AN ANALYSIS OF HOUSEHOLD EXPENDITURES ON NURSERY PRODUCTS IN THE UNITED STATES

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Abstract

This paper develops Engel relationships to identify the determinants of household expenditures on nursery products and specifies their impact on consumer purchases of these goods for subregions of the United States. Household income, the number of single family home construction starts, educational level attained, and age composition of the population were found in influence nursery product expenditures. The economic variables of income and construction starts appear to be key factors affecting nursery purchases. To maintain a competitive edge, industry participants should monitor these variables carefully and adjust their production and marketing plans to meet changing market conditions.

Key words: nursery products, expenditures, purchases

Consumer expenditures on nursery products in the United States increased from $265 million in 1963 to $2.8 billion in 1982. In the period 1977 to 1982, purchases of nursery related items grew by 78 percent from $1.6 billion. Despite these changes, more recent data showed that U.S. expenditures per person on nursery products remain at less than one half of those made by consumers in Europe and many other developed countries (USDA). In 1963, there were 2,755 retail nursery establishments in the country; by 1983 the number had risen by 185 percent and in 1987 there were approximately 10,690 retail establishments (Bureau of the Census). On the production side, cash receipts received by the nation's producers of greenhouse and nursery crops were $726 million, $4.0 billion, and $6.6 billion in 1963, 1982, and 1987, respectively. These growth patterns have increased the importance of the production and marketing components of this sector. In fact, the nursery industry has become one of the most viable agricultural alternatives in several states throughout the nation. The importance of nursery production in southern states can be shown by noting that in recent years (1982-1987) fourteen southern states have accounted for over 55 percent of the nation's total production.

As nursery firms continue to increase production and invest in additional marketing facilities, they should know what factors affect consumer purchases, study these factors and determine whether or not consumers will continue to support the industry. Further, when making decisions on where to locate new firms, firms should examine market characteristics to identify areas where nursery product sales are likely to grow. Clearly, research identifying and specifying the relationship between consumer expenditures on nursery products and the socioeconomic factors affecting these purchases would assist the industry in developing marketing and production plans.

Economic factors hypothesized to affect expenditures on nursery products include consumer income, construction starts, and the value of homes. Sociodemographic variables that have been linked to nursery purchases are level of education and the age composition of the population (Bishop; Dunn; Gineo; Varner and Lalo; and Weyerhauser). While theory provides basic insight into the relationships between these factors and expenditures on nursery products, quantitative research specifying their exact nature has not been completed.

In a series of studies on the Western market (California, Idaho, and Oregon) for nursery products, Dunn was able to show, in a qualitative manner, that consumer income and age composition of the population are linked to sales in the Western region. Voight has hypothesized that the number of construction starts and the value of homes are related to expenditures on nursery products.

Varner and Lalo studied household expenditures on landscaping trees and shrubs in New Jersey by examining the relationship between expenditures and homeowner characteristics, household profiles, and interest in landscaping. Specifically, they used multiple regression analysis to determine the effects

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of factors such as age, educational level, occupation, and income on purchases of trees and shrubs in New Jersey. Gineo has also suggested that similar factors may affect consumer expenditures on nursery products and services. None of the above studies attempted to quantify beyond a state level the link between purchases of nursery products and services and the determining factors. The industry would benefit from knowing precisely how these factors affect expenditures nationally as well as in subregions of the country.

The purpose of this study was to develop Engel relationships showing the linkage between per-household expenditures on nursery products and the determinants of these purchases in different states and nationally.[1] More specifically, the analysis identifies those socioeconomic factors which influence household expenditures on nursery products in the United States and quantitatively determines and compares the effects of these factors in several groups of states.

PROCEDURES AND MODEL

Multiple regression analysis was employed to determine how various socioeconomic factors influence expenditures on nursery products in the United States. It is plausible that the determinants of consumer purchases vary across states. For instance, when buying nursery related goods, a consumer in a rural state with low economic growth may behave differently from a consumer in an urbanized, high-growth state. In this situation, regression models should be developed for states having similar factors influencing expenditures. Based on the assumption that consumption patterns are different, the analysis proceeded by (1) partitioning states into five groups based on the demographic criterion of population density, (2) developing "group" regression models for each population density group, (3) exploring the possibility of combining these models to develop aggregate equations, and (4) specifying aggregate relationships that explain household purchases of nursery products within the United States.

