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Analysis of the impact and importance of re-wholesalers in the ornamental market

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ANALYSIS OF THE IMPACT AND IMPORTANCE
OF RE-WHOLESALERS IN THE ORNAMENTAL MARKET

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ABSTRACT

Sales by ornamental nurseries in the United States have grown, recently, at an impressive rate. For example, sales of the greenhouse and nursery crops component increased about 18% from 2000 to 2006 (USDA, 2007). The evolution of a diverse set of market channel alternatives, including the garden center, landscaper, home center, mass merchandiser and re-wholesaler channels, has been one of the reasons for this growth. Knowledge about growers' use of the individual marketing channels is indispensable for the development of appropriate sales strategies for better income and profits. Periodic survey data indicates that the re-wholesaler channel is a frequently used alternative, and in recent years, there has been the perception that this is one of the fastest-growing channels in the industry. Utilizing a survey conducted in 2004, this study aims to estimate the impacts of growers' business characteristics on (i) market channel choice, and on (ii) proportion of producers' sales through each market channel, by firm size and by region. These objectives are achieved by using the multinomial logit model and the two-limit tobit models. The producer's choices about marketing channels and the proportion of sales through each of these channels are a function of business characteristics including firm age, categories of plants sold, trade shows attendance, contracts with specific kinds of buyers, and advertising expenditures. The estimated coefficients and marginal effects calculated for each model suggest that producers with a more diversified marketing strategy were associated with higher use of the mass merchandiser and garden center channel. Furthermore, producers selling specific categories of plants chose different marketing channels. Trade shows advertising had a strong positive impact on choice and sales to the re-wholesaler and mass merchandiser channels. The results demonstrate that sales to specific channel are affected by the location of the nurseries. Producers in the West used the re-wholesaler channel more than did producers in the South. Large firms in the Northeast behaved differently than large firms in the South when they used any marketing channel except for re-wholesaler. This study's results support the thesis that nurseries characteristics affect marketing channel choice and sales addressed toward specific middleman.

CHAPTER 1 – INTRODUCTION

Ornamental crops sales in the United States have grown at an impressive rate over the past years. The total value of sales of greenhouse and nursery crops increased about 18% just between 2000 and 2006, jumping from $13.71 billion to a $16.89 billion. During the same period, all the country regions show an increment on sales of about 21% in the Northeast, 23% in the Midwest, 20% in the South, and 26% in the West, according to the USDA (2007). These sales consider production of two components which in 2005 had the following participation segments: floriculture (33.1%) and nursery and other greenhouse crops including Christmas trees (66.89%). The floriculture segment is defined as the cultivation of ornamental and flowering plants. Meanwhile, nursery crops are goody ornamental trees, shrubs, and vines. This study will be focused in these two biggest segments (Table 1) leaving aside the Christmas trees segment.

Table 1 – Total grower sales of floriculture and nursery and other greenhouse crops, 2000 to 2006.

Year	Floriculture expanded wholesale value*	Nursery and other greenhouse crops
	----------1,000 dollars----------	
2000	4,576,585	9,133,679
2001	4,802,555	9,592,982
2002	5,089,514	10,091,025
2003	5,082,172	10,353,037
2004	5,284,643	10,835,595
2005	5,361,877	11,478,446
2006	3,995,847	12,896,087

Sources: USDA, NASS, Floriculture Crops; estimated by Economic Research Service (2007)
*Includes commercial growers with at least $10,000 in annual floriculture crop sales

The production in greenhouse includes the vegetable production which in 1998 represented only about 2.2% of the total (1998 Census of Horticultural Specialties). Therefore, considering a similar pattern for the years after the census, the increment of total sales is an indicator of the increasing nursery industry production and its importance in U.S. agriculture.

