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Measuring Demand Factors Influencing Market Penetration and Buying Frequency for Flowers in the U.S.

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Abstract

The floriculture industry faces many challenges including increasing energy and input prices, seasonality of its products and international competition. To analyze floriculture demand, we estimate and use simulation analysis to decompose it into market penetration and buying frequency. Understanding what are the factors that influence non-buyers of floral products to become buyers, and the factors that influence current buyers to increase their expenditures on floral products is vital information that the industry can use to design specific programs targeting different demographic groups according to their specific preferences for flowers.

Keywords: floriculture, consumer preferences, ornamentals, horticulture, environmental

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Introduction

Consumption behavior has always been of great importance and a topic of focus for researchers. The consumption of goods takes place because of the satisfaction that the goods or services provide (Johnson et al., 1984). The consumption of traditional agricultural food products depends on the characteristics of the product or attributes which can be measured or quantified. In contrast to traditional food products, many nonfood items are consumed because of their aesthetic value. Flowers are purchased for various reasons such as expression of love or friendship, a way to express thankfulness or appreciation, beautification purposes for self use or gifts. Most flowers attributes cannot be quantified directly; therefore the satisfaction gained from the consumption of these goods is closely related to the purpose of the purchase. 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 floral products is substantially higher compared to non-calendar occasions.
Demand for all products depends on the characteristics or attributes of the products. For most food products the prevailing characteristic is to satisfy nutritional needs and/or taste. Even though flowers do not satisfy any nutritional needs, they possess other important characteristics that influence the buying decision; and because flowers are not essential for survival a substantial portion of the population are non-buyers or infrequent buyers. Therefore there is a considerable gap for the decision of buying or not, and this decision is based upon the demographics and the buying occasions and periods. Understanding how consumers make choices whether to buy or not and the perceptions of the characteristics of the products are essential to understanding flower demand (Girapunthong, 2002).

Compared to the other food products such as milk, meat, citrus, etc., floriculture and nursery crops lack an extensive marketing literature. There are only a few studies in the literature with information on the demand side and consumer preferences for flowers. 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 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 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 special calendar occasions when the demand for flowers is substantially higher. The most common special calendar occasion dates are Mother’s Day and Valentine’s Day (Ward, 1997).

The main objective of this paper is to analyze the demand for flowers by decomposing the demand into two types of analysis for cut-flowers, potted flowering plants, dry/artificial and outdoor flowers. First, market penetration models were developed and then buying frequency was analyzed. This decomposition is one of the main contributions of this paper to the literature, and it will also aid managers in designing marketing programs to address either the entry of new buyers or to increase the number of transactions of current buyers. Because flowers are non-essential for survival, in a typical month the percentage of the population that buys flowers is less than five percent. From this fact arises the need to understand how consumers make the choice to purchase flowers or not and what are the factors that influence their purchasing decisions. After determining the factors that affect their purchase behavior, simulation analysis was used to develop specific programs to increase the entry of new consumers (market penetration). Once a person becomes a consumer of flowers, the remaining question is what motivates a buyer to increase their expenditures (the frequency of buying). Together these two models provide a basic understanding of the factors that influence the demand for flowers, and can help the industry make marketing decisions in an attempt to increase total flower consumption.

Even though fresh cut flowers, potted flowering plants, and dry-artificial flowers are fundamentally different and substitutable to some degree, there are certain similarities in their attributes if analyzed in terms of the purpose of use. They can be used to express love, thanks, reflect emotions, project beauty, and show environmental concerns. Consumer expenditure patterns may change among these products even though they are physically different. These consumer patterns are affected by many factors, including income, purpose of use, occasions, information, perceptions and sources of purchases. The level of consumer expenditures depends on three basic components: market penetration, frequency of transactions among buyers and prices. Demand analyses for floral products differ among other agricultural commodities because 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 flower; 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.

Methods

Consumer aggregate data for flower purchases from July 1992 to July 2004 was obtained from the American Floral Endowment (AFE) and Ipsos-NPD group. Data were based in a consumer panel of 15,300 households who reported their purchases of floral products in the US. Data include consumers in 48 states and Washington D.C. with 612,000 aggregate transactions. The data set is organized by total number of households, expenditures, transactions and buyers. Market penetration and buyer frequency models are developed in order to separate the total demand effect for flowers in the U.S. into market penetration effect and buyer frequency effect. Because both models, market penetration and buyer frequency, have a cluster of observations on the lower limit, a model was selected that takes into account its asymptotic distribution. The market penetration model has a lower limit at zero, while the buyer frequency has a lower limit of one, since in order to be defined as a buyer a household must have made by definition at least one transaction per month or more. The model that deals with this type of clustering of the data is the Tobit model (Greene 2000).

The dependent variables for each model were penetration and frequency respectively. Market penetration was defined as the number of buyers divided by the number of households (equation 1). This would result in a market penetration index between the values of zero and one, where zero means that there are no buyers at all, while a value above zero means that some households with a defined group were buyers.

$$(1) \qquad P_i = \frac{B_i}{HH_i}, \qquad 0 \le P_i \le 1,$$

where P_i , B_i , and HH_i are penetration, households making purchases (buyers) and total number of households for the *ith* product form.

