Household Demand for Ornamental Plants

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Introduction

The article examines consumers' price sensitivity of demands for ornamental plants by estimating a system of demand equations for 16 plants at the individual consumer level. The extent to which demand would response to price changes is an important economic question for retailers who formulate pricing strategy. The decision to increase or decrease the price of one plant is important in optimizing retailer profit and should depend on both the own price elasticity and the substitutability of other plants for the plant in consideration. In order to answer to those questions, we collected stated preference data through a nationwide internet survey. Two-stage demand system approach proposed by Hausman and Leonard (2002) is employed in order to estimate a large system of demand equations for 16 annual, perennial and foliage plants. In estimation, a correction is made for censored data problem resulting from the use of household data with zero purchases.

There are many studies in the literature with information on consumer preferences for nursery and floriculture products. Earlier studies focused on identifying floriculture consumers by clustering consumers according to their characteristics and propensities of consumption. Behe, Prince, and Tayama (1992a) segmented supermarket floral consumers on the basis of demographic characteristics and floral-purchase factors that include their attitudes toward floral products, types of products purchased, and the uses of floral-product purchases. Behe, Prince, and Tayama (1992b) identified principal factors that affect the consumer's floral purchase decision in supermarkets, which include product, store, occasion, use of location, and psychographic characteristics. Palma, Hall and Collart (2010) investigated plant-specific and socio-demographic factors affecting the frequency of purchase for ornamental plants. They found that the major factors impacting the frequency of buying were the purpose of the purchase (i.e., self use vs. gifts) and seasonality. As the outlets of floriculture and nursery products are diversified and the competition arises among the retailers, consumers' preference toward different types of retail outlets became an interest of researchers'. Yue and Behe (2008) evaluated consumers' choice of different floral retail outlets among box stores, traditional freestanding floral outlets, general retailer, other stores, and direct-to-consumer channels. They found that consumers patronizing traditional freestanding floral outlets or direct-to-consumer channels were more likely to buy arranged flowers than unarranged flowers. The authors also found that the consumers who purchased foliage plants and outdoor bedding or garden plants were more likely to buy them from box stores.

It is notable from the literature that, while these studies provide valuable information on consumer preferences for floricultural products, they do not take into account the influence of product prices on demand behavior. To the best of our knowledge, there are only three studies that evaluate the relationship between price and quantity demanded by estimating demand functions derived from consumers' utility maximization problems under budget constraints. Abdelmagid, Wohlgenant, and Safley (1996) estimated demand for selected nursery plants sold in North Carolina employing a modified Almost Ideal Demand System (AIDS) model. Girapunthong and Ward (2003) examined the demand for fresh-cut flowers, dry/artificial flowers and potted flowers employing an AIDS model. Steen (2006) estimated the demand for cut flowers using an inverse AIDS model and data from Dutch flower auctions. However, these studies provide a limited treatment of demand analysis as they incorporate only a fraction of the floriculture and nursery market by using regional data or including only specific type of products in the analysis.

The present study contributes to the literature in the following ways. First, while the previous studies focus only on a few floral products, we provide analysis for a more complete set of floricultural products by estimating a large system of demand equations that include five annual plants, five perennial plants, and six foliage plants. By including foliage plants in our model, we examine various substitution patterns among floral and foliage products. Secondly, we provide more robust analysis that is based on the behavior of general population. While previous analyses focus on specific regional markets or certain groups of people who participate often in the floricultural market, our analysis is based on the data collected from a nationwide survey. In addition, we consider unobserved heterogeneity of individual consumers in our model by utilizing the panel structure of the data. This method reduces the potential for bias in price and expenditure elasticities (Meyerhoefer, Ranney and Sahn, 2005).