Part of the sales growth is due to the evolution of a diverse set of market or distribution channels. This increase provides the opportunity for the producers to have higher sales and a larger number of places to sell their products. The national nursery survey of 2003 (Brooker *et al.*, 2005) identified five main

marketing channels in this industry: mass merchandisers, home centers, garden centers, landscape firms and re-wholesalers (also known as horticultural distribution centers (HDCs).

Furthermore, there are other reasons for the increasing sales of ornamental plants. A study in Florida argues that the population growth, disposable personal income, and building activity are considered as the three main economic reasons influencing demand for the environmental horticulture industry and ornamental crops (Hodges and Haydu, 2003). This demand is also affected by the increment of real per capita income that likely means greater purchases of this kind of luxury goods.

Despite these important factors, producers are increasingly faced with challenges on where to sell their products. Therefore the marketing channels represent a very important component for the industry. The presence of different class of wholesale channels offers a variety of opportunities to the producers and will influence their selling decision about quantity and kind of product. The producer's decision regarding the amount of production per year generally is based on the analysis of future demand of each channel. Consequently, the knowledge about the individual participation of the marketing channels is indispensable for the development of an appropriate sales strategy to generate better income and profits. Furthermore, each channel has different requirements, scope in the market, preference of products, and terms and conditions of sales. As well, within this variety of channels, some have had more growth than others (Hampton, 2001).

The competition generated between wholesale outlets (market channels) improves the producers' productivity because of the consecutive higher quality requirement of these outlets. In addition, real wholesale prices have decreased by a range of 3% to 15% for most of the major floriculture commodities in the United States from 1992 to 2002, which reflected increased industry competition as mass merchandise retailers consolidated markets, lowered prices and gained a larger share of the market (Hodges and Haydu, 2003).

Therefore, this productivity is also affected by the growth of mass-market sales in big discount stores and supermarkets, which encourage crop specialization and price competition among growers, and fewer crop varieties are grown in larger quantities (Jerardo, 2006; Stegelin, 2007). According to Navajas (2003), in theory, large nurseries would be chosen as businesses' partners by large mass merchandisers. They prefer to deal with fewer nurseries because of the transaction cost increase with larger number of suppliers. Furthermore, large growers are able to supply the products demanded at lower cost to the final client. Another reason is the availability in quantity of a standard product. However, there is a limited number of this type of growers that handle enough volume to supply their clients. This situation might be the reason for use of some marketing channels, such as the re-wholesaler channel. Re-wholesalers are defined as "specialists that buy from the finishers and hold in a display yard" (Garber, 2000). Firms in this marketing channel buy the necessary products from numerous growers with the objective of enabling their customers, especially landscapers, to get the products and items they need for jobs at one place, being considered essentially a nursery middleman (West, 2002).

Re-wholesalers also may be producers who sometimes raise plants and buy from other growers. This is another organizational alternative to growers, who could expand their scope in the market to operate also as a re-wholesaler. However, the risk related to the market channel choice might affect this decision since producers becoming only re-wholesalers and not selling to other outlets with increasing market share, "face the risk of being left out of the growing marketing channel segment" (Navajas, 2003). In that case, producers prefer to specialize and address their resources to the production process instead of vertical integration, in order to improve the quality of their products and leave others take care of the marketing activities; thus, nurseries have more flexibility when they need to choose among different alternative of outlets.

Regarding the marketing and trade practices, in the ornamental nursery industry, surveys were conducted in 1999 and 2004. The "Trade Flows and Marketing Practices within the United States Nursery

Industry: 2003" report included one of four mail surveys used in the United States since 1990 (Brooker *et al.*, 2005). The 2003 survey's result tables have information in percentage about the number of producers (firms) and the amount of sales per year; furthermore that data was classified by wholesale outlet and state. The total sales of producers represent valuable information about the importance of the re-wholesalers. The average percentage of total sales across states was led by landscape firms (33.9%), followed by the re-wholesalers (25.9%) and garden centers single location (15.2%) (Brooker *et al.*, 2005). According to these results, the re-wholesalers seemed to be a significant market channel in the country, regarding quantity of sales for the last years and within the ornamental market for the success of producers as well.