Frequency is derived by dividing transactions by buyers (equation 2).

$$(2) \qquad F_i = \left(\frac{T_i}{B_i}\right),$$

where F_i , T_i , and B_i are frequency, total transactions and households with purchases (buyers) for the *ith* product form. By definition a person who is a buyer had at least one transaction or more in a given period, or else that person would not be defined as a buyer. Since F_i is censored at 1, an often-used option for an estimation purpose is to adjust the censored variable so that the lower limit is zero. That adjustment simply entails subtracting the lower level from the original censored value of one.
In order to account for this truncation on the data set, Tobin developed a model specified as follows:

$$(3) \qquad y_i^* = x_i'\beta + \varepsilon_i,$$

where x_i' is a (1 × K) vector of explanatory variables and $\varepsilon_i \sim N(0,\sigma^2)$ and it is independent of other errors. The problem arises because in order for a household to be a buyer, it has to have at least one transaction during a given period. Adjusting the subtracted one from the frequency variable to have the lower limit equal zero. In the penetration model a large number of the observations take the value of the lower limit, zero. Thus for any household the penetration and frequency models would take the form:

$$(4) \qquad \begin{aligned} y_i &= y_i^* && \text{if } y_i^* > 0 \\ y_i &= 0 && \text{if } y_i^* \le 0. \end{aligned}$$

From the total number of observations T in the sample, the number of observations can be divided into two groups; one for which $y_i = 0$, T_0; and another for the number of observations for which $y_i > 0$, T_1 (Greene 2000).

The independent variables for both penetration and frequency models were discrete variables created for income, gender, purpose, age, seasonal monthly, and region dummies. If the common method of creating dummy variables described by Greene (2000) is used, then the base level for all the coefficients of the dummy variables will be the category left out of the equations in order the avoid the dummy variable trap. A different approach consists of restricting the sum of the coefficient of the dummy variables to zero. In this case, the base of the dummies would be the mean of all the categories, and any parameter estimate would be compared relative to the average variable.

The price per transaction is calculated from the data set by dividing total expenditures by the number of transactions (equation 3).

$$(5) \qquad P_i = \frac{E_i}{T_i},$$

where P_i , E_i , and T_i are price per transaction, total expenditures and total transactions for the ith product form.

The penetration model is defined as:

$$P_i^* = \delta_{0(i)} + \sum_{k=2}^{4} \delta_{k(i)}\left(I_{k(i)} - I_{1(i)}\right) + \delta_{6(i)}\left(G_{2(i)} - G_{1(i)}\right) +$$
$$\delta_{8(i)}\left(PP_{2(i)} - PP_{1(i)}\right) + \sum_{k=2}^{4} \delta_{8+k(i)}\left(A_{k(i)} - A_{1(i)}\right) +$$
$$\sum_{k=2}^{12} \delta_{12+k(i)}\left(M_{k(i)} - M_{1(i)}\right) + \sum_{k=2}^{9} \delta_{25+k(i)}\left(R_{k(i)} - R_{1(i)}\right) +$$
$$u_i$$

And the frequency model is defined as:

$$F_i^* = \delta_{0(i)} + \sum_{k=2}^{4} \delta_{k(i)}\left(I_{k(i)} - I_{1(i)}\right) + \delta_{6(i)}\left(G_{2(i)} - G_{1(i)}\right) +$$
$$\delta_{8(i)}\left(PP_{2(i)} - PP_{1(i)}\right) + \sum_{k=2}^{4} \delta_{8+k(i)}\left(A_{k(i)} - A_{1(i)}\right) +$$
$$\sum_{k=2}^{12} \delta_{12+k(i)}\left(M_{k(i)} - M_{1(i)}\right) + \sum_{k=2}^{9} \delta_{25+k(i)}\left(R_{k(i)} - R_{1(i)}\right) +$$
$$\beta_{1(i)}P + \beta_{2(i)}IMR + \beta_{3(i)}GXP + \beta_{4(i)}PPXP + u_i$$

The variables and their summary statistics are defined in the Appendix as Tables 1 and 2.

Results and Discussion

The parameters were estimated using TSP version 4.5 (Hall 1992). The results for both demand models yielded similar results. If the common method of creating dummy variables is used, then the base level for all the coefficients of the dummy variables will be the category left out of the equations in order the escape the dummy variable trap. A different approach consists of restricting the sum of the coefficient of the dummy variables to zero. In this case, the base of the dummies would be the mean of all the categories (Wirth 2007; Suits 1984; Greene and Seaks 1991). For example, let β_{ki} be the parameter estimate for income, then if the restriction $\sum_{k=1}^{4} \beta_{ki} = 0$ is imposed, then $\beta_{1i} = -\sum_{k=2}^{4} \beta_{ki}$ is obtained and then the dummy variable $di_k = i_k - i_1$

will be created, where $k \neq 1$. More generally we would impose the restriction as follows:

(6) $\sum_{k=1}^{K} \beta_{ki} = 0$, to obtain $\beta_{1i} = -\sum_{k=2}^{K} \beta_{ki}$,

In order to create the dummy variables the following operation follows:

$$(7) \qquad dummy_k = category_k - category_1 \text{ , where } k \neq 1 .$$

The results for flower types and regions differed considerably. Their interpretation is quite simple, as all of the variables except price are dummy variables and hence represent deviations from its means. For example, if the parameter estimate for the month of February is positive and significant, it means that the month of February is statistically higher than the average of the twelve-month cycle. Alternatively if income group 2 was negative, it means that income group is lower that the average of all income groups. Most of the parameter estimates in both models were significant at the 95 % confidence level.

In general it was found that the demand for flowers, both market penetration and buyer frequency, depends on demographic characteristics, purpose of the purchase and seasonality factors. The results vary depending on the flower types and regions. For example, for most cut-flowers, it was found that market penetration and buyer frequency increased with females purchases for the purpose of self-use and with the higher age categories. In general, for seasonality effects, each month was compared to an average over the twelve-month period. The results were in agreement with the findings of Miller (1983) and indicated that household demand, in our case, decisions to purchase flowers (market penetration) and the number of transactions on a given period (buyer frequency) was highly impacted by calendar occasions. The only continuous variable was price on the buyer frequency model and it was negative. This is in accordance with economic theory for normal goods (Nicholson 1998). The rest of the parameter estimates were obtained from dummy variables and can be interpreted easily as deviations from its means. The complete set of results can be found in the Appendix (Tables 3 and 4).

