Repeat Buying Behavior for Ornamental Plants: A Consumer Profile

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Introduction

The floriculture and nursery industry has evolved rapidly in recent years. The introduction of mass-market retailers such as supermarkets, department stores and Internet-based businesses has changed the marketing paradigm of floriculture. Compared to the other food products such as milk, meat, citrus, etc., floriculture and nursery crops lack an extensive marketing literature. In general, the demand for all products is highly dependant on its characteristics or attributes. For most food products, the prevailing characteristics are to satisfy nutritional needs and/or taste. Even though ornamental plants do not satisfy any nutritional needs, they possess other important characteristics that influence the buying decision; and because ornamentals are not essential for survival, a substantial portion of the population is comprised of non-buyers or infrequent buyers. Therefore there is a considerable gap for the decision of buying or not, and buying intensity. This decision is linked to consumer demographics and the buying occasions and periods. Understanding how consumers make choices of whether to buy or not and the perceptions of the characteristics of the products they do buy is essential to understanding ornamental demand.

Floriculture and nursery products are purchased for various reasons such as expression of love or friendship, a way to express thankfulness or appreciation, and beautification purposes either for self use or as gifts. These attributes of flowers and plants cannot be quantified directly; therefore the satisfaction gained from the consumption of these goods is closely related to the purpose of the purchase (Girapunthong, 2002). This also implies that the demand for these products can be influenced by the characteristics or preferences of buyers and the reasons for buying the products. This situation becomes evident during special seasonal calendar occasions (i.e., Mother's Day, Valentine's Day, etc), where the consumption of ornamental products is substantially higher compared to non-calendar occasions. The main objective of this paper is to analyze the main factors affecting consumer frequency of purchasing ornamental plants.

There is extensive literature regarding demand analysis for traditional agricultural products; however, studies on the demand side for floriculture products are very limited in the literature. Miller (1983) performed an extensive sub-sector analysis for the fresh cut-flower industry in the U.S. by analyzing the structure, conduct and performance of the existing conditions of the industry to try to predict future trends. Miller observed that there were special calendar occasions when the demand for flowers was substantially higher and other non-calendar occasions where the demand was substantially lower. He also determined that the demand for flower arrangements was inelastic, meaning that consumers are not highly responsive to changes in price of floral products.

Tillburg (1984) analyzed a panel of cut flower and potted plant consumers in the Netherlands to relate aspects of consumer behavior to marketing variables and demographic characteristics of households. He identified three market segments: the first segment consisted of 44 percent of the households and was sensitive to prices but insensitive to national advertisements; the second segment consisted of 40 percent of the households, and was insensitive to both prices and advertisements; and the third segment, with 13 percent, was sensitive to both prices and advertising.

Behe (1989) analyzed the consumer purchasing behavior of Pennsylvanians at the retail level. She recommended three ways to segment retail flower markets: by product, volume of purchase, and by location of the purchase. Behe et al. (1992a) carried out an analysis of consumer purchases of floral products in Ohio supermarkets using principal components analysis. Behe et al. (1992b) followed up on her previous study and applied cluster analysis to identify the most important factors affecting floral buying decisions. Becker (1993) studied differences in service quality between supermarkets and florists in Texas. He found that the differences on the types of retail outlets were based on the types of products sold, custom design and other in-store services, delivery options and convenience. Rimal (1998) analyzed the effects of generic and brand promotions on sales of fresh cut-flowers at the retail level in the U.S.

Girapunthong (2002) analyzed the demand drivers for fresh cut-flowers and their substitutes in the U.S. Girapunthong found that all direct price effect coefficients with the seasonal and actual variables were statistically significant and changes in the relative prices had a significant impact on flower market shares among fresh cut-flowers, potted flowering plants, and dry/artificial flowers. Ward (2004) evaluated the impacts of the Flower Promotion Organization (FPO) advertising campaign on cut-flower sales, concluding that the promotions have impacted the demand for flowers through increasing buyer frequency and through attracting new buyers. He found that about 87 percent of the increase in demand for the promotional programs is from the increased number of transactions per buyer. Ward found that the demographic group that responded the most to the promotional program were female buyers that purchase flowers for self-use. This was consistent with the target of the FPO promotion program.