Methodology

Hypothetical valuations

The most common hypothetical valuation methods in the agricultural economics literature are contingent valuation (CV), in which subjects indicate their willingness to pay (WTP) for the given products (e.g., Buzby et al., 1998; Lusk and Schroeder 2004; Maynard et al., 2003), and repeated discrete choice experiments (DCE), where subjects simply choose a preferred product in each scenario that is a combination of attributes (e.g., Louviere et al., 2008; Hanemann 1994, 1984). However, the CV method is criticized for not accounting for diminishing marginal utility. Utility theory suggests that WTP for the first unit exceeds average WTP per purchase, but CV cannot capture this since WTP is elicited for a single unit or fixed unit (Maynard et al., 2004). Repeated DCE is also criticized for subject fatigue as the number of attributes in the choice scenario increases (Arentze et al., 2003) and discreteness of choice in which participants purchase at most one unit of one product. Hypothetical open-ended choice experiments (OECE), that is developed by Gabor, Granger, and Sowter (1970) and applied in non-hypothetical settings by Maynard et al. (2004) and Corrigan et al. (2009), incorporates the advantages of CV and repeated DCE. By allowing participants name the quantities of products demanded at each of price combinations instead of reservation price, OECE provides respondents more familiar retail environment that they experience during everyday shopping trips. In addition, by collecting count data instead of binary data as in DCE, OECE provides the researcher a richer dataset (Corrigan et al., 2009) that can be used to estimate a large system of demand equations.

Internet Survey with open-ended choice experiment

A nationwide internet survey was conducted in the spring of 2012 through Global Market Insite (GMI) that provides Internet survey services. The online questionnaire was designed based on the recommendations by Dillman et al. (2009). In the beginning of the survey, a brief explanation about the types of plants of which this survey concerns, herbaceous annual, herbaceous perennial and foliage plants, was given. We included five annual plants, five perennial plants, six foliage plants in the survey. We first asked the respondents to indicate the approximate amount they were planning to spend on plant purchases for the next 12 months, and then we asked how they would allocate their budget among three types of ornamental plants. Although we do not use their approximate budgets recorded in dollar term in our estimation, we asked this question in order to remind the respondents that they are under a budget constraint and let them make choices in the following questions as if they are bind with budget constraints. In order to obtain stated preference data for the demand estimation of 16 individual plants, we applied hypothetical open-ended choice experiment (OECE).

Hypothetical OECE participants were asked to name the quantities of products demanded at each of price combinations. Each price combination is referred as a scenario in this study, and a scenario consists of the names of 16 plants and their prices. The same set of 16 plants was repeated in all scenarios, but price levels differ across scenarios. In other words, price is the only factor that differentiates scenarios. Price levels are generated based on the market prices and discussions with a number of independent garden center managers. Each combination of prices is determined utilizing fractional factorial design (Louviere, Hensher, and Swait, 2000), and each respondent was given four scenarios to answer. We assume that each plant has four possible price levels and different plants have different ranges of price level. For example, begonia is assumed to be sold at $2.99, $3.99, $4.99, or $5.99 while hosta is sold at $4.99, $6.99, $8.99, or $10.99. A scenario is designed by a combination of prices of 16 plants where each price is selected from 4 assumed levels. Utilizing fractional factorial design, we have 64 uncorrelated combinations of prices. However, it is not feasible to ask respondents to answer to 64 scenarios. Thus, 64 scenarios were divided into 8 blocks that consisted of 4 scenarios following Kuhfeld (2009) and each block of 4 scenarios was randomly shown to the respondents. It was assumed and informed to the respondents that plants were in similar size and quality, and any varieties were available at no extra charge.

The survey questionnaire was distributed to 2,198 randomly selected panel members who were registered with GMI, of which 1,982 agreed to participate in the plant purchasing preference survey. Among the participants, 1,632 responded that they were willing to purchase new plants over the next 12 months, but only 1,151 respondents actually completed the survey. The estimation is conducted with the data collected from 1,151 completed surveys. Therefore, the demand model we discuss in the next section is conditional on plant purchase. In other words, our model does not account any hypothetical shopping trip without buying any plant.

