Willingness to Pay for Retail Location and Product Origin of Christmas Trees

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Abstract

Christmas trees sales are considerable throughout the U.S. Understanding the drivers of purchase for Christmas trees, especially the impact of retail outlet and local label, is critical for producers and policy makers within states with tree production. Utilizing data from a choice experiment Connecticut residents in combination with latent class modeling we find that Christmas tree height is important to all latent classes but tree species had less of an impact. Furthermore, we find that a grown in CT label does not influence all consumers, though a majority of our sample had a preferential view and would pay a premium for a CT trees. With respect to retail location, we find that nursery/greenhouse and choose and cut retail outlets are preferred by a majority of consumers, but not by all consumers. Recommendations for the varying retail outlets are provided.

According to the USDA there were 309,365 acres of cut Christmas tree production in 2012 with acreage down 10% from 2007. However, the number of harvested trees was only down 1% to 17,319,060 in 2012 (USDA Table 35). Counting domestic as well as import sales there are around 25-30 million Christmas trees sold every year with the retail value in 2014 around $1.04 billion for real trees alone (National Christmas Tree Association, 2014). Even with the large number of Christmas trees sold each year there are particular consumer segments that have a higher likelihood of purchasing a tree, notably Christians, households with children and consumers that spend Christmas at home. Furthermore, consumers that are Caucasian, younger, have a higher income, and live in a single-family dwelling are more likely to have a real tree (Hamlett et al. 1989). More recent studies have validated that younger consumers are more likely to purchase a real tree compared to older consumers most likely due to the perceived extra cleanup associated with a real tree by older consumers (Florkowski and Lindstrom, 1995; Behe et al. 2005; Bauerlein, 2011).

Given the number of Christmas trees sold and the retail value associated with those sales every year it is essential to understand and provide information to tree producers to help facilitate good decisions at the outset of production. For instance, it takes an average of seven years for a Christmas tree to reach the typical six to seven foot height consumers desire (National Christmas Tree Association, 2014). Thereby, a producer must forecast out half a decade or more as to what tree species will be desirable, anticipated height needed, which retail outlets to target, and estimated price needed to remain profitable. Adding to the complexity of the market are artificial trees which have seen an 18% increase in purchases from 2008 to 2014 (National Christmas Tree Association, 2014). As noted by Davis and Wohlgenant (1993), artificial and

real trees are substitutes with a one percent increase in artificial tree price resulting in an 11.8% increase in the quantity demanded for real trees.

Understanding the value of attributes that influence a consumer's decision to purchase a real Christmas tree is essential to providing actionable recommendations to producers and other stakeholders. As noted by Davis (1993) consumers with knowledge of tree species valued height, branch spacing, color, and had a negative value of needle length, while consumers that were not knowledgeable valued only color. Outside of the Davis (1993) paper there has been little work examining consumer valuation of real Christmas tree attributes (not including tabletop trees). In order to provide information to producers and retailers as well as to fill a gap in the literature we utilized a choice experiment with latent class modeling to value various attributes to better understand the drivers of purchase for real Christmas trees. Of particular interest we examine the value of retail outlet and the potential impact local labeling (i.e. grown in CT) might have on preference and willingness-to-pay (WTP). Our main hypothesis was that local labeled trees at choose your own and nursery/greenhouse retail outlets would receive a premium compared to locally labeled trees sold in home improvement centers across latent classes. Furthermore, we hypothesized CT trees would be valued more than trees imported from outside of CT.

Materials and Methods

During the fall of 2012 we initiated an online survey of Connecticut (CT) consumers to value key attributes of Christmas trees. CT was chosen for a variety of reasons, notably due to the funding source for this project. However, CT provides an interesting case study given the rise in Christmas tree production from 2007-2012. CT had 5,389 acres in production during 2012

which was up from the 3,887 acres in production in 2007. Furthermore, CT ranked in the top ten states with 159,091 trees cut in 2012 which was up 40% from 2007 (USDA Table 35). Based on these statistics, it is clear that CT Christmas tree production is trending upward so understanding how local labeling might influence tree sales is essential.

Survey respondents were obtained from the database of Global Market Insight, Inc. (GMI). Panelists from the GMI database were emailed an invitation to participate in the survey with those agreeing to participate being directed to the survey. The survey instruments for this study were evaluated and approved by the University of Connecticut Internal Review Board. The online survey had a 80% response rate and produced 640 completed responses.