Grouping Procedures

Several criteria (e.g., population density, percentage of people in urban areas, and the percentage of households owned in a state) or combinations of criteria could be used to group states. However, there is no clear rationale for utilizing one criterion over another. Thus, alternative grouping criteria were evaluated prior to selecting population density or the number of persons per square mile in the state to group states. The use of the population density criterion is related to the assumption that nursery product purchases are higher in states with mid-range population density and lower in states with a high or low number of persons per square mile. Those states with high, medium, and low densities are likely to be characterized by urban/central-city, suburban, and rural populations, respectively. Suburban households, more numerous in states with mid-range density, may typically engage in more landscaping activities than urban or rural households and, thus, have higher per-household expenditures on nursery products. In rural areas there are fewer homes per square mile, and landscaping on a per-household basis may be less intensive, resulting in lower expenditures than in suburban areas. In urban/central-city areas the number and proximity of buildings leaves little land for planting and less opportunity for landscaping. Therefore, sales of nursery products may be lower than in suburban areas.

Using the population density criterion, five groups were specified as follows: Group 1, consisting of states with 1-30 people per square mile—Alaska, Arizona, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, and Wyoming; Group 2, which has states with 31-60 people per square mile—Arkansas, Iowa, Maine, Minnesota, Mississippi, Oklahoma, Texas, and Vermont; Group 3, that has states with 61-120 people per square mile—Alabama, Georgia, Kentucky , Louisiana, Missouri, New Hampshire, South Carolina, Tennessee, Washington, West Virginia, and Wisconsin; Group 4, containing states with 121-270 people per square mile—California, Florida, Hawaii, Illinois, Indiana, Michigan, Ohio, North Carolina, Pennsylvania, and Virginia; and Group 5, consisting of states with over 271 people per square mile—Connecticut, Delaware, Massachusetts, Maryland, New Jersey, New York, and Rhode Island.

General Model

One limitation confronting researchers in the nursery industry is data availability. In fact, the lack of price and quantity data does not allow the estimation of a traditional demand function. However, expenditure figures for a bundle of nursery products and related goods, such as lawn mowers, soil, and seeds, are available (U.S. Bureau of the Census) which enable Engel relationships to be developed. The

[1] An Engel relationship specifies how expenditures on a particular commodity vary with income.

available data represent a combination of observations in both the time series and cross sectional domains. Five time periods were considered: 1963, 1967, 1972, 1977, and 1982. Each of these periods contains cross-sectional observations on the fifty states in the nation, with the exception of a limited number of missing observations.

Initial regression analysis focused on estimating relationships for the five different population-density groups. The generalized model of the Engel specification for these groups is based on economic theory and the previous work of Bishop, Dunn, Varner and Lalo, Voight, and Weyerhauser. The model is given by:

$$EPH_{ijt} = f(IPH_{itj}, CLAG2_{ijt}, AGE_{ijt}, ED_{ijt}, TIME_{ijt}), \tag{1}$$

where i = group, 1 to G; j = state, 1 to J; t = time period, 1 to T; EPH = average per household expenditures on nursery products and related goods which include christmas trees (natural), garden supplies and tools, lawn mowers, nursery stock, seeds and bulbs, sod, and topsoil in nominal dollars; IPH = nominal income per household; CLAG2 = number of single family home construction starts per thousand households, lagged by two years; AGE = percent of population between 35 and 44 years of age; ED = average number of years of education of state residents; TIME = time variable (1-5 corresponding to the five observation years between 1963-1982).

A priori, expected relationships between nursery product purchases and the selected variables were established. These relationships were based on economic theory and the discussion of Bishop, Dunn, Gineo, Varner and Lalo, and Weyerhauser. It was expected that increases in consumer income would have a positive effect on household expenditures for nursery products. Varner and Lalo found that, as consumer income in New Jersey increased, purchases of trees and shrubs in this state also increased. Economic theory suggests that the expenditure-income elasticity for nursery products may be higher than that of other agricultural products due to the non-essential status of nursery products as consumer goods. However, Varner and Lalo estimated an expenditure-income elasticity of 0.54 for New Jersey consumers. Their results may be explained by the use of cross-sectional data, which typically yield lower elasticities than time series data.