Yue and Behe (2008) analyzed consumer preferences for different floral retail outlets. They used a consumer panel data collected by the American Floral Endowment from 1992 to 2005 were used to evaluate consumers' choice of different floral retail outlets among box stores, traditional freestanding floral outlets, general retailer, other stores, and direct-to-consumer channels.

When studying the aforementioned literature regarding the demand for floral and other ornamental products, it is apparent that there are many factors that affect their demand. These factors can be grouped into three main categories: external, controlled, and seasonal factors. External factors of demand include inflation, wages, prices, unemployment rate, demographic factors and other economic variables. Controlled factors of demand may be used to change perceptions and awareness with the use of promotions, product development and innovations. Seasonal factors also affect the demand for flowers. There are certain calendar occasions when the demand for flowers is higher compared to other non-calendar occasions. The most common calendar occasion dates are Mother's Day and Valentine's Day (Ward, 1997). This paper will concentrate on evaluating some of the controlled factors of demand affecting ornamental purchases during non-calendar occasions and hence looking at core ornamental buyers.

Because ornamental plants are non-essential for survival, in a typical month the percentage of the population that buys flowers is relatively low. From this fact arises the need to understand how ornamental buyers make the choice to purchase and to have a measure or profile of consumer intensity. Demand analyses for ornamental products differ among other agricultural commodities in the sense that for other agricultural commodities, the quantity consumed is used directly in the analysis. In the case of floriculture products, a consumer purchase quantity is ambiguous and closely tied to the type of ornamental plant; for example, a quantity of one may refer to one single stem rose, or an arrangement of a dozen roses and several other plants. Hence, this study replaces quantity (number of units) observed by the number of transactions given on a defined period of time. In doing so, all properties (or restrictions) of the demand function are still satisfied.

Repeat buying occurs when a consumer buys a product more than once in a given period of time. Consumers are influenced by pre-purchase needs, perspectives, attitudes, the experience of previous usage, and external influences such as advertising and promotion programs, retail availability, personal selling and word of mouth effects, and differences in products, services and prices. The consumer has to make decisions regarding what products to buy and at what prices and where to buy the products. All of these characteristics form a post-buying experience in the customer's mind after the purchase takes place; based on all these factors a consumer would choose depending on the level of satisfaction or utility obtained from the product or service whether to re-purchase the product or not.

There are basically three cases of repeat buying situations that can be defined. First, if a consumer buys more than one product in one or more purchase occasions (transactions) in a given time period. In this case, consumers differ in how often they repeat buy the products. The frequency of buying would be 0 for a consumer that did not purchase the product and 1 for consumers that purchased the product once. For repeat buyers, the frequency will be 2, 3, 4, etc., depending on the number of repeat buying occasions they purchased the product. The second way of repeat buying refers to consumer that may buy the product in more than one time period, or multiple transactions in a given period. Then a model can be formulated for repeat buying behavior under stationary and no trend conditions. The third and last form of repeat buying behavior is that more than one unit may be purchased on the same purchase occasion (Ehrenberg, 1988).

Data and Methods

The data were obtained through an electronic mail survey conducted in July of 2008 to a representative sample of the Texas population consisting of 880 individuals provided by MarketTools Corporation, a company specialized in market research and online survey services. From the total sample, approximately 31% were actual consumers of the ornamental industry's products, lowering the final number of usable responses to 274 observations.