Although the importance of re-wholesalers in the industry is established, few studies were conducted to demonstrate the performance of this channel in the ornamental market at a national level. For instance, the marketing practices nurseries were analyzed in 2001 using the data obtained in three past surveys of 1989, 1993, and 1998 at a state level (Louisiana). The explanation of this study rests on a set of information available for producers about the market participation, operations and efficiency by re-wholesalers.

Problem Statement

Since one factor in producers' success is their relationship with the wholesale market channels, a complete understanding regarding the characteristics and preferences of the market/distribution channels is needed to keep their business on the right path based on tendencies in the industry.

Producers face the decision about where to allocate their products based on production capacity and business characteristics because each marketing channel has specific quality, prices and quantities conditions, all included in the contract terms (Navajas, 2003). The different scope and requirements of each channel represent a challenge for the producers to choose the most appropriate combination of products if they are not familiar with the channel's characteristics. The lack of detailed information about

activities, market participation, tendencies and opportunities is a barrier to 'optimal' producer decisions and financial results.

Problem Justification

Certainly, the solution for this problem will have an overall impact in the economic situation of the ornamental nursery market and the business of nursery growers, representing an excellent opportunity to improve the efficiency of production, sales, profits, and security to generate a better relationship between price, quality, quantity, and service for the final client.

The results obtained in this study will provide useful information and knowledge to producers about the distribution of the re-wholesaler channel, market operations and tendencies for coming years. Furthermore, for producers, a better understanding of their relationship with the outlets will contribute to better management strategies, production systems and offer service improving quality and price which will imply greater sales. The application of these implementations will improve the efficiency not only of the producers, but of the overall system as well. Therefore, the more efficient the ornamentals system's producers are, the more benefits the final consumer will have. The consumer will receive products with desired characteristics and with lower prices.

Objectives

The proposed study addresses the relationship between the producer's business characteristics, their major channel choice as measured by percent of wholesale sales, and the proportions of wholesales sold through each of the market channels. The specific objectives are the following:

1. To describe changes in market channel and business practices use by producers based on survey conducted in 2004.

2. To estimate the impacts of business characteristics on (i) market channel used, and on (ii) proportion of producers' sales through alternative market channels, with a focus on the re-wholesaler channel

a. by size of the producer firm as measured by sales, and

b. by other factors including regional comparisons.

CHAPTER 2 - LITERATURE REVIEW

Characteristics and Situation of Wholesale Outlets in the Nursery Industry

The marketing of agricultural goods represents a functional process that lets producers efficiently allocate their products in the market. This represents a business activity where goods and services flow from the production unit point to where the final consumer is reached (Kohls and Uhl, 2002). The flow of products through marketing channels represents one of the most important components within this process of commercialization. The number, type and use of the marketing channels may vary with the characteristics of the industry and the geographic area where they operate. For instance, Figure 1 shows the flow of ornamental products by region through the five market channels identified in the 2004 National Nursery Survey. At a national level, landscaper was the channel with the highest percentage of sales with 32%, followed by re-wholesalers with 26% (see Appendix B).