Table 1 presents some basic demographic and behavior characteristics of the sample. Optimally we could test whether our sample demographics were different from the CT population, however, variances are not provided for census estimates meaning significance testing is not feasible. We do provide a discussion of differences below to get a better understanding of the potential differences. As can be seen in Table 1, our sample was 89% Caucasian respondents which is slightly more than the 82% reported in the census for CT. Further the median income for the sample was $95,000. For comparison, the CT population median income was $69,461 (United States Census Bureau 2015). The differences between our sample and the CT population is not especially problematic given generalizations from this paper are for Christmas tree purchasers, which as noted by Hamlett et al. (1989) are more likely to have higher incomes.

In constructing the choice design the first step was to determine potential drivers of purchase for real Christmas trees. Using previous literature in conjunction with experts at the CT Department of Agriculture, several attributes were identified as being important in the decision

process, notably price, retail location, tree species, and height (Table 2). The price range ($20 to $75) was determined by surveying several producers in CT in conjunction with past prices obtained from the CT Department of Agriculture. In order to capture the various retail outlets that sale trees in CT, we utilized a number of options for retail outlet choice. Of particular interest to this study is how consumers value CT grown trees sold at a nursery/greenhouse compared to CT grown trees sold at a choose your own and home improvement centers. We also included imported trees from Oregon, Pennsylvania, and Canada sold at a home improvement center in order to better understand the trade-offs between "local" and imported trees. Oregon was chosen since it is the largest producing Christmas tree state (acres and trees cut), while Pennsylvania was the largest producing state in the Northeast (acres and trees cut) in 2012 (USDA Table 35). With respect to tree species, we utilized White Spruce, Scotch Pine, Frasier Fir, and Douglas Fir. These species represent the most common tree species purchased during Christmas (i.e., Douglas Fir and Scotch Pine) as well other trees that are a little less common (i.e., White Spruce and Frasier Fir) but still frequently utilized (National Christmas Tree Association, 2016).

In designing the final number of choice sets for each product, we utilized the D-efficiency criterion (Kuhfeld 2010). By optimizing the D-efficiency criterion, which compares design efficiency with an orthogonal balanced design, we determined the final design to be used in the experiment (Kuhfeld 2010). The final number of choice sets was eight with each set including three product profiles plus a "none" option.

Given the multinomial nature of the data, a multinomial logit model would seem like a good choice. However, consumers most likely are heterogeneous across tastes and preferences (Wedel and Kamakura, 2000). In order to account for the unobserved heterogeneity we utilized

a latent class model (LCM) (Wedel and Kamakura, 2000; Boxall and Adamowicz, 2002; Greene and Hensher 2003; Kafle, Swallow, and Smith, 2014). LCM is a semi-parametric extension of the multinomial logit model and similar to the mixed logit model commonly used for discrete choice analysis (Greene and Hensher 2003). However, the LCM relaxes the mixed logit model requirement that specific assumptions have to be made about the distribution of parameters across individuals (Green and Hensher, 2003). The final number of latent classes to be included in the model was chosen by finding the model that had the lowest Bayesian Information Criteria (BIC) given a varying number of latent classes. The lowest BIC was achieved using three latent classes.

The LCM model can be viewed in the following context. The indirect utility for a consumer *i* corresponds to segment *s* when choosing product *j* such that

$$U_{ij|s} = X_j\beta_s + \varepsilon_{ij} \quad [1]$$

where X_j is a vector of product attributes *j*. β_s is a vector of class-specific taste parameters and ε_{ij} is the error term that follows an i.i.d Type I extreme value distribution. The LCM estimates the unconditional probability that consumer *i* can be attributed to class *s* based on socio-demographic characteristics, as noted in equation two.

$$Prob_{is} = \frac{\exp(\theta_s \mathrm{Z}_i)}{\sum_s \exp(\theta_s \mathrm{Z}_i)} \quad [2]$$

where Z_i is a set of socio-demographic characteristics for consumer *i* and θ_s is a vector of parameters that determine the class membership probability. After matching an individual with their likely class, conditional on belonging to class *s*, probability that individual *i* chooses product *j* is given by:

$$Prob_{ij|s} = \frac{\exp(\mu_s X_j \beta_s)}{\sum_j \exp(\mu_s X_j \beta_s)} \quad [3]$$

where μ_s is the scale parameter for a class *s* and is normalized to 1. Therefore, the joint probability that consumer i in class s choosing product j can be expressed as:

$$Prob_{ijs} = Prob_{ij|s} * Prob_{is} = \frac{\exp(\mu_s X_j \beta_s)}{\sum_j \exp(\mu_s X_j \beta_s)} * \frac{\exp(\theta_s Z_i)}{\sum_s \exp(\theta_s Z_i)} \quad [4]$$