Expenditures on nursery products for landscaping purchases were anticipated to increase as construction starts increase. It was presumed that this effect has a lag since landscape activities cannot begin until construction is completed and usually not until new owners have taken up residence. In addition, new owners are often faced with higher living expenses and other purchases (storm windows, furniture, window coverings, etc.) that take priority over landscaping (unless these costs are included in the purchase of the home). Thus, landscaping is postponed for some time after completion of the home. This lagged relationship was hypothesized to be two years from the start of construction (Voight) which allow for construction to be completed, families to regain financial strength, and landscaping purchases to materialize.

Dunn has argued that individuals in the 35 to 44 year age bracket purchase more nursery products than people in other age brackets. Varner and Lalo empirically demonstrated a positive relationship between this age group and expenditures using cross-sectional data and suggested that this higher demand is related to a high rate of home purchases among this group. In their study of New Jersey consumers, Varner and Lalo have also shown that a quadratic relationship between age and purchases may be appropriate. As an age measure, the present study utilized the percentage of the population in the 35-44 age bracket and since the baby boom generation was in this age bracket over the period studied, a quadratic relationship may be appropriate. The rationale for this relationship was that baby boomers entered the age bracket, made their purchases and remained in the age group. Even though this age group continued to grow as a percent of the population, expenditures probably tapered off because individuals did not continually purchase landscape materials once their landscape was established. This hypothesis was investigated with a quadratic age specification. It was expected that the AGE parameter will have a positive sign and the AGE term squared will have a negative coefficient.

Additional years of education have also been associated with more purchases of nursery products (Dunn; Gineo; Varner and Lalo). This may be due to the greater incomes that usually accompany higher education levels. The effect of educational level may not be continuous and expenditures may show significant increases only after a certain level has been attained. This study used a dummy variable for education to capture such a shift effect. A related effect of educational attainment may be that highly educated people are typically more mobile than less educated individuals, resulting in additional home purchases and increased landscaping activities. However, based on the available data, this re-landscaping activity is difficult to capture without introducing the problem of multicollinearity into the analysis.

The TIME variable was expected to have a positive sign that corresponds to the increase in expenditures per household over time. A rationale for including this variable was to account for unobservable changes in household tastes and preferences over the period analyzed.

As previously mentioned, the data consist of a combination of time series and cross-sections. Observations on expenditures in each state were obtained from data in the 1963 Census of Business and the 1967, 1972, 1977, and 1982 Census of Retail Trade. The data on household numbers, consumer income, construction starts and education level were found in The Statistical Abstract of the United States, 1960 to 1983. Age composition data were obtained in The Current Population Report, 1963 to 1982.

Procedure for Developing Aggregate Relationships

After establishing the individual group equations, pooling procedures that allow similar equations to be combined were investigated. If factors had statistically similar effects on expenditures in two or more of the five groups, implying that coefficients in the group equations are comparable, data from these groups were combined. Pooling observations for the joint estimation of equations provides additional information, increases the degrees of freedom and efficiency, and results in more accurate parameter estimates (Kennedy and Gujarati).

To determine if pooling observations from different groups was appropriate, the Chow Test was used (Chow). If possible, observations from two groups were combined and a single equation was estimated. The Chow test was carried out in a stepwise fashion to determine if observations from additional groups could also be added. Observations that were not similar to one group were considered separately or in combination with any additional observations that could be combined. The pooling technique as utilized to combine observations from as many groups as possible in forming the aggregate relationship.

Two other considerations made in developing the relationship were functional form for the aggregate equation and the estimation technique. The rapid growth rate of per-household purchases of nursery products relative to changes in the data on the explanatory variables suggests that a linear model may not be appropriate to accurately estimate the Engel relationship. Two functional forms, both appropriate when relating expenditures for a group of goods to consumer income (Salathe; Theil), were used to obtain parameter estimates. The first is the log-linear model which is expressed as :

$$\begin{aligned} \ln EPH_{ijt} = {} & a_o + a_1 IPH_{ijt} + a_2 CLAG2_{ijt} \\ & + a_3 AGE_{ijt} + a_4 DED_{ijt} \\ & + a_5 TIME_{ijt} + e_{ijt}. \end{aligned} \tag{2}$$

The second is the double logarithmic form which is commonly used in consumption studies. The model used is given by:

$$\begin{aligned} \ln EPH_{ijt} = {} & b_0 + b_1 \ln IPH_{ijt} + b_2 \ln CLAG2_{ijt} \\ & + b_3 \ln AGE_{ijt} + b_4 DED_{ijt} \\ & + b_5 TIME_{ijt} + v_{ijt}. \end{aligned} \tag{3}$$

All variables have the same meaning as previously defined. The terms appearing for the first time are defined as follows: ln before a variable indicates that the variable is represented by its natural logarithm; DED is a binary dummy variable with a value of one when the educational level of state residents is above the sample mean of states within that group and a value of zero otherwise; a_i's and b_i's are coefficients to be estimated; and e_{ijt} and v_{ijt} are error terms.