Source: Multi-state regional Project S-1021survey, 2004
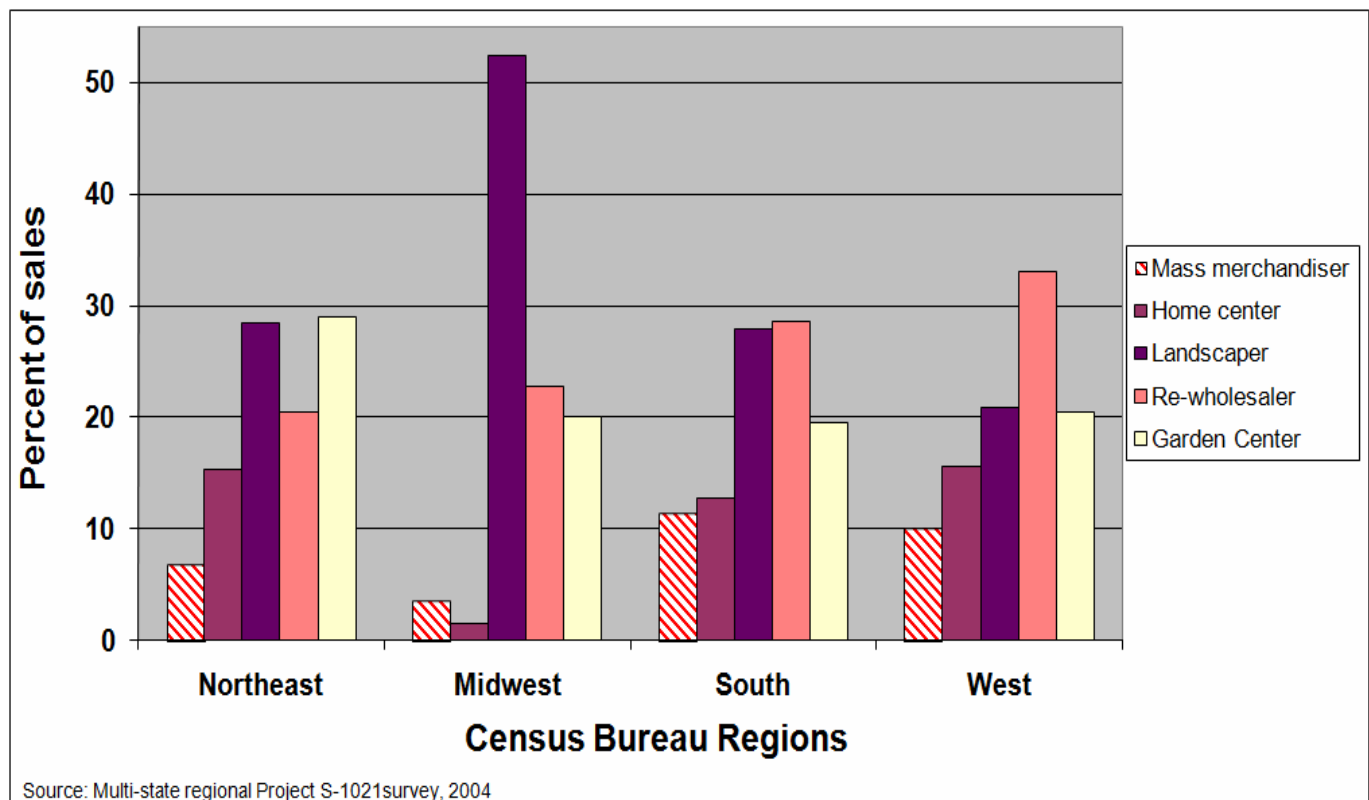
Figure 1 – Percent of sales through wholesale channel, by region

The Midwest presented a similar pattern with 52% of sales made through the landscaper channel and 23% through the re-wholesaler channel. Interestingly, re-wholesaler was the largest channel in the South

(28%) and the West (33%). Hodges and Haydu (2006) also analyzed the situation of wholesale sales in the nursery industry and concluded that, in Florida, re-wholesaler and landscaper were the marketing channels most used in 2003 with 64% and 57% of the total number of firms, respectively.

In recent years, there has been the perception in the industry that the re-wholesaler channel (including horticultural distribution centers) is the channel contributing most to industry growth, and that it represents one of producers' main options to sell their products. Results above confirm the importance of the re-wholesaler channel, but indicate that it lags the landscaper channel in total number of firms.