The dependent variable is frequency of buying for ornamental plants. It is defined as the number of transactions per month ($f_i = 0,1,2,3,...,n$) and it is a function of the purpose of the purchase (PP), seasonality (S), and several demographic characteristics, including age, gender, marital status, income, ethnicity, education, and region . The purpose of the purchase is to use the ornamental plants for self consumption or gifts. The frequency of buying of flowers is affected by seasonal factors. As an example, the frequency of buying and the total number of buyers increase during special calendar occasions such as Mother's Day, Valentine's Day, Christmas, etc. Since our data are not time series, monthly seasonality can not be evaluated. The variable seasonality is a discrete variable that identifies self described special occasion buyers only (non-habitual buyers), versus habitual ornamental buyers. The dependent variable frequency of buying is censored and therefore the Tobit model is used for the estimation. The general frequency of buying econometric model can be written as:

$$f_i = \beta_0 + \beta_1 AGE2 + \beta_2 AGE3 + \beta_3 AGE4 + \beta_4 FEMALE + \beta_5 MARRIED + \beta_6 INC2$$
$$+ \beta_7 INC3 + \beta_8 INC4 + \beta_9 ET2 + \beta_{10} ET3 + \beta_{11} EDU2 + \beta_{12} EDU3 + \beta_{13} REG2 \quad (1)$$
$$+ \beta_{14} REG3 + \beta_{15} PP + \beta_{16} S + \varepsilon_i$$

where all variables used in the model and their definition are presented in Table 1.

Because the dependent variable in our regression model equation has a lower limit (i.e. zero), and the dependent variable takes the value of zero for a large number of sample observations (24.8%), conventional multiple regression analysis is not an appropriate technique to be used (Lung-Fei and Maddala, 1985). In order to account for this truncation on the data set the Tobit model can be specified as follows (Greene, 2000):

$$f_i^* = x_i'\beta + \varepsilon_i, \quad (2)$$

where x_i' is the (1 × K) vector of explanatory variables and $\varepsilon_i \sim N(0,\sigma^2)$ and it is independent of other errors. Thus for any household the buying frequency model would take the form:

$$f_i = f_i^* \quad \text{if } f_i^* > 0 \quad (3)$$

$$f_i = 0 \quad \text{if } f_i^* \leq 0.$$

From the total number of observations N in the sample, the number of observations can be divided into two groups; one for which $f_i = 0$, N_0; and another for the number of observations for which $f_i > 0$, N_1. In order to observe the statistical problems arising from the censored sample problem, consider leaving out of the analysis the N_0 observations for which $f_i = 0$. For the remaining N_1 sample observations, they are complete observations. Hence, one can use least squares estimators to estimate β. The problem is that this estimator is biased and inconsistent. In order to prove that, one can write down the expectation of the observed values of f_i conditional on the fact that $f_i > 0$:

$$E[f_i \mid f_i > 0] = x_i'\beta + E(\varepsilon_i \mid f_i > 0) \tag{4}$$

If the conditional expectation of the error term is zero, then the estimates of the least square regression on N_1 would provide an unbiased estimator for β. However this is not the case; if the ε_i are independent and normally distributed random variables, then the expectation would be:

$$E[\varepsilon_i \mid f_i > 0] = E[\varepsilon_i \mid \varepsilon_i > -x_i'\beta] > 0 \tag{5}$$

It can be shown that this conditional expectation can also be expressed in the following manner:

$$E[\varepsilon_i \mid \varepsilon_i > -x_i'\beta] = \sigma \phi_i / \Phi_i \tag{6}$$

where ϕ_i and Φ_i are the standard normal probability distribution function (p.d.f), and cumulative distribution function (c.d.f.) evaluated at $(x_i'\beta / \sigma)$; therefore in the regression model, if $f_i > 0$, then,

$$\begin{aligned} f_i &= x_i'\beta + \varepsilon_i \\ &= x_i'\beta + \sigma \frac{\phi_i}{\Phi_i} + u_i \end{aligned} \tag{7}$$

if we apply the regular least squares procedures the term $\sigma \frac{\phi_i}{\Phi_i}$ is omitted. Since that term is not independent of x_i the results are biased and inconsistent.