Using the utility parameters from the LCM the willingness to pay (WTP) values for each attribute can be calculated as

$$\text{WTP}_j = -\left(\frac{\beta_j}{\beta_p}\right) \quad [5]$$

where β is the estimated coefficient for each attribute level *j* and *p* is the price attribute.

Results and Discussion

Table 3 includes the results of the LCM analysis. Of interest, we see that the price coefficients for each latent class are significant and negative, implying that as price increases consumers are less likely to choose a product. This finding is consistent with economic theory that consumers prefer lower prices. Furthermore, the price coefficient for latent class two is a lot higher than for classes one or three, which could indicate that class two is more price sensitive than the other classes.

Latent Class 1

Latent class one has the most significant attributes compared to the other classes. Notably we see that consumers in this class were less likely to prefer a larger tree as noted by the -0.163 coefficient associated with tree height. However, we see that only Scotch Pine was significantly

less preferred than the Douglas Fir. The other tree species were preferred equally as the Douglas Fir.

By comparing the home improvement center outlet across origin label we can determine how consumers value CT grown trees. For class one, we find CT trees are preferred compared to imported trees. This partially validates one of our hypotheses that some consumers would value a CT labeled tree. Given the 'buy local' movement has been primarily focused on food this result indicates that the 'buying local' movement can impact decision making for non-food items as well. As noted by Onozaka, Nurse, and McFadden (2010), supporting the local economy, farmers receiving fair returns, and maintaining local farmland are some of the most important factors when choosing local produce. These characteristics can easily be applied to non-food products as well which may lead to the perception that purchasing a CT grown tree supports the local community, provides fair returns to farmers, etc.

Many nusery/greenhouse operations in CT, and throughout the U.S., have struggled due to the recession. Some nursery/greenhouse operations have investigated offering new types of products, such as Christmas trees, in order to offer a broader product selection and compete with home improvement centers. By comparing CT grown trees offered at a home improvement center, nursery/greenhouse, and choose your own outlet we can determine whether differences exist between varying retail outlets. As can be seen in Table 3, consumers in class one prefer the nursery/greenhouse and choose and cut outlets more than the home improvement center. On the surface this finding provides evidence that nursery/greenhouse operations may be able to gain extra revenue by offering Christmas trees during the holiday season.

Age and income have been shown to be key indicators of whether a consumer will purchase a tree. With respect to our analysis, we find that older consumers were less likely to be

in class one compared to class three. Furthermore, we find that having experience (i.e., having purchased a real tree at least once during the past two years) with a tree has a negative impact on being in class one. Taking the results that nursery/greenhouse trees are preferred over home improvement center trees and class one is more likely to be inexperienced tree buyers, nursery/greenhouse operators that are selling trees need to find ways to move inexperienced buyers into buyers. This may entail direct communication with potential buyers or other means to address concerns about purchasing a real tree.

Latent Class 2

Latent class two is by far the smallest class with a share of 19.2% of consumers (Table 3). Similar to class one, tree height is a primary determinant of purchasing a real tree for class two. The height coefficient is negative (-0.827) implying these consumers are averse to a tall tree. Furthermore, we find that tree species is not that important. This result seems to indicate that the tree selection process with respect to the specific type of tree purchased may be a point-of-sale decision such that there is no real preference that consumers have for tree species.

However, class two has unique preferences regarding local labeling that do not align with *a priori* expectations. In particular, class two does not prefer CT grown trees to imported trees. Even given the small share associated with this class, the results indicate that firms may not be able to rely simply on a grown in CT label to facilitate tree sales. Furthermore, we find that consumers in this class did not have a preferential view of purchasing at a nursery/greenhouse or choose and cut outlet compared to a home improvement center. Based on this finding it is clear that non-home improvement center outlets may need to work harder to bring in this class to their business given there is not a preferential view toward these outlets.

