Price Elasticities of Demand for Mums and Pansies Sold in Independent Garden Centers

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Abstract. Data from a survey of North Carolina independent garden center customers in Fall 1996 were used to determine the price responsiveness of mums and pansies. A survey was conducted of four garden centers in the Raleigh, N.C., area and four garden centers operating in the Triad marketing area (Greensboro, Winston-Salem, and High Point, N.C.). Information collected on 1608 consumers included various socioeconomic and demographic variables (age, value of residence, type of residence, number of years in the residence, housing tenure, and employment status) as well as plant purchase information (plant price, plant types, and plant sizes). Price responsiveness of consumers was estimated by analyzing how customers' responses change as prices varied from one store to another and from one location to another. Measures of price responsiveness indicated statistically significant price elasticities of demand of -0.76 for mums and -0.80 for pansies. These elasticities can be used to indicate how industry sales would respond to a change to the industry that affects all firms in the same way—such as the response to an increase in energy costs. The paper shows how to use the elasticities to develop particular pricing strategies under different circumstances facing firms in the industry.

Among the many products sold in garden centers, annual and perennial plants comprise a significant portion of total sales. In North Carolina, as well as many other states, pansies and mums are two of the most significant plants within the annual and perennial plant categories, respectively [U.S. Dept. of Agriculture (USDA), 1998]. As demand for home landscaping has increased in recent years, interest has focused on the factors affecting purchases of annual and perennial plants and, in particular, in factors affecting purchases of pansies and mums. Among other things, garden center managers must decide what prices to charge for their plants. While individual pricing decisions depend upon a number of factors, an important consideration is how sensitive purchases of their plants are to changes in price. In this paper, we discuss how estimates of price elasticities of demand for mums and pansies were derived from survey data collected on independent garden centers in North Carolina. We also discuss how this information might be used in developing pricing strategies for garden centers.

Materials and Methods

Garden center customers were interviewed during the Fall 1996 marketing season at four garden centers operating in the Raleigh, N.C.,

area and four garden centers operating in the Triad marketing area (Greensboro, Winston-Salem, and High Point, N.C.). The surveys were conducted every Friday and Saturday at the different garden centers in each marketing area over a four-week period in September and October. A follow-up survey was conducted in Nov. 1997 to validate the findings of the 1996 consumer survey (Safley, Wohlgenant, and Rezitis, 1998). The questionnaire was divided into two parts. The first segment was administered before the customers entered the garden center to determine what they intended to purchase and how much they expected to spend. The second part of the survey was conducted as the customers left the store to identify the plants they purchased and the amount of money they actually spent and to obtain socioeconomic characteristics. A total of 1961 consumers were interviewed for these surveys, but only 1608, or 82%, of the surveys were usable. The remaining surveys were discarded because they were completed incorrectly or customers left without completing exit interviews.

With respect to frequency of purchases, the data collected reflect individual/household purchases on just one day. A total of 14.8% of the customers did not buy any plants while visiting a garden center. Thirty-one and nine-tenths percent of the customers purchased annuals, 31.6% purchased perennials, 15.6% bought shrubs, 7.38% bought trees, and 4.1% bought bulbs. The analysis here is conducted on one annual plant (pansies) and on one perennial plant (mums) because data on these two plants are the most extensive of all the data collected. In addition, 90% of the customers

who purchased annuals bought pansies, and 83% of the customers who bought perennials purchased mums. Therefore, analysis of demand for pansies and mums should provide insight into demand for annuals and perennials as a whole.

The information collected includes socioeconomic and other demographic variables, including age, income, value of residence (owned by the homeowner), type of residence, number of years lived in residence, housing tenure, and employment status. Purchase information collected includes plant prices, plant types, and plant sizes. Consistent with an earlier spring survey of independent garden centers by Safley and Wohlgenant (1994), the "typical" customer was between 25 and 44 years old, worked 40 or more hours per week, had an annual household income of \$75,000 or more, and owned a home valued at between \$150,000 and \$199,999.

The price responsiveness of customers (price elasticity of demand) was estimated by analyzing how customers' purchases changed as prices varied from one store to another and from one location to the other. Because customers' purchases are also affected by other factors, including the various socioeconomic variables indicated above and product characteristics (i.e., size of plants purchased), it was necessary to control for these factors to isolate the impact price had on customers' purchases. Moreover, because of the presence of a number of zero customer purchases, the data on mums and pansies are said to be statistically censored so it was necessary to analyze the data using limited dependent variable statistical methods. The method used was a two-stage procedure. In the first stage, the probit method was used to obtain an estimate of the inverse Mills' ratio (INVMILL). This variable was then included as an independent variable in a multiple regression equation to correct statistically for the fact that the error term in the statistical model has a non-zero mean. [Other variables included in the model besides price include income, market value of the household residence, customer's age, number of years household has resided in current residence; and dummy variables (discrete variables which equal 1 if characteristic is present and zero otherwise) for location (Raleigh or Triad area), plant size (12, 18, 14, 36, 48, and 50 flats for pansies; 28", 34", 40", and 42" pots for mums), type of plant container (gallons or pots for mums; flats only for pansies), residence (whether condo, apartment, triplex, or other), and whether residence is rented. Complete statistical results and further discussion of the statistical methods used are available in Wohlgenant, Rezitis, and Safley (2000).]