Although they are not reported, the results from the individual "Group" equations provided the basis to formulate aggregate equations and evaluate the performance of the two functional forms. Based on t-statistic tests, there is no strong evidence suggesting that either model outperformed the other. Since neither functional form clearly performed better, and because certain characteristics of each form are appealing, a mixed form equation was also investigated for each of the five groups. This equation, which also tests the quadratic age specification, is described as follows:

$$\begin{aligned} \ln EPH_{ijt} = {} & c_0 + c_1 IPH_{ijt} + c_2 \ln CLAG2_{ijt} \\ & + c_3 AGE_{ijt} + c_4 AGESQ_{ijt} \\ & + c_5 DED_{ijt} + c_6 TIME_{ijt} + u_{ijt}. \end{aligned} \tag{4}$$

All variables are defined above except AGESQ, which is the age variable squared, and u_{ijt}, which is the error term, for this equation. The c_i's are coefficients to be estimated. The results of the estimations using this equation are similar to those found in the semilog and double-log functional forms.

RESULTS AND DISCUSSION

Based on results of tests performed with equations (2), (3), and (4), observations from Groups 3, 4, and 5 were pooled to form one equation and Groups 1 and 2 were pooled into a second equation for each functional form. To account for the possibility that group intercept terms are different, a binary dummy variable was created. Test results indicated that the only intercept term that differed statistically from the others, within each pooled equation, was the one for Group 5. Thus, for the Group 3,4,5 equation, the variable DGROUP was formed and given a value of zero for states in Group 5, and one for States in Groups 3 and 4. It is interesting to note that the pooling procedure has combined urban with suburban states (Groups 3, 4, and 5) and separated rural states (Groups 1 and 2) into another category.

RESULTS

Results of the pooled equations are reported in Table 1. From the t-statistics it appears that the mixed form equation outperforms the others for the Group 3,4,5 specification, while it is uncertain as to which equation is best for Group 1,2. One problem with estimating the Group 1,2 and Group 3,4,5 equations separately using the ordinary least squares (OLS) method is that relevant information may not be utilized. For instance, when the error terms from the two individual equations are contemporaneously correlated, the estimation of separate equations would result in inefficient parameter estimates. To deal with this problem and improve the efficiency of parameter estimates, Zellner's seemingly unrelated regression (SUR) technique is used to jointly estimate the two equations. The SUR results are reported in Table 2.

An overall comparison between Tables 1 and 2 shows that the SUR technique results in increased efficiency, as evidenced by the t-statistic values. The other significant change is for the Group 1,2 age

Table 1. Nursery Product Expenditure Relationships - Ordinary Least Squares Estimation Procedures

Variable[a]	Group 1,2 Models			Group 3, 4, 5 Models		
	Semilog	Double Log	Mixed Form	Semilog	Double Log	Mixed Form
Intercept	0.417	-2.34	-2.77	0.129	-2.45	-10.0
	(1.09)[b]	(-1.99)	(-1.68)	(0.31)	(-2.28)	(-3.05)
IPH	0.014	0.80*	0.02	0.046**	1.55**	-0.05**
	(0.27)	(2.11)	(1.20)	(3.60)	(5.13)	(3.54)
CLAG2	0.14 E-04**	0.28**	0.33**	-0.75 E-06	-0.02	0.12+
	(2.79)	(2.75)	(3.26)	(-0.19)	(0.34)	(1.62)
DED	-0.110	-0.28	-0.13	0.37**	0.21**	0.40**
	(-1.03)	(-1.60)	(-1.22)	(5.27)	(2.80)	(5.61)
TIME	0.514**	0.32**	0.50**	0.28**	0.03	0.31**
	(6.27)	(2.43)	(6.08)	(3.90)	(0.25)	(4.34)
AGE	-0.008	-0.35	0.01	0.69 E-02	-0.04	0.68**
	(-0.50)	(-0.84)	(0.11)	(0.41)	(-0.11)	(2.95)
AGESQ			-0.3 E-03			-0.01**
			(-0.20)			(-2.97)
DGROUP				0.33**	0.45**	0.30**
				(3.82)	(5.02)	(3.58)
Adj R-Square	.77	.78	.78	.81	.83	.82
Sample Size	101	101	101	135	135	135
Log Likelihood	-61.55	-58.57	-60.10	-56.75	-50.75	-51.56
F-Statistic	68.52	73.85	58.65	97.38	108.40	90.92

[a]For variable definitions refer to text. Models are described in equations (2) - (4).