Characteristics of potential[1] ornamental plant purchasers are described in table 1. The typical plant consumer resides in suburb area, lives in an owned single family home that values between \$100,000 and \$200,000, works more than 40 hours a week, and received at least some college education. The distribution of potential consumers' income indicates that households with annual income between \$40,000 and 119,000 are more likely to be ornamental plant purchasers than households in other income groups. While households with income between \$40,000 and 159,000 account about 56% of the population according to U.S. 2010 Census in table 1, about 65% of households who answered to purchase any plant in the next 12 months are in this income category. In contrast, the percentage of potential consumer with annual income less than \$40,000 is only 29% while 36% of general population is in this income category.

It is also notable that people between 60 and 69 years old are more likely to be potential plant purchasers than people in other age groups. According to U.S. 2010 Census, people between 60 and 69 years old account 13% of the population, but the percentage of this age group among respondents who answered that s/he planned to purchase ornamental plants is slightly higher than the percentage of this group in the Census as 17.6%.

Table 2 lists the name of individual plants, their price levels, and the share of each plant that is determined by respondents' hypothetical choices.

[1] We use both consumer and potential consumer interchangeably since the dataset includes respondents who answered to buy plants for the next 12 months, and more than 80% of them have purchased plants last year and 93% of them have purchased plants at any time in the past.

Model

In classical demand systems, one can face large number of parameters to estimate as the number of products in consideration becomes large since the demand is determined by prices of other products in the system as well as the own price. Although discrete choice models can accommodate a large system of demand equations (Nevo, 2010), the application of discrete choice model is limited since its substitution pattern is very restrictive. It is well known that logit models exhibit the independence of irrelevant alternatives (IIA) property. The IIA claims that the ratio of choice probabilities between two options does not change even if the third option is introduced. This might be a plausible assumption in some cases when the researcher is only interested in examining choices among a subset of alternatives (Train 2003, pp.53), but it is not behaviorally accurate in many real-world situations. Some of discrete choice models, such as nested logit or mixed logit models, are relatively flexible. However, the nested logit model is still restrictive because the cross price elasticities of all products within a nest are still equal with respect to the price change of any one product, and the mixed logit model may not as flexible as Almost Ideal Demand System (AIDS) model in many situations (Hausman and Leonard 2005). Hausman, Leonard and Zona (1994) proposed the multistage demand system that employs Linear Approximate AIDS to maintain flexibility and solves the dimensionality problem by applying Gorman (1959)'s multi-stage budgeting approach at the disaggregate level. Under the assumption of weakly separable utility, Gorman (1959) argues that consumers first allocate their budget among broad groups of products and then make decisions on expenditures within each group. The price changes of products in one group can affect the utilities of products in other groups only through group price indices. Thus, the demands of individual products in one group can be estimated separately from the products in other groups.

We apply the two-stage demand system approach to individual household level demand estimation, whereas Hausman, Leonard and Zona (1994) apply the approach to the aggregate demand of representative consumers. Under the assumption of weakly separable utility function[2], the upper level of the demand system is defined as the demands for three groups of ornamental plants: annual, perennial and foliage plants; the lower (second) level is defined as the demands for individual plants within each plant group. Demand equations were specified with Linear Approximate Almost Ideal Demand System (LA/AIDS) in both levels.