Simulation Analysis

The simulation analysis is an essential part of this research project. Each simulation procedure measured demand changes by adjusting one or more variables relative to the mean value of the rest of the variables in the demand model. The first step in the simulation analysis was to calculate the market penetration and buyer frequency values for the average household consumer. Then, both market penetration and buyer frequency were calculated with changes in one variable only with the rest of the variables kept constant at the average consumer level. After obtaining the values for market penetration and buyer frequency, the proportion of the total number of transactions attributed to frequency of buying versus the increment in the number of buyers (market penetration) was calculated. This was accomplished by multiplying the market penetration value by the total number of households to obtain the total number of buyers (B); Then, the total number of buyers and the frequency of transaction (F) were obtained for the average household and for changes within a specific variable, and the proportion of the variable attributed to buyer frequency versus market penetration was calculated. For example, for age, the highest and lowest number of transactions were selected, in order to capture the whole variation effect from the age variable. This would be referred to as the range of transactions. The range represents total variation in transactions from the variable means, and it could have a negative or a positive impact. The range would differ from variable to variable, depending on the relative

negative or positive impact of that variable in the total number of transactions. Some variables may have a large negative range, while other may only have a small negative range. In general the larger the negative impact, then the highest potential to reduce it and increase the number of transactions. Managers should concentrate on marketing programs that address the negative component of each variable. For example, if the younger age group had a large negative range, it means that young age group should be targeted in promotional and advertising campaigns.
The proportion of the variable changes in total number of transactions corresponding to frequency of buying for cut-flowers, plants, dry/artificial, and outdoor are low, varying from one flower type to the other. In other words, the increase in the number of transactions is due in a larger proportion to an increase in the number of buyers (market penetration). The number of transactions for all flower types was most affected by attracting new buyers into the market. Even though these results seem to differ from the findings of Ward (2004), who found that 87 percent of the increase in the number of transactions were due to increase in the frequency of purchase, this is because Ward was evaluating the impact of the FPO promotional campaign; and the main objective of that campaign was to increase the number of transactions of females in the older age groups and higher income levels.

The results clearly show that the demand for flowers is driven in part by demographics, seasonal occasions, purpose, price and geographical differences based on regions in the U.S. Furthermore, the demand response is from both changes in the level of market penetration and frequency of buying with penetration being the major component in the demand equation. Important differences in the demand drivers were observed across the four flower types, (i.e., cut-flowers, flowering plants and greens, dry/artificial flowers, and outdoor flowers). Also, the drivers influenced both market penetration and frequency of buying with the level of importance quite different across the drivers within each flower type.

Demand for flowers in all forms is a direct reflection of consumer preferences and differences in preferences across the population. Measuring demand's two components, as proposed in this study, is essential to understanding and influencing the longer-term growth and opportunities for marketing flowers in the U.S. Unlike many other countries, the percentage of U.S. households buying flowers within a month is quite low and differs by flower type. The results provide clear insights into these differences across flower types and the demand drivers. For each sector, the obvious goal would be to move the average number of total transactions to higher levels.
Much of that could probably be accomplished by addressing the factors to generate transaction levels below the means, or a negative impact in the range of transactions (Figure 1). For fresh cut-flowers age and seasonality are the two demand drivers having the greatest potential negative impacts with the values below the average level of transactions being nearly equal between these two variables. Then purpose, regional differences and gender produce similar relative effects on the number of total transactions. Furthermore, for each of these variables most of the changes above or below the average level are attributed to buyer penetration. These results point to marketing programs to address the age effect and seasonality negative effects to have probably the most potential to move the average transaction levels even higher. Some of these programs may include some sort of promotion or advertising targeting these specific demographic group interests with particular advertising and promotion efforts that seek to attract younger age groups to become buyers of flowers and also to promote consumption of floral products during non-calendar occasions (seasonality). While the regions, purpose (i.e., gift versus self) and gender

have slightly lower negative impacts, these three are likely easy to target. Recent programs developed by the Flower Promotion Organization, a relative new generic promotion program, currently target females to buy flowers for self-use and promotions are targeted to specific regions (Ward 2004). The regional differences shown in the Tobit models provide guidance to better regional targeting to the extent that there is flexibility in the regional selection. Finally, targeting income groups appears to have considerably less potential relative to the other demand drivers for fresh cut-flowers.