The re-wholesaler channel has particular business characteristics and activities that differentiate it from other channels. Garber and Bondari (2000) confirmed that horticultural distribution centers (HDC's), which serve mostly landscaper channels and generate profits by adding value to the product bought from growers, represent a very important customer to nurseries. Furthermore, an HDC's wide product inventory means that customers can make one stop rather than going from producer to producer to find everything they need (Scullin, 1997). Thus, location and service basically help to increase sales and customer loyalty. For this reason, some landscapers and retailers see re-wholesaler channel as a convenience store to the nursery industry, with prices slightly higher than if sourced directly from producers but located in convenient metropolitan areas (Volkmer, 1988). The HDC strategy of holding large quantities of product lets these middlemen pay a lower price to the producer. At the same time, facilities large enough for these inventories and convenient to potential customers can be significant expenses. HDC's and other re-wholesaler channel are attractive because growers often are more interested in production than marketing activities and generally prefer to invest their time in producing a good-quality product. Bigelow (1989) argued that large-volume buyers are preferred by most growers, so producers can concentrate on growing rather than marketing (Urbano, 1989).

Moreover, this large demand of products forces producers to know re-wholesaler channel's requirements to ensure a good and efficient client service. For instance, Garber and Bondari (2000)

argued that producers could improve their service if they had a better understanding of current and future industry needs. Consequently, at the time of taking the production decision about product mix, producers should consider the possible changes in the HDC's plant material requirements.

Even though one definition states that re-wholesaler channel is only middlemen focused on marketing strategies and activities, some re-wholesalers begin as growers and then vertically integrate to become middlemen as well. Integration is defined as "the alignment of direction and control across and segments of a production/marketing system" (King, 1992). However, growers would need to consider many factors before integrating the firm. The degree of integration would be important (Hudson, 2000). Another consideration is that re-wholesalers generally are located near metropolitan areas where production land is costly (Hampton, 2001). Therefore, these two situations faced by producers may be the fundamental reasons to focus only on the production process.

Producers must decide on the single or combination of outlets channels that gives the highest benefits considering the firm's constraints. But this step is not simple since nursery firms have a diverse set of variables and characteristics affecting this decision. For instance, Ingram *et al*. (1980) affirmed that before producers start a business activity, the characteristics of market demand for nurseries products must be defined. Furthermore, factors like size, diversity and location determine the species and size of plants to be produced, and outlets in different areas or regions might provide better markets for these products. Generally, it is observed that large nurseries focus on expanding their market to regional or national channels, while medium or small nurseries tend to market more locally. Small growers also could compete in other areas if they produce and sell specialty plants (ground covers, specimen plants, or plants with unusual characteristics), liners and propagation materials to large wholesale producers. Otherwise, plant diversification is necessary to supply regional retail outlets.

Marketing channels have different tendency about the type of plants they sell and who are the suppliers of those products. Since large and small firms have some differences about the categories of

plants they grow, business relationships between marketing channels and producers will tend to be affected by these categories and firm's size. For instance, Hampton (2001) affirmed that mass merchandisers typically sell, among others categories of plants, annual and bedding plants and are expected to do business with large nurseries. Furthermore, he stated that small and large producers grow a similar mix of plants. However, large firms typically produce more of these plant categories: annual bedding plants, evergreen trees and broad-leaved evergreen shrubs.

Hinson and Turner (1994) hypothesized that marketing channel choice was influenced by firms' characteristics such as age and size, propensity to negotiate, market channel diversification strategies, organizational structure, competitive pressures and location of the nursery. Size was assumed to influence producers' business partners and the amount of gross sales was used to identify large and small nurseries. In their study, large firms were expected to negotiate with retailers and small nurseries to sell their products directly to retail customers. The flow of wholesale sales to each channel also was based on the number of trade methods used (negotiation or marketing channel diversification) and the willingness to negotiate. Higher levels of price negotiation were associated with higher levels of sales to re-wholesalers.

In summary, producers' decisions about the adoption of the most convenient marketing strategy depend on the characteristics of the firm (age, size, type of plants, etc.) which guide the nurseryman in this selection. Therefore the estimation of the possible effects of each characteristic in the choice of the channel could enhance the marketing functionality in the ornamental industry and improve the service quality and price to the final consumer.