In order to estimate the parameters β and σ^2 consistently, maximum likelihood estimation (MLE) procedures were used. The likelihood function of the sample has a component for the observations that are positive, and one for the observations that are zero. For the observations $f_i = 0$ it is known that $x_i'\beta + \varepsilon_i < 0$ or expressed in a different way, $\varepsilon_i < -x_i'\beta$, then,

$$\Pr[f_i = 0] = \Pr[\varepsilon_i < -x_i'\beta] = \Pr\left(\frac{\varepsilon_i}{\sigma} < -\frac{x_i'\beta}{\sigma}\right) = 1 - \Phi_i \qquad (8)$$

If we define the product of the observations over the zero lower limit level to be Π_0 and the product over the positive observations to be Π_1, the likelihood function of the Tobit model is given by:

$$\ell = \prod_0 (1-\Phi_i) \prod_1 \left(2\pi\sigma^2\right)^{-\frac{1}{2}} \exp\left\{-\left(f_i - x_i'\beta\right)^2 / 2\sigma^2\right\} \qquad (9)$$

The corresponding log-likelihood function would be:

$$L = \ln \ell = \sum_0 \ln(1-\Phi_i) - (N_1/2)\ln(2\pi) - (N_1/2)\ln\sigma^2 - \sum_1 \left(f_i - x_i'\beta\right)^2 \Big/ 2\sigma^2 \qquad (10)$$

Then the first order conditions are:

$$\frac{\partial L}{\partial \beta} = -\frac{1}{\sigma}\sum_0 \frac{\phi_i x_i}{1-\Phi i} + \frac{1}{\sigma^2}\sum_1 \left(f_i - x_i'\beta\right)x_i \qquad (11)$$

$$\frac{\partial L}{\partial \sigma^2} = \frac{1}{2\sigma^3}\sum_0 \frac{(x_i'\beta)\phi_i}{1-\Phi_i} - \frac{N_1}{2\sigma^2} + \frac{1}{2\sigma^4}\sum_1 \left(f_i - x_i'\beta\right)^2.$$

The parameters were estimated with Time Series Processor (TSP). The estimation procedure uses the analytic first and second derivatives in equation 11 to obtain maximum likelihood estimates via the Newton-Raphson algorithm. The starting values for the parameters are obtained from a regression on the observations with positive f values. The numerical implementation involves evaluating the normal density and cumulative normal distribution functions. The cumulative distribution function is computed from an asymptotic expansion, since it has no closed form. The ratio of the density to the distribution function, used in the derivatives, is also known as the Inverse Mills Ratio (Hall, 1992).

Results and Discussion

The survey sample was a fair representation of the Texas' population based on selected socio-demographic characteristics including marital status, gender, ethnicity, and income. About 60% of respondents were married compared with 54% of the population in Texas. The percentage of females in the sample was 53% versus 50% for Texas; and 53% of the total number of respondents had an income of more than $50,000 compared to 47% of Texas' population. The ethnical distribution of the sample was similar to the U.S. Census Bureau data, with Caucasians accounting for the majority of responses in the survey and comprising the majority of the true population, followed by Hispanics. The highest educational degree obtained from 78% of the sample population was a bachelor's degree compared with 92% of Texas' population. Table 2 presents a comparison of survey respondent's demographic characteristics with actual population averages.

Most respondents (78.5%) reported to be non-habitual ornamental buyers or purchasers of ornamental plants during special calendar buying occasions only. Most (84%) ornamental products in Texas were purchased for self-consumption purposes. The preferred outlets to purchase ornamental products were garden centers (72%), followed by nurseries (40%), chain stores (32%), and supermarkets (30%).

Respondents were also asked to rate the importance of several aspects in the purchase decision including price (3.89/5), vibrant colors (3.85/5), low-care demand (3.83/5), drought tolerance (3.64/5), season (3.57/5), guaranteed growth (3.51/5), light demand or requirement (3.34/5), and organic (2.58/5). The weighted average rating of these aspects clearly suggests that price is the most important feature, followed very closely by vibrant colors and low-care demand (low maintenance). The rating of organically-grown and light requirement implies that these two features are typically not very important to Texas consumers when making purchasing decisions for ornamental plants. For instance, 45% of the respondents assigned low ratings of 1 or 2 to organically-grown products and 36% confirmed that light requirement was not a feature they carefully seek for when buying an ornamental plant.