[b]T-statistics in parenthesis.

**Implies significance at the 0.01 level.

*Implies significance at the 0.05 level.

+Implies significance at the 0.10 level.

Table 2. Nursery Product Expenditure Relationships - Seemingly Unrelated Estimation Procedures

Variable[a]	Functional Form			
	Semilog	Double Log	Mixed Form	Double Log 1, 2/ Mixed Form 3, 4, 5
Intercept-1, 2	-0.02	0.1 E-02	-0.4 E-02	-0.7 E-03
	(.326)[b]	(0.02)	(-0.06)	(-0.01)
IPH-1, 2	0.8 E-02	0.92**	0.02	0.94**
	(0.78)	(2.86)	(1.80)	(2.92)
CLAG2-1, 2	0.1 E-04**	0.19**	0.25**	0.20**
	(3.04)	(2.44)	(3.30)	(2.46)
DED-1, 2	-0.10	-0.14	-0.10	-0.14
	(-1.07)	(-1.54)	(-1.18)	(1.57)
TIME-1, 2	-0.56**	0.29**	0.48**	0.28**
	(9.20)	(2.59)	(6.98)	(2.53)
AGE-1, 2	0.7 E-02	-0.89**	-0.13**	-0.90**
	(1.26)	(-3.32)	(-2.70)	(-3.37)
AGESQ-1, 2			0.2 E-02**	
			(2.63)	
Intercept-3, 4, 5	0.14	-2.35	-9.98	-9.85
	(0.34)	(-2.25)	(-3.13)	(-3.09)
IPH-3, 4, 5	-0.05**	1.54**	0.05**	0.04**
	(3.69)	(5.23)	(3.65)	(3.64)
CLAG2-3, 4, 5	-0.8 E-06	0.03	0.12+	0.12+
	(-0.20)	(0.39)	(1.68)	(1.69)
DED-3, 4, 5	0.37**	0.21**	0.40**	0.40**
	(5.41)	(2.87)	(5.77)	(5.76)
TIME-3, 4, 5	0.28**	0.03	0.31**	0.31**
	(4.01)	(0.28)	(4.47)	(4.48)
AGE-3, 4, 5	-0.7 E-02	-0.07	0.67**	0.66**
	(0.68)	(-.18)	(3.02)	(2.98)
AGESQ-3, 4, 5			-0.01**	-0.01**
			(-3.04)	(-3.01)
DGROUP-3, 4, 5	0.32**	0.44**	0.30**	0.29**
	(3.91)	(5.10)	(3.69)	(3.66)
Log-likelihood	-119.99	-111.68	-114.00	-112.58

[a]For variable definitions refer to text. A 1, 2 following the variable indicates it is from Group 1, 2 and a 3, 4, 5 specifies that the variable is from Group 3, 4, 5.

[b]T-statistic in parenthesis.

**Implies significance at the 0.01 level. *Implies significance at the 0.05 level. + Implies significance at the 0.10 level.

Table 3. Estimated Expenditures Elasticities Based on Results from Seemingly Unrelated Estimation Procedures.

Variable	Functional Form: Semilog	Double Log	Mixed Form	Double Log-1,2 Mixed Form 3, 4, 5
IPH-1, 2	0.31[a]	0.92	0.36[a]	0.94
CLAG2-1, 2	0.22	0.19	0.25	0.20
IPH-3, 4, 5	0.77	1.54	0.75	0.75
CLAG2-3, 4, 5	0.14[a]	0.03[a]	0.12	0.12

[a]Estimated coefficient for the underlying parameters was statistically insignificant at conventional levels in this functional form.

variable in the Double Log and mixed form equations. When estimated separately using OLS, the parameter for this age variable is insignificant (Table 1) at conventional levels. Yet, when the SUR methodology is used, the coefficient is significant and negative (Table 2). This and other aspects of the SUR results are discussed below.