Formally, the lower level that represents the demand of individual ornamental plants within the given plant group is:

$$(1)\ \ w_{iht}^{G}=\alpha_{iht}+\sum_{j\in G}^{n}\gamma_{ij}\ln\left(p_{jht}\right)+\beta_{i}\ln\left(\frac{m_{ht}^{G}}{P_{ht}^{G}}\right)+\varepsilon_{iht},\ i=1,2,...,n\,,$$

where $i=1,2,...,n$ denotes the ith individual plant in the demand system, h denotes the consumer, t denotes the scenario; w_{iht}^{G} is the expenditure share of plant i within plant group G, where *G* denotes plant groups, which are annual, perennial, and foliage plants. The price of plant *j* respondent h faces in scenario t is denoted by p_{jht}. Respondent h's total expenditure on plant group *G* that plant *i* belongs to is m_{ht}^{G}, that is, $m_{ht}^{G}=\sum_{i\in G}^{n}p_{iht}q_{iht}$ and P_{ht}^{G} is the price index of plant group *G* that respondent h faces in scenario *t*, ε_{iht} is an error term that is heteroscedastic within the share equation for one product and correlated across the share equations for different products[3], and computed using a log-linear analogue of the Laspeyres price index:

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[2] In order to define the upper level demand system with group price indices, an additional assumption is that individual plant prices change approximately together. Since our price data are not observed market prices and the combinations of prices are randomly generated within given price ranges, our price data violates this assumption.

[3] Chavas and Segerson (1987) show the heteroscedastic error term by deriving the share equations from Random Utility Hypothesis (RUH).

$$(2)\ \log P_{ht}^{G} = \sum_{i \in G}^{n} w_{i0}^{G} \log(\pi_{iht}),\ \text{where } w_{i0}^{G} = \frac{1}{H}\frac{1}{T_h}\sum_{h=1}^{H}\sum_{t=1}^{T_h} w_{iht}^{G}\ .$$

Next, since we use micro-level data, we take household heterogeneity into account by specifying α_{iht} as:

$$(3)\ \alpha_{iht} = \rho_{i0} + \sum_{k=1}^{s} \rho_{ik} d_{kh} + \rho_{i(s+1)} t + c_h\ ,$$

where d_{kh} is the k th observed characteristic of consumer h. There are s such characteristics which do not vary across scenarios. Plant-scenario effect4 on consumer demand was captured by $\rho_{i(s+1)} t$, and c_h represents the time invariant unobserved respondent characteristic (respondent specific effects).

The upper level that represents demands for three different plant groups is specified as:

$$(4)\qquad q_{ght} = \rho_{ght} + \beta_g \log \frac{y_{ht}}{P_{ht}} + \sum_{k=1}^{M} \delta_{gk} \log \pi_{kht} + e_{ght},$$

where $g = 1, 2, 3$ denotes the *g*th plant group, *h* denotes the respondent, t denotes the scenario, q_{ght} is the expenditure share of segment *g* that respondent h is willing to spend in scenario t, y_{ht} is total expenditure on plants in scenario t, π_{kht} is the segment *k* price index for respondent h in scenario t that is defined as $\log \pi_{kht} = \sum_{j \in k} s_{j0} \log p_{jht}$ where $s_{j0} = \frac{1}{H}\frac{1}{T_h}\sum_{h=1}^{H}\sum_{t=1}^{T_h} s_{jht}$,

and s_{jht} is the share of product j's demanded by respondent h in scenario t. The P_{ht} (which is the price index of ornamental plants respondent h faces in scenario *t*) is computed in the same fashion as in (2):

[4] Plant-scenario specific effects were not statistically significant and hampered the optimization procedure of Maximum Likelihood Estimator. Thus, the variable is dropped in further analysis.

$$(5)\ \log P_{ht} = \sum_{g=1}^{3} w_{g0} \log(\pi_{ght}) \text{ where } w_{g0} = \frac{1}{H}\frac{1}{T_h}\sum_{h=1}^{H}\sum_{t=1}^{T_h} w_{ght}\ .$$

The ρ_{ght} is also specified as a linear function of plant group specific effect, and time-invariant demographic characteristics of respondent h and respondent specific effect in a similar fashion as in (3). Note that our demand model proposed in this study does not include an additional stage that considers the demand of the ornamental plant as one commodity. In other words, we do not account for how consumers allocate their budget to ornamental plant purchases among broader types of products, such as food and clothes. As a result, our analysis in the next sections is based on the assumption that consumers participate in plant purchase. That is, the elasticity estimates do not account for the case that a consumer decides not to purchase any plants when there is a price increase in any plant or a non-participant decides to purchase any plants when there is a price change (market expansion effects).