Results and Discussion

From these statistical analyses, we obtain the demand elasticities shown in Table 1. [In the statistical models estimated, the dependent variables were consumer expenditure shares of the commodity and the independent price variables were expressed in natural logarithms. Price elasticities of demand were computed

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Table 1. Price elasticities of demand for pansies and mums.

Plant	Price elasticity ^a of demand
Pansies	-0.80 (-5.00)
Mums	-0.76 (-3.21)

^aElasticities are evaluated at sample means; values in parentheses are approximate t-values (i.e., ratios of elasticities to estimated SE).

using the formula: Price elasticity = (estimated coefficient of logarithm of price/sample mean value of expenditure share) - 1.] Both price elasticities, as indicated by the t-values in parentheses, are significantly different from zero. The price elasticities in this context are best interpreted as national, market elasticities, i.e., price elasticities of demand for plants sold in independent garden centers. [A significant portion of mums and pansies are sold by mass merchants, but sales in independent garden centers are significant and compete favorably with mass merchants. Therefore, one might regard these elasticity estimates as referring to the markets for mums and pansies in total. In fact, a survey of independent garden centers and mass merchants in southern states indicated that about one-third of the plants were sold in independent garden centers and two-thirds were sold by mass merchants (McCormick, G., personal communication).] The source of independent price variation is differences in prices charged by the eight stores in the sample. Cox and Wohlgenant indicate that spatial price variation is desirable from the standpoint of estimating commodity demand curves. However, in the estimation, they indicate that it is important to control for quality variation caused by differences in consumers and product characteristics. In other words, the goal in statistical analyses with such data is to control for differences among consumers and products purchased in such a way to compare the same "identical" individual purchasing the same product across different stores. The approach we have taken, by controlling for the various socioeconomic differences (income, household residence, age, etc.) and size and type of plant containers, allows us to identify and estimate the net effect of price changes on consumer purchases of mums and pansies. These elasticities can be used to evaluate the impact on plant sales from a uniform change in costs across garden centers. For example, if all garden centers should experience an increase in costs due to, say, an

increase in energy costs, then plant prices will uniformly increase across all garden centers and industry sales will fall in proportion to the amounts indicated by the elasticities in Table 1. As these elasticities suggest, a 10% increase in price of pansies would cause national market sales of pansies to fall by 8%, while a 10% increase in price of mums would cause national market sales of mums to fall by 7.6%.

A comparison with price elasticities for the springtime annual plants estimated by Abdelmagid, Wohlgenant, and Safley indicates close correspondence to elasticity estimates for begonia of -0.80, dianthus of -0.93, geranium of -0.71, and vinca of -0.77. However, the other springtime annual plants (impatiens, marigolds, and petunias) were estimated to be price elastic (impatiens -1.65, marigolds -1.33, and petunias -1.07). In a controlled pricing experiment of rural and urban supermarkets, Rhodus found demand for bouquets (daisy, mixed, and garden) to be price elastic.

The fact that the price elasticities of demand for pansies and mums are less than one in absolute value (i.e., demands are inelastic) means that increases in price will lead to increases in industry total revenue and decreases in price will lead to decreases in total revenue. However, because neither price elasticity is significantly different from unity suggests that changes in prices will not have a significant effect on total sales revenue. (From Table 1, it can be inferred that the t-statistics of the null hypothesis that the elasticities be equal to minus one are -1.25 and -1.01, respectively, which are insignificant at conventional significant levels of 0.05 or 0.10.)

Decisions on pricing by independent garden centers must be determined in the context of a total marketing program. However, an important component of this pricing decision would be the effect of a change in price on industry sales if all other garden centers were to follow suit. This is where the price elasticities of demand for pansies and mums shown in Table 1 become especially relevant because these elasticities show the expected sales response to a given price change where all firms respond in the same fashion. In markets with products that are highly homogeneous—which would likely typify pansies and mums during the fall season—the firm has little choice but to meet a price reduction from its competitor (Kotler, 1988). Industry sales would then rise by the amount indicated

by the price elasticity of demand multiplied by the (same across firms) percentage price reduction. If all stores assume other stores passively react to other stores by not altering sales in response to each stores sales response, then the effect on each store's revenue can be calculated by multiplying its market share by the percentage increase in industry sales. (In the economics literature, this is known as the Cournot model of pricing.) So, for example, if the price of pansies should fall by 10%, industry sales would increase by 8%. With eight independent garden centers, the impact on each store's sales revenue would be 1% (one-eighth $\times$ 8%).

Even if the garden center should be able to differentiate its product from others and change its price independently of others, it may still need to know what effect changes in its price would have on industry sales because that may affect its total sales. While in such a case a firm may be more interested in the effect of a price change on its market share, a price change can also induce more or fewer customers in total to buy, which could benefit or harm an individual firm.

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