Marketing and Trade Practices in the Ornamental Industry: National Nursery Survey Characteristics

Historically, information related to marketing in the ornamental industry from producer's perspective has been limited (Brooker *et al.*, 2000). This need for information led the Multi-state Regional Project S-1021 (a research committee of horticulturists and agricultural economists from land-grant universities who conduct research in the green industry) to initiate a continuing effort on collecting information about

growers' marketing and trade practices. Producer surveys were conducted in 1989, 1994, 1999 and 2004. Although these surveys have kept similar structure, there are some differences in selection of participants and minor changes in specific questions and organization. In general the structure of the surveys was built with the following sections:

- General profile (age, size, employees),

- Production systems, agricultural and IPM practices and plant categories,

- Sales (percentage of sales, producer's sales by type of wholesale outlet, selling methods, type of market: in-state, national),

- Price determination (cost of production, inflation and market demand),

- Limiting factors to firm expansion (debt, personnel, production),

- Advertising practices and expenditures (radio, trade shows, catalogs).

Following each survey, a general descriptive document on trade flows and marketing practices was prepared.

The questionnaire of 2003 requested producers to provide percentage of total annual sales distributed among retailer and wholesaler channels. A total of 44 states participated in this process. Of respondents, the response rate to the sales question was very high with 94% respondents. On average, 76% of firms made wholesale sales and 59% made retail sales (Brooker *et al.*, 2005). The wholesale outlets were divided into six categories with their importance varying by the region where they were located. For example, re-wholesaler channel had high market share in Hawaii (85%) compared to Montana (58%) and other states. In Louisiana, Texas, California, and Florida, this outlet had an average of 40%, 18%, 17%, and 34% of the wholesale sales, respectively. Missouri was the state with the highest percentage of share of wholesale sales addressed to landscape firms (89%). California and Florida had only 26% and 29% of participation, respectively. These results showed the different patterns in the use of the channels by each state.

Respondents reported the percentage of total sales that producers committed to a particular customer before being planted. The average of sales made using production contracts was 15%. This result indicates that contract is not an unusual activity used by producers to guarantee the sale of their products and for the customer to ensure the provision of the desired products.

Since the adoption of computer technology has continuously increased for production and marketing activities, producers were asked about the use of computer functions on their operations. The main computer functions used were: word processing (66%), accounting/cost analysis (59%), inventory (40%), communications/e-mail (60%), production scheduling (18%), and bar coding (10%) (Brooker *et al*., 2005).

Previous Research of Producers' Marketing Strategies

Hampton (2001) evaluated the use of wholesale channels in Louisiana using data from the 1998 National Nursery Survey. Ordinary Least Squares (OLS) model was run to estimate the impact of the firm's business and market characteristics on marketing channel use. The explanatory variables assumed to explain the proportion of sales through each of the marketing channels (dependent variable) were acres, advertising expenditure, age of the business, contract production sales, in-person sales, in-state sales, repeat customer sales, percentage of sales made by telephone, level of computer use (> three computer applications) and market diversification (> four channels used).

A variety of incentives would affect producers' preferences and decisions about using one or another channel. Hampton (2001) analyzed the potential suppliers of the channels and affirmed that, traditionally, producers preferred garden centers customers, who are typically less price sensitive because their competitive position is based partly on quality. As another preferred channel, landscapers offer services to the client that add value to the nursery products and are less price sensitive. In the case of mass merchandisers who sell under a high volume and low price retail strategy, suppliers usually have contracts and/or long term business relationships in which price level is a key factor. Similarly, re-wholesalers are

usually very price sensitive since they need to be competitive in the market. As a result, producers prefer to sell their ornamental products to less sensitive channels such as landscapers and garden center retailers. Hampton considered garden centers and landscapers as core marketing channels and re-wholesalers and mass merchandisers as growth marketing channels.