Estimation

We first estimate the lower stage demand systems where there are three sets of demand systems. The demand system of annual plants consists of impatiens, begonia, geranium, pansy, and marigold; the demand system of perennial plants includes coreopsis, mum, daylily, hosta, and African violet; the demand system of foliage includes pathos, dieffenbachia, croton, Chinese evergreen, philodendron, and ficus. Each of three systems was estimated separately.

When estimating demand equations, which involve share expenditure functions using individual consumer level data, one is likely to face zero purchase observations since consumers do not always purchase the product in the choice set. Our survey data also indicated that some respondents were not willing to purchase some plants in some scenarios although our survey includes only the respondents who are willing to purchase at least one plant for the next 12 months. This behavior can be explained by a corner solution of the consumer's utility maximization problem. We employ a two-step estimation technique that was proposed by Peralli and Chavas (2000) within a cross-section application and extended by Myerhoefer, Ranney and Sahn (2005, MRS hereafter) to panel data. As our dataset is also in the panel structure that consists of cross section and time series (repeated scenarios), our model specification and estimation follow MRS that accounts for unobserved heterogeneity of individual respondents. In the first step, reduced form parameters of demand system are estimated for one equation at a time. Then demand theory restrictions (i.e., add-up, homogeneity, and symmetry) are imposed, and the structural parameters are identified using GMM framework in the second step.

Upper level demand estimation

The upper level demand equations specified in (4) and (5) were also estimated in the same fashion as the lower level demand equations. Although the upper level demand aggregates plant purchases across individual plants within the same group, it does not aggregate the expenditures across individual consumers, and the dataset organized for the estimation still indicates zero purchases. Therefore, the system of group level demands, that is defined as demand for annual, perennial and foliage, were specified with heteroscedastic Tobit model as in the lower level demand.

Conditional and unconditional elasticities

There are two issues in elasticity computation in our study. First, with the censored demand equations, the elasticity formulae that takes derivatives of (7) or (13) with respect to price or expenditure give the conditional elasticities that illustrate the percentage changes in demand only for the consumers who indicated the quantity of plants purchased greater than zero. The conditional elasticities do not measure the changes in demand when consumers with zero purchase on one product decide to purchase (greater than zero quantity) of that product due to price/expenditure changes or consumers with positive consumption on one product decide not to purchase the product at all due to price/expenditure changes. Second, the individual plant elasticities estimated from the lower level demand estimation are conditional on the expenditure allocated to the group the individual plants belong to. While the multistage demand system and the assumption of weakly separable utility reduce the number of parameters to be estimate, they do not allow finding the cross price elasticities between products in different groups.

The elasticities that are not conditional on positive purchase can be estimated using expected budget shares for the heteroscedastic Tobit model following McDonald and Moffitt (1980). The elasticities that are not conditional on the expenditure allocated to the group can be approximated following Carpentier and Guyomard (2001).

Results

The elasticity estimates of individual plants that are not conditional on group expenditure and/or positive purchases are shown in table 3. However, the elasticities are still conditional on the expenditure the consumer allocated to whole plant purchases. Demand elasticities are estimated for individual consumers, and the mean values are shown in the table. The expenditure elasticities of foliage plants (ranged from 0.98 to 3.79) are generally larger than the expenditure elasticities of annual plants (ranged from 0.87 to 0.96) or perennial plants (ranged from 0.66 to 1.34). In other words, when the amount of income that the consumers can spend on ornamental plants increases (decreases), they would increase (decrease) the quantity of foliage plants more than the quantity of annual or perennial plants. For example, average consumers in our sample would like to buy 3.79% more (less) of dieffenbachia when their budget on plant purchase increases (decreases) by 1% while they would increase (decrease) the amount of geranium only by 0.87%.