The parameter estimates of the buying frequency model for ornamentals are presented in Table 3. The strong significance of the sigma parameter suggests that for the data truncation, the lower limit level of zero can not be ignored and the estimation method must deal with the asymptotic distribution of the data. This parameter refers to the estimated standard deviation of the residual. In this model, 197 out of 264, or 74.6% of the usable observations were positive. The frequency of buying for the average respondent was 1.53 transactions per month. The sign of the parameters can be interpreted as an increase (positive), or decrease (negative) in the monthly frequency of buying, or transactions per month. The marginal effects represent the change in the monthly frequency of buying for an additional unit of the variable. Since most of the variables in the model are dummy variables, then marginal effects are interpreted as the change in the number of transactions per month associated to that dummy variable.

There was no statistical significant influence associated with younger age groups and frequency of buying. Age3 (40-55 years old) and Age4 (more than 55 years old) both decrease the frequency of buying. For individuals of 40-55 years of age, frequency of buying was reduced by 0.07 transactions per month, while individuals older than 55 had

0.06 less transactions per month. Respondents with incomes between $25,000 and $49,999 had a higher frequency of buying, with 0.07 more transactions per month. No other income groups had statistically significant effects on frequency of buying. One of the reasons why older households have lower frequency of buying may be because they tend to have landscaping services performed by contractors and do not deal with buying ornamental plants as often. In contrast, medium income level respondents may do most of their gardening or landscaping themselves.

Ethnicity also had no statistically significant effects on buying frequency. The two variables with the highest effects on frequency of purchasing were purpose of the purchase and seasonality, with both variables increasing the frequency of buying. When the purpose of the purchase was for self-use, the model showed an increase in the number of transaction per month of 0.11. The seasonality variable sought to differentiate between those making most of their purchases during special calendar occasions, such as Valentine's Day, Mother's Day and Christmas, etc. and those individuals who also purchase ornamentals in non-calendar occasions. Non-special occasion buyers increase frequency of buying. If a respondent was a special occasion buyer, then the frequency of buying was reduced by 0.2086 transactions per month. Individuals with a college degree tend to make 0.08 less transactions per month. We did not find any statistically significant differences in frequency of buying among Texas regions.

Summary and Conclusions

This paper used an electronic survey conducted in Texas to study the main factors affecting the frequency of purchase, measured in transactions per month, for ornamental plants. The frequency of buying for the average respondent was 1.53 transactions per month. While we found several differences in demographic characteristics of respondents, the two factors that impacted the frequency of ornamental plant buying the most were the purpose of the purchase and seasonality. Self consumption of ornamental plants, and respondents not buying products mostly during special calendar occasions (habitual buyers) increased the number of transactions per month by 0.11 and 0.21 respectively. Older age groups (Age3: 40-55 years, and Age4: 55 or older) and respondents with a college degree actually had a lower frequency of buying. Individuals with medium income levels ($25,000 to $49,999) increase frequency of buying by 0.07 transactions per month. One of the reasons why older households have lower frequency of purchase may be because they tend to have landscaping services performed and do not deal with buying ornamental plants as often. In contrast, medium income level respondents may do most of their gardening themselves. We found no statistically significant effects of ethnicity or regional differences in the state of Texas on frequency of buying.

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Table 1. Description of variables included in an ornamental plant buying frequency model.