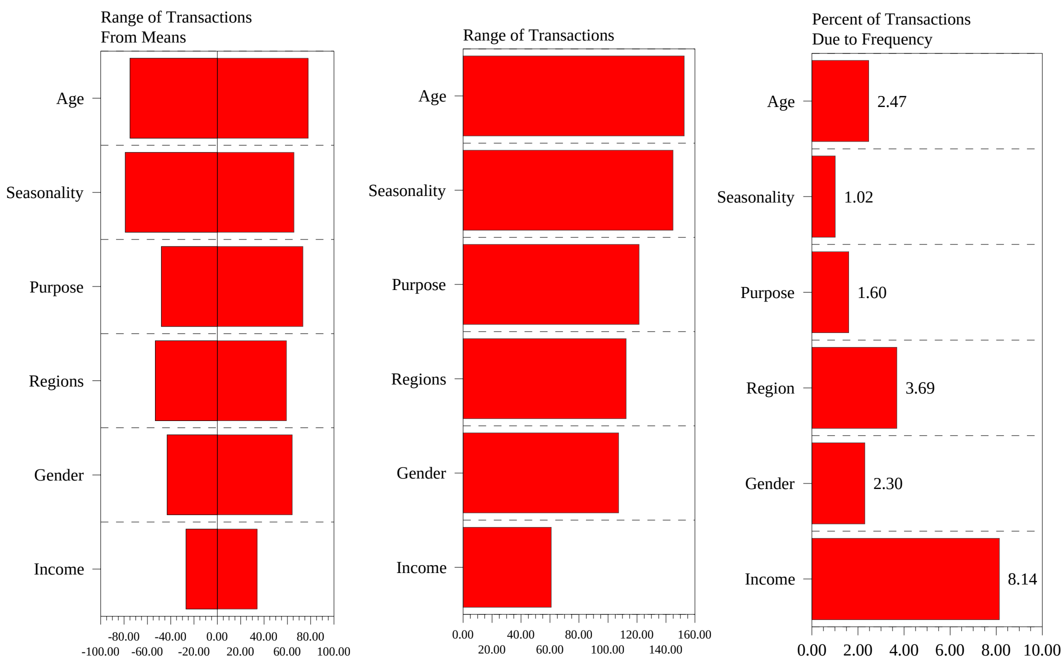

Figure 1. Ranges and percentages of variable changes affecting transactions due to frequency of buying for cut-flowers.

For flowering plants and greens, age and gender have the largest negative effects (Figure 2). Hence, programs designed to target age and gender have considerable potential whereas efforts to address seasonal and regional differences, as well as income and purpose, have far less potential to moving the transaction levels for flowering plants. Interestingly, the role of purpose is extremely small, causing very little variation in transactions below the mean. Clearly, targeting those age groups and gender that contribute to the negative side of the transaction equation is suggested with the estimates.

For dry and artificial flowers, age and gender are the two most important targets since some age groups and gender create most of the transactions below the mean levels (Figure 3). Among all four-flower types, gender is most important in relative terms for the dry/artificial flower group. Negative effects from regional differences, seasonality, income and purpose are very small and most likely have limited payoff in producing larger gains in the number of transactions for the dry and artificial flower group.

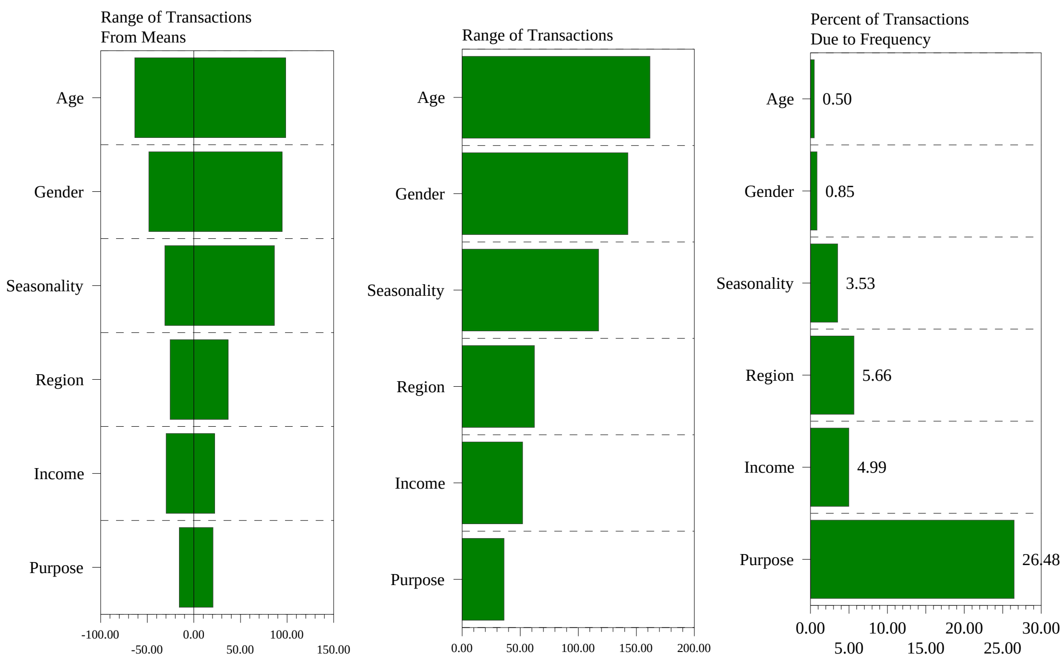

Figure 2. Ranges and percentages of variable changes affecting transactions due to frequency of buying for plants.