Own price elasticities indicate that ornamental plants are relatively price elastic since they are larger than 1 in absolute value. The own price elasticities of impatiens and marigold from our survey are similar to those in Abdelmagid, Wohlgenant and Safley (1996) while the own price elasticities of begonia and geranium are slightly more elastic than their estimates. The results indicate that foliage plants (whose own-price elasticities range from -2.10 to -5.65) are more elastic than annual plants (whose own-price elasticities range from -1.02 to -1.30) or perennial plants (-1.14 to -2.15). That is, consumers are more responsive to the price changes of foliage plants than to the price changes of annual or perennial plants. For instance, consumers drop (raise) the amount of pansy purchases only by 1.02% against 1% increase (decrease) of its price while they drop (raise) the quantity of ficus purchase by 3.98% to 1% increase (decrease) of ficus price. One of the explanations on the difference in own price elasticities among plants can be the higher price level of foliage plants. The prices of individual foliage plants are higher than those of annual or perennial plants as shown in table 2, and own price elasticities tend to be higher for products represent higher portion of the whole expenditure of ornamental plants as consumers would pay more attention when they purchase higher cost products.

Cross price elasticities show that individual plants are more substitutable among the plants in the same group than among the plants in different groups as expected. For example, against 1% price change of geranium (annual), the quantity of impatiens (annual) demanded changes 0.14% while the quantity of mum (perennial) demand changes 0.01%. Among annual plants, impatiens and geranium are relatively close substitutes (0.13 and 0.14) compared with begonia, pansy and marigold. Within perennial plant group, mum and coreopsis (0.15 and 0.09), and violet and daylily (0.12 and 0.16) are relative substitutes. The results also indicate that pothos is relative substitutes with philodendron and ficus within the group of foliage plants. In addition, it is notable that the demand elasticities of foliage plants with respect to price changes of annual or perennial plants show negative values while the demand elasticities of annual and perennial plants with respect to price changes of foliage plants show positive values. This indicates that plants in foliage group cannot substitute for plants in annual or perennial plant group while plants in annual or perennial group can be substitutes for foliage plants.

Group (upper) level elasticities shown in table 4 are also the mean values of elasticities estimated for individual consumers. These are also estimated in the similar fashion as in (11) - (13) and not conditional on positive purchase. The implications are also similar as in individual plant (lower) level elasticity estimates: 1) foliage (1.11) is expenditure elastic, while annual (0.86) and perennial (0.88) groups are inelastic to expenditure changes; 2) the demand of foliage is more elastic to its price change, while that of annuals or perennials are less elastic to own price changes; 3) annuals and perennials are substitutable to each other; 4) annuals and perennials can be substitutes for foliage but foliage cannot be a substitute for annuals or perennials.

Conclusions

The study utilizes stated preference data collected from an Internet survey to estimate demand functions for nursery products. In order to estimate the large demand system that includes sixteen annual, perennial and foliage plants, we adopt the multistage demand system approach. Linear Approximate AIDS model is specified for the demand equations, and zero purchasing behavior is accounted in the estimation using a two-step method in a Tobit framework. Unobserved heterogeneity is also accounted with the random effects method.

Based on the parameter estimates, we computed the price elasticities and expenditure elasticities of both individual plants and plant groups. We not only present the elasticity estimates in the mean values across the entire sample, but also distribute the elasticity estimates of individual consumers' with respect to their demographic characteristics. For the most part, the own-price elasticities indicate that sales of ornamental plants are quite sensitive to price changes. The results also indicate that the demands foliage plants are more elastic than those of annual or perennial plants.

