain, etc.)
	The state you live in
	The southeast
	The United States