Variable	Description
Socio-demographic characteristics	
AGE2	Age between 25-39 years old (= 1 if true and 0 otherwise)
AGE3	Age between 40-55 years old (= 1 if true and 0 otherwise)
AGE4	More than 55 years old (= 1 if true and 0 otherwise)
FEMALE	If gender is a female (= 1 if true and 0 otherwise)
MARRIED	Married marital status (= 1 if true and 0 otherwise)
INC2	Income level (= 1 if income between $25,000- $49,999 and 0 otherwise)
INC3	Income level (=1 if income between $50,000-$74,999 and 0 otherwise)
INC4	Income level (=1 if income is $75,000 or more, and 0 otherwise
ET2	Ethnicity (=1 if ethnicity is Hispanic, and 0 otherwise)
ET3	Ethnicity (=1 if ethnicity is other, and 0 otherwise)
EDU2	Education level (=1 if college degree, and 0 otherwise)
EDU3	Education level (=1 if graduate school, and 0 otherwise)
Consumer habits	
S	Seasonality (= 1 if habitual buyers – non special occasion only- and 0 otherwise)
PP	Purpose of the purchase (= 1 if self consumption and 0 otherwise)
Region	
DREG2	Region: Central Texas (= 1 if true and 0 otherwise)
DREG3	Region: South Texas (= 1 if true and 0 otherwise)
Dummy variables base levels	
AGE1	Age group of under 25 years
INC1	Income group of under $25,000
ET1	Ethnicity is Caucasian
EDU1	Education level is high school or less
REG1	Region is north

Table 2. Representativeness of the survey respondents relative to the Texas Census population data.

Demographic variables		Survey Data Frequency	Survey Data Percentage	Census Data Percentage
Marital status	Married	163	59.9	53.5
	Single	109	40.1	46.5
Gender	Male	129	47.3	49.8
	Female	144	52.7	50.2
Education level	High School	32	11.8	48.4
	College	181	66.5	43.5
	Graduate School	59	21.7	8.1
Ethnicity	African American	10	3.7	11.5
	Caucasian	210	76.9	47.0
	American Indian	6	2.2	0.7
	Hispanic	29	10.6	36.0
	Asian/Pacific Islander	12	4.4	3.4
	Other	6	2.2	1.3
Age	Less than 25	35	12.9	38.7
	25-39	69	25.5	15.2
	40-55	81	29.9	28.4
	More than 55	86	31.7	17.6
Income	Under $25,000	45	16.4	26.7
	$25,000-$50,000	85	31.0	26.6
	$50,001-$75,000	57	20.8	17.9
	$75,001-$99,999	36	13.1	11.3
	$100,000-& above	51	18.6	17.5

Source: U.S. Census Bureau, 2000 and 2005-2007 American Community Survey

Table 3. Results from a tobit model analyzing the frequency of buying ornamental plants.

	Tobit			
	Coefficient	**Standard Error**	**t-value**	**Marginal Effects**
Intercept	0.9454**	0.4264	2.2174	0.1417
Socio-demographic characteristics				
AGE2	-0.1731	0.2237	-0.7742	-0.0260
AGE3	-0.5075**	0.2107	-2.4087	-0.0761
AGE4	-0.3887*	0.2177	-1.7853	-0.0583
FEMALE	0.0571	0.2541	0.2248	0.0086
MARRIED	0.4141	0.2753	1.5045	0.0621
INC2	0.5003**	0.2038	2.4553	0.0750
INC3	-0.2982	0.2345	-1.2712	-0.0447
INC4	-0.0132	0.2248	-0.0589	-0.0020
ET2	0.1101	0.2992	0.3681	0.0165
ET3	0.1176	0.2762	0.4259	0.0176
EDU2	-0.5230***	0.1827	-2.8626	-0.0784
EDU3	0.1923	0.2296	0.8377	0.0288
Consumer habits				
PP	0.7264**	0.3457	2.1015	0.1089
S	1.3914***	0.3045	4.5694	0.2086
Region				
REG2	-0.1931	0.1709	-1.1299	-0.0290
REG3	0.1993	0.2363	0.8431	0.0298
SIGMA	1.8776***	0.1001	18.7602	
Number of usable observations	274			

* P-value ≤ 0.1, ** P-value ≤ 0.05, *** P-value ≤ 0.01