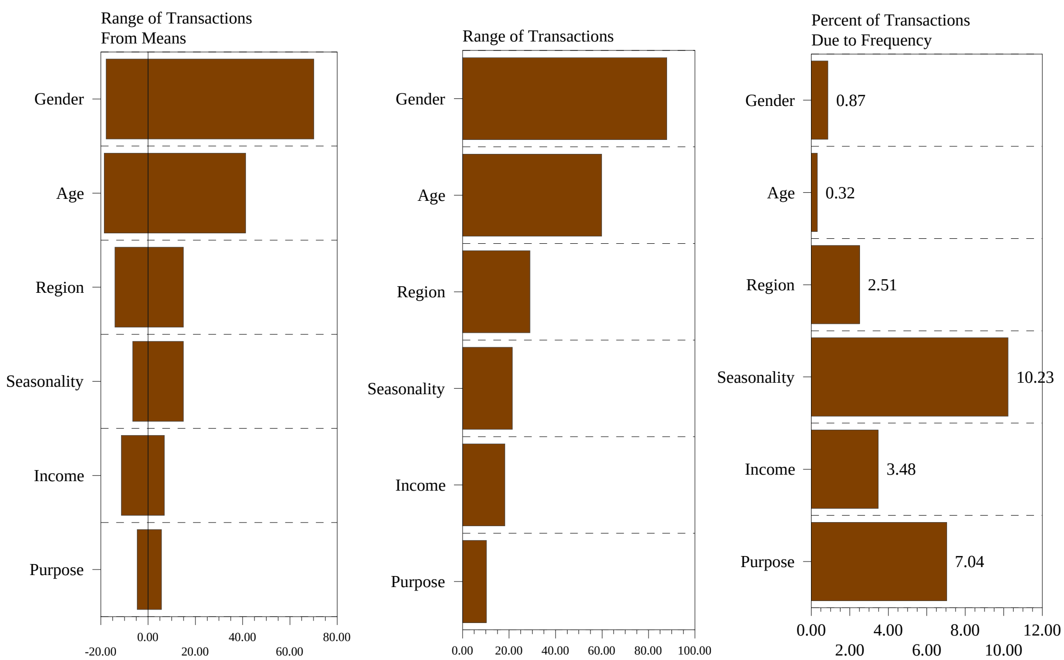

Figure 3. Ranges and percentages of variable changes affecting transactions due to frequency of buying for dry/artificial.

Finally, the outdoor flowers show a profoundly different response level with most of the variation in the transactions being attributed to seasonality. This obviously reflects much of the spring planting season with outdoor flowers. Beyond seasonal differences, age, gender and purpose on the negative side of the equation (i.e., producing values below the average) were reasonably small in relative terms (Figure 4). Addressing seasonal patterns is likely the most difficult thing to change since the season demand is closely tied to weather, fixed holidays and seasonal celebrations. Also, the importance of frequency of buying is slightly greater for the outdoor market than for the other flower types. There is probably more substitutability among cut-flowers, plants and dry/artificial flowers compared with the outdoor flowers.

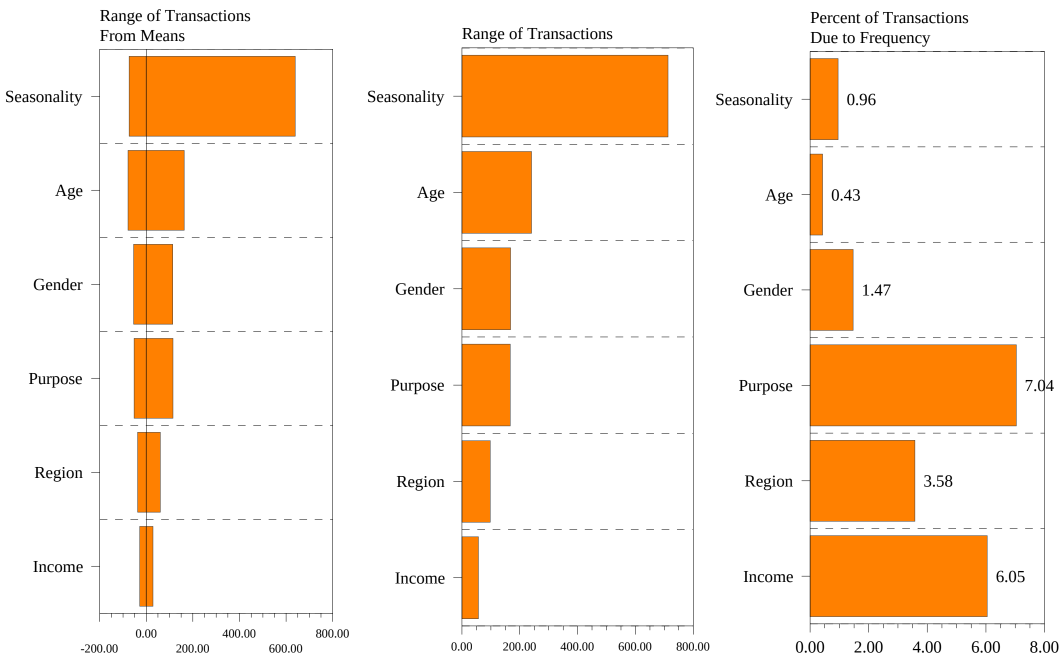

Figure 4. Ranges and percentages of variable changes affecting transactions due to frequency of buying for outdoor.

Summary and Conclusions

One of the most important overall objectives of this research project was to separate the demand drivers for flowers into the market penetration component from that of the frequency of buying. Most transactions for all flowers took place because of the entry of new buyers rather than repeat buying customers (frequency); however, when analyzing each variable individually, this percentage differed across flower types. Figure 5 presents a summary of the percentage of the number of transactions that is due to frequency of buying for all flower types. The extreme importance of market penetration versus frequency of buying has considerable implications. New buyers may need additional information and are potentially influenced by the first impression, whether the facilities or quality of the flowers. Buying habits may not be as well established in terms of the types of flowers and what is communicated with different types. Hence, having in-store information to guide potential buyers is more important than with products where the consumer is a frequent repeat buyer. For outdoor flowers, informational needs are even more challenging for the new buyer. Store layout, resource materials, and personal assistance are likely more important with the demand gains coming mostly from market penetration versus the frequency of buying.