These demand estimates for different ornamental plants provide insights to policy makers who want to regulate the market as well as promote the market. For example, if policy makers have to change regulation that causes an increase in costs for nursery producers, they would like to know how much the industry revenue would be affected by the price change due to the increase of regulatory compliance costs. The elasticity estimates from this study help evaluate how much industry revenue would be affected and which segment of the industry would be affected more than the others. In addition, demand estimates at both the individual plant level and the plant group level should provide nursery retailers with important information that can be applied to their marketing strategies in various ways depending on their product coverage and marketing purpose. For example, a begonia retailer can improve his/her sales of begonia by decreasing its price because a small decrement in price can increase the demand more than proportionally, while a small increment can decrease the demand more than proportionally.

However, these results should be utilized with care if the retailer also carries other plants and would like to maximize overall revenue from all plants, because the increase in sales results in decreases of other product sales due to substitution effect although the magnitude of substitution is very small. In addition, the elasticities estimated at the plant group level can answer to the questions such as how the overall demands of annual, perennial and foliage plants would respond when the prices of all individual plants in one group change proportionally. Although the demand analysis discussed in this article provides insights on pricing strategies in various applications, however, our model is limited to analyzing homogeneous products. That is, our model does not account for different product attributes such as color, quality of plant, type of pot, and growth rate since having all of these attributes in one choice experiment would exacerbate the quality of data by fatiguing or complicating the consumers. The future research might analyze the demand for differentiated products by conducting a separate survey.

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Table 1. Summary of the Internet survey data descriptive statistics

Variable	Mean	Standard Deviation	Variable	Mean	Standard Deviation
Gender	1.52	0.50	Education	4.04	1.49
Male=1			1=Less than high school		
Female=2			2=High school		
Age	46.01	16.91	3=Some college		
Minimum=18			4-Two years college		
Maximum=87			5=Four years college		
Annual Income	3.82	1.95	6=Master’s degree		
1=Below $20,000			7=Doctoral degree		
2=$20,000–$39,000			8=Professional degree		
3=$40,000–$59,000			Marital Status	1.44	0.50
4=$60,000–$79,000			1=Married		
5=$80,000–$99,000			2=Single		
6=$100,000–$119,000			Race	2.93	0.70
7=$120,000–$139,000			1=African American		
8=$140,000 and more			2=Asian American		
Ownership of Residence	1.27	0.48	3=Caucasian		
1=Owns			4=Hispanic		
2=Rents			5=Pacific Islander		
3=Other			6=Other		
Residence Type	2.72	0.86	Regional Distribution	2.51	1.04
1=Condo/Apartment			1=Northeast		
2=Townhouse			2=Midwest		
3=Single house			3=South		
4=Duplex			4=West		
5=Other					

Table 2. Plant groups, names, and price ranges used in choice scenarios

Group (Category)	Individual plants	Price range				Share within group	Group share
Annual	impatiens	2.99	3.99	4.99	5.99	0.26	0.36
	begonia	2.99	3.99	4.99	5.99	0.17	
	geranium	2.99	3.99	4.99	5.99	0.19	
	pansy	2.99	3.99	4.99	5.99	0.21	
	marigold	2.99	3.99	4.99	5.99	0.17	
Perennial	coreopsis	3.99	4.99	5.99	6.99	0.12	0.34
	mum	4.99	5.99	6.99	7.99	0.24	
	daylily	4.99	5.99	6.99	7.99	0.25	
	hosta	4.99	6.99	8.99	10.99	0.21	
	african violet	4.99	5.99	6.99	7.99	0.18	
Foliage	pathos	4.99	5.99	6.99	7.99	0.14	0.30
	dieffenbachia	9.99	11.99	13.99	15.99	0.16	
	croton	4.99	7.99	10.99	13.99	0.16	
	chinese evergreen	4.99	6.99	8.99	10.99	0.20	
	philodendron	5.99	6.99	7.99	8.99	0.16	
	ficus	9.99	11.99	13.99	15.99	0.18	