Latent Class 3

Latent class three is similar to class one, except class three tends to have deeper preferences, as noted by the larger coefficients, across many of the attributes. As with the other classes, height was an important driver of preference with smaller trees preferred to taller trees. Similar to the other classes, we do not see any significance across tree species. However, in contrast to class one, class two does not prefer CT trees over Pennsylvania trees but it does prefer CT over Oregon and Canada trees. This finding implies that class two has a slightly expanded view of local that includes CT as well as regional production. Furthermore, this class preferred trees sold at a nursery/greenhouse or choose and cut retail outlet more than those sold at home improvement centers.

Based on the results of the class probability model for classes one and two, we can infer that class three was made up of younger consumers. Given tree buyers are more likely to be younger, class three may be the primary group that Christmas tree retailers and producers, should target. Adding credence to this assertion is the fact that compared to class one, class three members were more likely to have recent purchasing experience with a real tree.

Willingness to Pay

As noted above height is an important factor for each class's tree purchase decision. We find on average that class one would pay $5.86 less for each extra foot of tree compared to class three which would pay $3.41 less (Table 4). In comparison, class two would pay $4.14 less for each extra foot of tree. Examination of the confidence intervals indicates that the height WTP across classes were not statistically different so we could expect the true WTP discount to be around $3-5 per foot.

When examining the impact of CT labeling we find that class one would pay between $18-$32 more for a CT grown tree. However, class three would discount an Oregon tree by almost $42.77 and the Canadian tree by $21.74, while not discounting a Pennsylvania tree compared to a CT tree. For class two the Canadian tree was discounted by $13.37. Based on these results it is clear that the classes have differing views of local. Class one was the pure local consumer that discounts imported trees. Class two discounts international imports while having no difference between CT and domestic imports. Finally, class three was more of a regional consumer given the discounts associated with Oregon and Canada and the lack of discount for Pennsylvania trees.

Home improvement center trees can expect a discount of $24.36 and $28.91 from a class one consumer compared to nursery/greenhouse and choose and cut retail outlets, respectively. Class two consumers show no discount/premium across retail outlet type. However, class three sees a wide disparity in retail outlet prices. Nursery/greenhouse outlets can expect an $18.79 premium while choose and cut outlets can expect a $36.30 premium compared to home improvement centers.

Conclusions

Across all classes, height was an important driver of purchase. Notably, consumers want smaller trees in the range we tested (6-10 feet). We also find tree species was not as important to the decision process, which leads to the recommendation that retail outlets need to carry a variety of tree species as consumers most likely do not have specific tree species in mind when they shop for a tree. Furthermore, we find that a grown in CT label does not influence all consumers, though a majority of our sample had a preferential view and would pay a premium for a CT tree.

Finally, we find that nursery/greenhouse and choose and cut retail outlet are preferred by a majority of consumers; however, not all consumers have a preference for a retail outlet.

Based on where a Christmas tree is being sold the recommendation for increasing its chance to be sold differs. For instance, home improvement centers must overcome the preferential view of nursery/greenhouse and choose and cut outlets when purchasing a Christmas tree when dealing with consumers in classes one and three. Home improvement centers need to capitalize on consumers that come to their stores for other reasons. Using in-store advertising that CT trees are available and attempting to make a connection to the community and local producer could be key to increasing sales at home improvement centers. However, nursery/greenhouse and choose and cut need to maximize the preferential perception that many consumers have about their outlet and continue to leverage the CT grown and supporting the local economy image. To expand to different consumer basis these outlets need to focus on younger consumers, particularly those with experience with a real tree (class three).

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Table 1. Descriptive statistics for key demographic and behavior variables.

Variable	Mean	Std. Dev.
Experienced (%) [a]	0.76	0.43
Mean Income	96,701	51,176
(median)	95,000	--
Age	49.1	14.0
(median)	51.0	--
Children	0.22	0.51
Male (%)	0.34	0.47
Caucasian (%)	0.89	0.32

[a] Experience = 1 implies a respondent purchased a Christmas tree at least once during the past two years.

Table 2. Attributes (and levels) included in the choice experiment.

Price	Species	Height (feet)	Retail location
20	White Spruce	6	Home improvement center: grown in CT
30	Scotch Pine	8	Home improvement center: grown in Oregon
40	Frasier Fir	10	Home improvement center: grown in Pennsylvania
50	Douglas Fir		Home improvement center: grown in Canada
60			Nursery/Greenhouse: grown in CT
75			Cut your own: grown in CT

Table 3. Latent class model results for Christmas trees.