An additional equation, labeled Double Log 1,2/Mixed Form 3,4,5 (DLM) is estimated using the SUR method and the results are reported in Table 2. The DLM specification combines the Double Log functional forms from Group 1,2 and the Mixed Form equation for Group 3 ,4,5. Based on t-statistics, these two forms appear to outperform the other specifications.

The remainder of this discussion focuses on the SUR results reported in Table 2. In these equations, the income coefficient has the anticipated sign and is significant in the Double Log form for Group 1,2 and in all forms for Group 3,4,5 (Table 2). Associated expenditure-income elasticities are reported in Table 3. In the DLM pooled equation, the expenditure-income elasticities for Group 1,2 and Group 3,4,5 are 0.94 and 0.75, respectively, indicating that a ten percent increase in per-household income in these states will result in a 9.4 and 7.5 percent increase in per-household expenditures on nursery products. The relatively high expenditure-income elasticities suggest that nursery products are non-essential items. Note that when income coefficients are statistically significant in the other functional forms, the expenditure-income elasticities are similar. The exception is for Group 3,4,5 in the double log form where the estimated elasticity is 1.54, twice that of the other forms. Salathe has argued that expenditure elasticities can vary significantly when differing functional forms are used that may explain the outlier value.

The expenditure-CLAG2 elasticity in the Group 3,4,5 DLM pooled equation is 0.12. This indicates that a ten percent gain in single family home construction starts per thousand existing homes results in a 1.2 percent increase in expenditures for each household, two years later. [2] For Group 1,2 the corresponding elasticity is 0.20. The effect of construction starts may be understated since the specifications consider construction data from a single year when the full impact of construction starts on expenditures may occur over a number of years. Further research could address this issue by using a distributed lag model (Judge *et al.*) to capture any multiple-year effects from construction starts.

In the Mixed Form and DLM specifications, reported in Table 2, the quadratic expenditure-AGE relationship is found to be significant and have the hypothesized signs (positive for AGE and negative for AGESQ) for Group 3,4,5. The Group 3,4,5 relationship indicates that expenditures will increase as AGE does, until AGE reaches 33 percent of the population and will decline with further increases in AGE. The effect of AGE in the states covered by Group 1,2 is opposite of that which was expected. Attempts to include other age groups (e.g., 25-34 years of age) in the specification resulted in multicollinearity problems. Moreover, when alternative age groups were entered into the specification without the current AGE variable (35-44 years of age) present in the Group 1,2 equation, the signs for the estimated parameters were also opposite those anticipated. The negative effect of AGE in these rural states is discussed below.

As shown in Table 2, the DED coefficient in the Group 3,4,5 equations suggests that individuals in

[2] Alternative lag times were tested in the model and it was found that the hypothesized two year lag was appropriate.

states covered by this group, having above average years of education, have higher levels of purchases than individuals in states with below average years of education. This result is consistent with expectations and supports the findings of Dunn, and Varner and Lalo. The relationship between education and expenditures in the rural states comprising Group 1,2 is insignificant in each of the alternate functional forms. The variable TIME is found to be a determinant of expenditures in both groups suggesting that household tastes and preferences have had a positive impact on expenditures over time. Alternatively, TIME may indicate that there is some unexplained variation in expenditure patterns that has not been considered in the model.

In evaluating the results for Groups 1,2 it should be noted that states in this grouping are those that are predominately rural in nature, having the lowest population densities in the nation and expenditures on nursery products relative to other states. In addition, construction starts per thousand households, age composition of the population, and education probably show little variation over time in many rural states. These considerations may account for the perverse results on AGE and the insignificant estimated parameter for DED. Data on individual consumers at the point of purchase are likely to provide an improved understanding of the relationship between age, education, and expenditures in rural areas. Alternatively, the possibility of unknown specification bias cannot be ruled out for the Group 1,2 portion of the analysis.

One final test was made to ensure that the effect of the explanatory variables did not change over the time period analyzed. The stability of the estimated parameters over the five time periods studied was investigated by using the Chow Test. One equation was obtained using observations from 1982 and 1977, and another using observations from 1972, 1967, and 1963. A test conducted to determine if parameters in the equations estimated from each of these two period are equivalent found that they were; thus, pooling across time periods is valid.

Discussion

Based on the regression results, it appears that the recent growth of the nursery industry has been dependent on the existence of higher income consumers and vibrant construction activity. A conducive age composition, higher educational level, and changes in consumers' tastes and preferences also appear to have influenced the nursery sector in suburban and urban areas. In assessing short-term growth potential, firms should focus on movements in the cyclic variables of income and construction starts, rather than the slow-moving trend variables of age and education. However, long-run growth may hinge on the economic, education, and age variables.