Table 3. Unconditional easticities (on expenditure and positive purchase) of individual plants

Elasticity of:	With respect to the change of:						
	expenditure	Impatiens	begonia	geranium	pansy	marigold	coreopsis	mum
Impatiens	0.96	-1.30	0.06	0.13	0.02	0.06	0.02	0.01
begonia	0.89	0.06	-1.30	0.03	0.05	0.09	0.02	0.01
geranium	0.87	0.14	0.03	-1.21	0.01	0.08	0.02	0.01
pansy	0.87	0.01	0.04	0.00	-1.02	0.02	0.02	0.01
marigold	0.87	0.07	0.10	0.09	0.04	-1.24	0.02	0.01
coreopsis	1.18	0.03	0.02	0.02	0.02	0.01	-2.15	0.15
mum	0.85	0.02	0.01	0.01	0.01	0.01	0.09	-1.15
daylily	0.88	0.02	0.01	0.01	0.01	0.01	-0.04	0.01
hosta	1.34	0.04	0.02	0.02	0.02	0.02	-0.04	-0.14
violet	0.66	0.02	0.01	0.01	0.01	0.01	0.04	0.08
pothos	0.98	0.00	0.00	-0.01	-0.01	-0.01	0.01	-0.01
dieffenbachia	3.79	-0.03	-0.02	-0.03	-0.03	-0.02	0.00	-0.03
croton	2.16	-0.01	-0.01	-0.01	-0.02	-0.01	0.00	-0.02
chinese evergreen	1.75	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	-0.02
philodendron	1.66	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	-0.02
ficus	2.83	-0.02	-0.02	-0.02	-0.02	-0.02	0.00	-0.03

(Continue table 3)

Elasticity of:	With respect to the change of:								
	daylily	hosta	violet	pothos	dieffenbachia	croton	chinese evergreen	philodendron	ficus
Impatiens	0.01	0.04	-0.01	0.00	0.13	0.07	0.07	0.06	0.10
begonia	0.01	0.04	-0.01	0.00	0.12	0.07	0.06	0.06	0.09
geranium	0.01	0.04	-0.01	0.00	0.11	0.07	0.06	0.06	0.09
pansy	0.01	0.04	-0.01	0.00	0.11	0.07	0.06	0.06	0.09
marigold	0.01	0.04	-0.01	0.00	0.11	0.07	0.06	0.06	0.09
coreopsis	-0.09	-0.06	0.03	0.00	0.14	0.08	0.07	0.06	0.11
mum	0.01	-0.08	0.04	0.00	0.10	0.06	0.05	0.05	0.08
daylily	-1.33	0.00	0.12	0.00	0.10	0.06	0.05	0.05	0.08
hosta	-0.04	-1.76	0.01	0.00	0.16	0.09	0.08	0.07	0.12
violet	0.16	0.05	-1.14	0.00	0.07	0.04	0.04	0.04	0.06
pothos	-0.01	0.02	-0.02	-2.10	-0.11	0.08	0.02	0.24	0.22
dieffenbachia	-0.03	0.00	-0.04	-0.36	-5.65	-0.76	-0.78	-0.72	-1.03
croton	-0.02	0.01	-0.03	0.03	-0.52	-2.94	-0.22	-0.20	-0.49
chinese evergreen	-0.01	0.02	-0.03	-0.07	-0.39	-0.17	-2.18	-0.14	-0.44
philodendron	-0.01	0.02	-0.03	0.13	-0.33	-0.15	-0.14	-2.37	-0.22
ficus	-0.02	0.01	-0.03	0.30	-0.80	-0.55	-0.67	-0.34	-3.98

Table 4. Elasticities of plant group

Elasticity of:	With respect to the change of:			
	expenditure	annual	perennial	foliage
annual	0.86	-0.99	0.05	0.05
perennial	0.88	0.05	-0.96	0.03
foliage	1.11	-0.04	-0.04	-1.03