	Latent Class 1 Coefficient (Std. Error)		Latent Class 2 Coefficient (Std. Error)		Latent Class 3 Coefficient (Std. Error)	
None option	-4.311	***	-15.713	**	-1.899	*
	(0.570)		(6.361)		(1.133)	
Price	-0.028	***	-0.200	***	-0.054	***
	(0.004)		(0.069)		(0.010)	
Height	-0.163	***	-0.827	**	-0.184	**
	(0.040)		(0.378)		(0.093)	
Scotch pine	-0.506	**	-0.644		-0.414	
	(0.231)		(1.376)		(0.456)	
Frasier fir	-0.014		-0.200		0.022	
	(0.159)		(0.692)		(0.410)	
White spruce	-0.045		0.543		-0.500	
	(0.173)		(0.560)		(0.380)	
Nursery/greenhouse: grown in CT	0.677	***	-1.365		1.012	***
	(0.173)		(1.101)		(0.350)	
Home improvement center: grown in Oregon	-0.880	***	-0.370		-2.303	**
	(0.229)		(1.067)		(1.061)	
Home improvement center: grown in Canada	-0.513	**	-2.668		-1.171	**
	(0.235)		(1.873)		(0.550)	
Choose and cut (grown in CT)	0.803	***	0.947		1.955	***
	(0.191)		(1.050)		(0.379)	
Home improvement center: grown in Pennsylvania	-0.626	***	-0.591		-0.802	
	(0.231)		(1.134)		(0.504)	
Class Probability Model						
	Latent Class 1 Coefficient (Std. Error)		Latent Class 2 Coefficient (Std. Error)		Latent Class 3 Coefficient (Std. Error)	
Experience	-0.916	*	-0.882		--	
	(0.553)		(0.756)			
Income	0.000		0.000		--	
	(0.000)		(0.000)			
Age	-0.037	**	-0.053	**	--	
	(0.017)		(0.024)			
Children	0.560		-0.007		--	
	(0.515)		(0.726)			

Male	0.395		0.296		--
	(0.444)		(0.606)		
Caucasian	-0.398		-1.199		--
	(1.000)		(1.045)		
Constant	3.328	**	4.160	***	--
	(1.301)		(1.419)		
Log likelihood			-1,280.8		
Number of respondents (times 8 choices for total number of observations)			640		
Percent share	0.49		0.192		0.319

BIC values for varying latent classes: 2 = 2819.9, 3=2800.1, 4=2807.3, and 5=2836.4.

Table 4. Willingness to pay estimates from the latent class model results.

	Latent Class 1 Coefficient (Confidence Interval)		Latent Class 2 Coefficient (Confidence Interval)		Latent Class 3 Coefficient (Confidence Interval)	
Height	-5.86	***	-4.14	***	-3.41	**
	(-8.66, -3.07)		(-5.94, -2.35)		(-6.46, -0.37)	
Scotch pine	-18.21	**	-3.23		-7.68	
	(-33.53, -2.88)		(-14.93, 8.48)		(-22.87, 7.51)	
Frasier fir	-0.49		-1.00		0.40	
	(-11.70, 10.72)		(-8.09, 6.08)		(-14.59, 15.40)	
White spruce	-1.62		2.72		-9.29	
	(-13.68, 10.45)		(-2.42, 7.87)		(-22.06, 3.49)	
Nursery/greenhouse: grown in CT	24.36	***	-6.84	*	18.79	**
	(8.59, 40.13)		(-14.57, 0.89)		(3.42, 34.17)	
Home improvement center: grown in Oregon	-31.65	***	-1.85		-42.77	*
	(-49.68, -13.63)		(-11.77, 8.06)		(-86.06, 0.52)	
Home improvement center: grown in Canada	-18.44	**	-13.37	*	-21.74	**
	(-35.57, -1.32)		(-25.33, -1.41)		(-43.40, -0.09)	
Choose and cut (grown in CT)	28.91	***	4.75		36.30	
	(13.37,		(-25.33, 13.23)		(19.99, 52.61)	***
Home improvement center: grown in Pennsylvania	-22.52	***	-2.96		-14.89	
	(-38.65, -6.39)		(-12.83, 6.92)		(-33.44, 3.66)	