Since many states, particularly those in Group 3,4,5, are experiencing moderate growth in the construction of single family homes and income, it is anticipated that consumer nursery product expenditures may slacken in the near future. Industry firms should carefully monitor these variables and adjust their production and marketing plans to match expected consumer demand and market conditions. For instance, information about current construction activity is reported regularly in national and regional publications and is easily observed. Thus, firms could keep abreast of any developments in the construction industry and use this information to provide a basis to forecast sales over the next two years. When construction data are considered in conjunction with income, firms have a solid basis to guide current and future activities.

A discussion of income typically assumes that this variable will increase, but it is not unreasonable to realize a decrease. The effect of a decrease in income may not result in an equal, but opposite, effect as an increase in this variable. It can be argued that since nursery products are non-essential items, they may be the first to be eliminated when income falls. Thus, decreases in income or even construction starts, especially the former, might result in greater reductions in expenditures than equivalent increases in these variables. In an environment where incomes or construction starts may slacken, wholesale and retail firms should develop strategic marketing and merchandising plans to avoid sales declines when overall reductions in expenditures are anticipated.

The influence of age composition and education level of the population are more difficult to evaluate and not easily converted into recommendations for improved industry marketing. Even though movements in these two variables are easily observed and can be forecasted accurately, the results of this study have not provided a clear picture of their effects. In particular, in Group 1,2 the education coefficient was insignificant, while the impact of age in these states was opposite that which was anticipated. However, firms in the states which comprise Group 3,4,5, where DED and the age variables are significant and of expected sign, should be aware of the demographic characteristics of their customers in order to evaluate any relevant changes that occur. Research using individual observations on consumers at the point of purchase may result in a clearer understanding of the effects of age and education characteristics.

The results of this study can assist firms which plan to expand, develop new retail outlets, or market products at the wholesale level. If the expanding firm studies consumer income, construction starts, age, and education characteristics in alternative market areas, it can make an informed decision on store location. Wholesale firms can target market their products by concentrating sales force and advertising in states where they can gain market shares. In general, by observing changes in key variables and understanding the implications of these changes, astute managers can remain ahead of their competition. However, it should be noted that, due to data limitations, this study focuses on expenditures for a wide range of nursery products and that the determinants of some of the individual products could differ from those influencing expenditures on the aggregate group of goods. Thus, caution should be exercised when applying the results to the marketing of individual products.

SUMMARY

Consumer purchases of nursery products in the United States increased dramatically in recent years. Research identifying and quantifying the socioeconomic factors which influenced expenditures is sparse. Information on the determinants of nursery product expenditures can assist producers and retailers, particularly those in the southern states that comprise an important segment of the national industry, in planning production and marketing activities. This study developed Engel relationships showing the linkage between household expenditures on nursery products and the determinants of these purchases in different groups of states for the 1963-1982 period.

States were sorted into five groups based on their population densities. Whenever possible, observations from these groups were pooled to form aggregate equations. The estimated Engel relationship showed that per-household expenditures will increase as household income and single family construction starts, two statistically significant variables, increased. Age composition and educational level of the population were found to be important determinants of expenditures in the suburban and urban state portion of the analysis. Yet, the affect of the age and education variables on expenditures in rural areas was not significant.

Growth in the nursery sector over the next few years depends on the cyclical and more volatile factors of household income and construction starts. In states with favorable economic conditions (growing income and active building) consumer purchases should continue to grow. Any declines in business cycles or recessions which reduce income or dampen construction starts would have an adverse impact on expenditures. Consumer preferences, education level and population age composition are likely to have longer term implications for nursery product purchases. Frequent evaluation of these variables and the development of corresponding marketing and production plans is crucial to staying in front of competitors.

APPENDIX

Number of Retail Product Establishments and Sales in the United States.[a]

YEAR	ESTABLISHMENTS	SALES[b] (1,000 dollars)
1963	2,755	264,583
1967	3,030	393,022
1972	3,845	690,137
1977	6,920	1,580,532
1982	7,850	2,873,365
1987	10,692	5,410,774

[a]Census of Business - 1963, Census of Retail Trade - 1967-87.
[b]Sales include Christmas trees (natural), garden supplies and tools,lawn mowers,nursery stock, seeds and bulbs, sod, and topsoil.

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