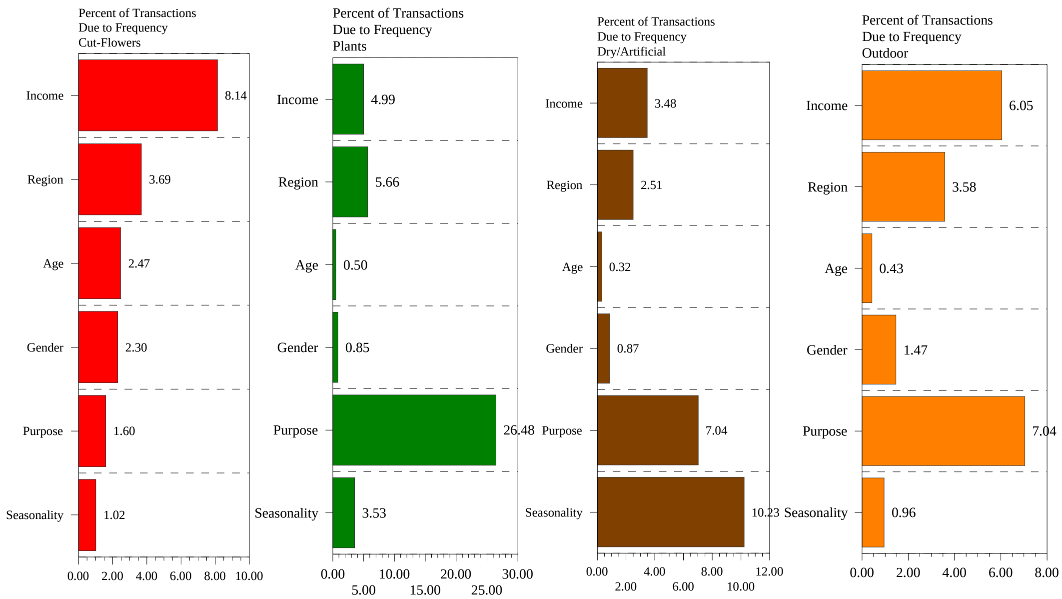

Figure 5. Percentage of transactions due to frequency of buying for all flower types.

While the goals likely differ among the four flower types, there are several generalities that have potential for all four. The demand for each flower type was closely tied to the age of the buyer with the transactions increasing with the age of the buyer. Hence, promotional efforts to target the younger market in all flower types should have potential positive benefits in all four groups. For the other classifications, programs targeting specific household attributes should more likely be tailored to the type of flowers (e.g., cut, plant, dry or outdoor) being marketed as described previously.

References

Becker, W.A. 1993. Products, Services, and Consumer Perceptions of Service Quality in the Retail Floral Industry of Texas. Ph.D diss., Texas A&M University, College Station, Texas.

Behe, B.K. 1989. Floral Purchase Behavior of Pennsylvanians. Ph.D diss., Pennsylvania State University, University Park, Pennsylvania.

Behe, B.K., T.A. Prince, and H.K. Tayama. 1992a. Analysis of Consumer Purchases of Floral Products in Supermarkets. *Hortscience* 27:455-459.

Behe, B.K., T.A. Prince, and H.K. Tayama. 1992b. Market Segmentation of Supermarket Floral Customers. *Hortscience* 27:455-459.

Girapunthong, N. 2002. Demand Drivers for Fresh Cut Flowers and Their Substitutes: An Application of Household Expenditure Allocation Models. Ph.D diss., University of Florida, Gainesville, Florida

Greene, W.H. 2000. *Econometric Analysis*. 4th Edition. Prentice Hall. Upper Saddle River, New Jersey.

Greene, W., and T. Seaks. 1991. The Restricted Least Squares Estimator: A Pedagogical Note. *Review of Economics and Statistics* 73: 563-567.

Hall, B.H. 1992. *Time Series Processor Version 4.2*. Reference Manual. Palo Alto, California.

Ipsos-NPD Group. 2004. National Panel Diary Group, Inc. Chicago, Illinois.

Johnson, S.R., Z.A. Hassan., and R.D. Green. 1984. *Demand Systems Estimation*. Iowa State University Press. Ames, Iowa.

Miller, M. 1983. Commodity Sub-Sector Analysis of Cut Flower Industry. Ph.D diss., University of Florida, Gainesville, Florida.

Nicholson, W. 1998. *Microeconomic Theory: Basic Principles and Extensions*. Dryden Press. Fort Worth, Texas.

Rimal, A.P. 1998. Effect of Generic and Brand Promotions of Fresh Cut Flowers on the Use of Retail Flower Outlets. Ph.D diss., University of Florida, Gainesville, Florida.

Suits, D. 1984. Dummy Variables: Mechanics vs. Interpretation. *Review of Economics and Statistics* 66:177-180.

Tilburg, A.V. 1984. *Consumer Choice of Cut Flowers and Pot Plants*. Agricultural University. Wageningen, The Netherlands.

Ward, R.W. 1997. Evaluating Promoflor: Have the Promotions of Fresh Cut Flowers and Greens Had an Impact. *National Promoflor Council. UF/PER97#2.* University of Florida, Gainesville, Florida.

Ward, R.W. 2004. Estimated the Impact of FPO's Generic Promotions of Fresh Cut Flowers: Analysis Through Phase VI. *Research Paper Food and Resource Economics.* University of Florida, Gainesville, Florida.

Wirth, F., L. Love, and M.A. Palma. 2007. Purchasing Shrimp for At-Home Consumption: The Relative Importance of Credence Versus Physical Product Features. *Aquaculture Economics and Management* 11: 17-37.

Yue, C. and B.K. Behe. 2008. Estimating U.S. Consumer's Choice of Floral Retail Outlets. *Hortscience* 43:764-769.

Appendix 1

Table 1. Variables for the market penetration and buying frequency models

Purpose	PP = (self = 0) and (gift = 1)
Gender	G = (male = 0) and (female = 1)
Income	I2 = ($25,000 - $49,999 = 1) or (otherwise = 0)
	I3 = ($50,000 - $74,999 = 1) or (otherwise = 0)
	I4 = ($75,000 or more = 1) or (otherwise = 0)
Age	A2 = (25 - 39 = 1) or (otherwise = 0)
	A3 = (40 - 54 = 1) or (otherwise = 0)
	A4 = (55 or more = 1) or (otherwise = 0)
Seasonability	M2 = (February = 1) or (otherwise = 0)
	M3 = (March = 1) or (otherwise = 0)
	M4 = (April = 1) or (otherwise = 0)
	M5 = (May = 1) or (otherwise = 0)
	M6 = (June = 1) or (otherwise = 0)
	M7 = (July = 1) or (otherwise = 0)
	M8 = (August = 1) or (otherwise = 0)
	M9 = (September = 1) or (otherwise = 0)
	M10 = (October = 1) or (otherwise = 0)
	M11 = (November = 1) or (otherwise = 0)
	M12 = (December = 1) or (otherwise = 0)
Region	R2 = (Middle Atlantic = 1) or (otherwise = 0)
	R3 = (East North Central = 1) or (otherwise = 0)
	R4 = (West North Central = 1) or (otherwise = 0)
	R5 = (South Atlantic = 1) or (otherwise = 0)
	R6 = (East South Central = 1) or (otherwise = 0)
	R7 = (West South Central = 1) or (otherwise = 0)
	R8 = (Mountain = 1) or (otherwise = 0)
	R9 = (Pacific = 1) or (otherwise = 0)
Price P	
Mills	IMR – Inverse Mills Ratio of the Probability of Becoming a Buyer, calculated using a Probit Model
Gender x PRT	GXP – Interaction Variable Gender X Price

Appendix 2

Table 2. Summary statistics for all variables and all flower types combined

Category	Variable Name	Description	Mean	Std Dev
Purpose	PP	Gift	0.4593	0.4983
Gender G		Female	0.5407	0.4983
Income	I1	< $25,000	0.2619	0.4397
I	2	$25,000-$49,999	0.2830	0.4505
	I3	$50,000-$74,999	0.2315	0.4218
I	4	$75,000 +	0.2235	0.4166
Age	A1	<25	0.1293	0.3355
A	2	25-39	0.2688	0.4434
	A3	40-54	0.2989	0.4578
A	4	55 +	0.3030	0.4595
Month	M1	January	0.0733	0.2606
M2		February	0.0866	0.2813
	M3	March	0.0868	0.2815
M4		April	0.0958	0.2943
	M5	May	0.1013	0.3017
M6		June	0.0865	0.2810
	M7	July	0.0790	0.2697
M8		August	0.0761	0.2651
	M9	September	0.0784	0.2689
M1	0	October	0.0810	0.2729
	M11	November	0.0762	0.2654
M12		December	0.0790	0.2697
Region	R1	New England	0.1405	0.3475
R2		Mid Atlantic	0.0824	0.2750
	R3	East North Central	0.1123	0.3158
R4		West North Central	0.1103	0.3133
	R5	South Atlantic	0.0820	0.2744
	R6	East South Central	0.1128	0.3163
	R7	West South Central	0.0751	0.2636
R8		Mountain	0.0950	0.2932
	R9	Pacific	0.0785	0.2689
Price P		Price	13.5013	14.0586

Appendix 3

Table 3. Market penetration model results

Category	Variable Name	Description	Cut-flowers		Plants		Dry		Outdoor	
			Beta	*T-value*	*Beta*	*T-value*	*Beta*	*T-value*	*Beta*	*T-value*
	C		-0.0007	-52.3112	-0.0011	-76.8696	-0.0022	-115.6828	-0.0038	-120.9518
Purpose	PP	Gift	0.0011	102.9237	-0.0003	-25.1376	-0.0002	-20.4351	-0.0019	-84.9935
Gender G	2	Female	0.0009	86.0835	0.0014	125.2033	0.0015	114.4173	0.0022	99.2070
Income	I2	$25,000-$49,999	0.0003	18.6526	0.0004	19.5252	0.0003	15.8162	0.0007	18.6633
I	3	$50,000-$74,999	-0.0005	-29.6864	-0.0008	-38.8804	-0.0007	-36.6055	-0.0010	-25.9222
	I4	$75,000 +	0.0005	28.0709	0.0004	21.6003	0.0001	6.0903	0.0007	18.3733
Age A	2	25-39	0.0002	13.7908	0.0001	7.9370	0.0001	4.3646	0.0002	6.0113
	A3	40-54	0.0008	45.9536	0.0007	37.9315	0.0005	28.6399	0.0015	42.8205
A	4	55 +	0.0010	56.0033	0.0015	84.6699	0.0012	70.0850	0.0030	84.8853
Month	M2	February	0.0009	29.3479	0.0000	-0.0506	0.0001	3.3859	-0.0014	-18.8813
M	3	March	0.0004	10.7160	0.0002	6.3438	0.0003	8.1818	0.0007	10.9955
	M4	April	0.0004	10.7361	0.0010	30.6956	0.0002	5.6269	0.0036	58.8141
M	5	May	0.0008	24.8736	0.0012	36.1014	0.0005	14.8107	0.0062	104.3894
	M6	June	-0.0002	-6.5393	-0.0002	-6.6311	-0.0003	-8.2608	0.0026	41.3037
M	7	July	-0.0003	-9.2678	-0.0006	-17.3406	-0.0003	-9.9504	-0.0001	-1.1828
	M8	August	-0.0003	-8.3059	-0.0008	-20.5723	-0.0003	-8.2480	-0.0012	-16.3510
M	9	September -0	.0003	-9.8279	-0.0007	-18.0200	-0.0001	-3.3137	-0.0003	-3.5717
	M10	October	-0.0002	-5.2949	-0.0006	-15.6467	0.0000	-0.5259	-0.0006	-8.2480
	M11 N	ovember	-0.0003	-7.6487	-0.0003	-7.8065 0	.0001	2.8372	-0.0027	-32.8293
	M12	December	-0.0005	-14.6275	0.0013	40.2844	0.0001	3.2050	-0.0036	-41.2331
Region R2		Mid Atlantic	0.0005	15.2437	-0.0002	-6.0979	-0.0012	-31.2740	-0.0006	-9.4757
	R3	East North Central	0.0007	25.6229	0.0002	7.4795	-0.0001	-3.0994	0.0002	3.9665
R4		West North Central	0.0004	12.3367	0.0003	9.4144	0.0003	10.0981	0.0003	4.3330
	R5	South Atlantic	-0.0006	-17.5750	-0.0005	-15.4916	0.0000	-0.4940	-0.0009	-13.3050
	R6	East South Central	0.0002	7.7168	0.0003	10.7089	0.0004	12.9990	0.0011	18.1417
	R7	West South Central	-0.0013	-37.0119	-0.0007	-20.6050	0.0001	4.7204	-0.0011	-16.2393
R8		Mountain -0	.0004	-13.4968	-0.0002	-6.4145	0.0000	1.5941	-0.0004	-5.8071
	R9	Pacific	-0.0006	-19.2774	-0.0006	-17.3769	-0.0008	-23.3985	-0.0016	-22.1806
S	igma		0.0026	269.3091	0.0026	258.0288	0.0021	188.0584	0.0048	249.8967

Appendix 4

Table 4. Frequency of buying results

Category	Variable Name	Description	Cut-flowers		Plants		Dry		Outdoor	
			Beta	*T-value*	*Beta*	*T-value*	*Beta*	*T-value*	*Beta*	*T-value*
	C		-0.4969	-10.3032	-0.8461	-14.5258	-1.5248	-6.1599	-0.1197	-1.6551
Purpose	PP	Gift	-0.0674	-4.0430	-0.3138	-27.6656	-0.0621	-2.7835	-0.5539	-30.8803
Gender G	2	Female	0.1335	9.1006	0.2632	12.8957	1.0034	11.3425	0.2686	13.6566
Income	I2	$25,000-$49,999	-0.0049	-0.3982	0.0628	4.3289	0.1497	4.4845	0.0034	0.1926
I3		$50,000-$74,999	-0.0441	-3.6628	-0.1251	-8.4163	-0.3005	-7.2216	-0.0166	-0.9369
	I4	$75,000 +	0.1253	11.3766	0.0822	5.9498	0.0266	0.8880	0.1014	5.8005
Age A	2	25-39	-0.0429	-3.5423	0.0843	5.8475	0.2203	7.2472	0.1772	9.6118
	A3	40-54	0.2247	14.7371	0.2235	12.4431	0.2961	6.6943	0.2052	9.1415
A	4	55 +	0.3276	21.9142	0.2144	10.4883	0.3233	5.3088	0.1290	4.9904
Month	M2	February	0.0980	4.7494	-0.0140	-0.5638	0.0811	1.6419	-0.2101	-5.4304
M	3	March	0.0411	2.0070	0.1206	5.0352	0.2589	5.3248	0.2377	7.5798
	M4	April	0.0533	2.6056	0.2582	10.6746	0.1893	3.8931	0.6245	17.3198
M	5	May	0.1664	8.1822	0.3360	13.6652	0.4232	8.6589	0.9306	21.8288
	M6	June	0.0216	1.0069	-0.0419	-1.6323	-0.2716	-4.9119	0.5625	17.2824
M	7	July	-0.0390	-1.7880	-0.1456	-5.1976	-0.1643	-2.9610	0.0208	0.6413
	M8	August	0.0059	0.2732	-0.1648	-5.7083	0.0387	0.7106	-0.1646	-4.5228
M	9	September	-0.0421	-1.9114	-0.1657	-5.9417	-0.0871	-1.6874	-0.1292	-3.9033
	M10	October	-0.0822	-3.8307	-0.1113	-4.0932	-0.0524	-1.0457	-0.1133	-3.3277
M	11	November	-0.1021	-4.6436	-0.1651	-6.2678	-0.0842	-1.6859	-0.4327	-9.1418
	M12	December	-0.0225	-0.9716	0.2452	10.1382	-0.1910	-3.7843	-0.8675	-14.5413
Region R2		Mid Atlantic	-0.0145	-0.6413	-0.2358	-7.6445	-0.6873	-6.0833	-0.0659	-1.7498
	R3	East North Central	0.1604	7.6671	0.1077	4.7708	-0.0320	-0.6788	-0.1473	-5.0375
	R4	West North Central	0.0739	3.6175	0.1384	6.0367	0.1462	2.8940	-0.0268	-0.9184
	R5	South Atlantic	-0.3027	-11.7934	-0.3052	-10.1533	-0.2860	-5.2314	0.0267	0.7247
	R6	East South Central	0.1266	6.3317	0.1142	4.9973	0.1610	3.0354	0.0631	2.1514
	R7	West South Central	-0.3272	-9.1399	-0.2122	-6.2438	0.1189	2.1508	-0.1429	-3.6855
R8		Mountain	-0.0050	-0.2340	-0.0243	-0.9889	0.0318	0.6729	-0.0306	-0.9868
	R9	Pacific	-0.3078	-10.1270	-0.2702	-8.2696	-0.4877	-5.5829	-0.1000	-2.5368
Price P		Price	-0.0121	-13.5142	-0.0139	-17.7185	-0.0391	-22.8771	-0.0221	-22.4493
IMR	IMR	Inverse Mills Ratio	0.2579	5.0657	0.3592	6.4711	0.7329	4.7177	0.1049	1.7253
Interaction	GXP	Gender x Price	0.0013	2.8169	-0.0014	-1.9389	-0.0057	-3.3711	-0.0075	-7.9813
	PPXP	Purpose x Price	0.0059	6.6979	0.0015	1.9570	-0.0072	-5.2307	-0.0003	-0.2661
Si	gma 1		.1256	172.4753	1.2359	158.6380	1.9869	135.5962	1.5970	186.0218