In addition to the previous considerations, growers' business characteristics were also fundamental factors affecting producers' marketing channel use. Generally, smaller producers were expected to concentrate ornamental sales in core marketing channels using local and regional trade shows, walk-in customers at the nursery site, and telephone sales, as main marketing activities. Meanwhile, larger nurseries may attend more and larger trade shows, and use more active sales tactics (outside salespeople), but still prefer to serve core marketing channels because margins are better. Re-wholesaler and mass merchandiser channels offer growth opportunities through volume of sales, but at lower margins per unit (Hampton, 2001).

Therefore, small and large nurseries face different type of limitations and the use of marketing channels was expected to vary with the nursery size. Separate econometric models for each channel by small and large firm were estimated using sales of $200,000 as the dividing line. This level of sales was determined based on available sales categories and sample size requirements.

These models also were applied separately for Louisiana and Gulf-states data series to compare behaviors of Louisiana respondents to behavior of growers in similar, nearby states.

Louisiana Econometric Model Results - 1998 Data Set

In Louisiana, small producers reported that shares of sales were to re-wholesaler (35%), garden center (27%), and landscaper channels (27%). For large nurseries, the leading channels were re-wholesaler (31%) and garden center (29%).

The following section includes results obtained from Hampton and shows the economic relationship between explanatory variables and sales.

Small Nursery Model Results

In this section, only statistically significant variables are listed.

- Mass Merchandiser Model – In this model, none of the parameters was significant.

- Garden Center Model – The variables contract, telephone sales, and in-person sales were negatively related to the percentage of sales to this channel, while in-state sales and sales to repeat customers were positive.

- 'Other' Retailer Model – In this model, none of the parameters was significant

- Landscaper Model – The variable age had a negative impact on sales to this channel.

- Re-wholesaler Model – The variables firm age, contract production, in-person sales, and telephone sales had positive impacts on sales, while the channel diversification had a negative impact on portion of sales.

Large Nursery Model Results

- Mass Merchandiser Model – The variables production contract and marketing channel diversification variables were positive.

- Garden Center Model – The variable computerization had a positive value. Contract sales and in-state sales had, respectively, a negative and positive impact on percentage of sales.

- 'Other' Retailer Model – Contract production had a positive value.

- Landscaper Model – In this model, none of the variables was significant.

- Re-wholesaler Model – This equation showed a negative value for the computer function estimate. The variables channel diversification and in-state sales had a negative impact on the percentage of sales to this channel.

<u>Comparison and Contrast between Louisiana Small and Large Nursery Results</u>

Small Nurseries – The landscaper channel equation was expected to obtain many significant estimates results, however only the parameter of the firm age variable had a significant effect on sales to this channel. Furthermore, age followed the expectations of a positive effect on sales to re-wholesalers.

The variable contract sales in the re-wholesalers equation had a positive impact on sales. Nevertheless, this variable had the expected negative sign for garden centers.

Telephone sales estimate had a negative sign in the garden center equation, contrary to the expectations for small nurseries. For re-wholesalers this variable had a positive impact on sales.

The only significant channel diversification variable for small firms was obtained in the re-wholesaler equation with a negative sign.

For mass merchandisers, the lack of significant parameters in the model confirmed the expectation that this channel tended to negotiate with large instead of small producers.

Large Nurseries – The expectation that large firms pursued a diversified marketing strategy was confirmed by the significant positive sign of the channel diversification variable in the mass merchandiser channel equation. However, this variable had a negative sign in the re-wholesaler equation.

Production contract sales had the expected negative impact on sales to garden center. This variable in the mass merchandiser and other retailers channel equation had a positive sign.

For garden centers and re-wholesalers, the unexpected positive result was obtained for the computerization variable, implying that this kind of firms were more likely to sell their products to these channels when they used three or more computer functions.

Furthermore, the negative parameter of the in-state sales variable implies that large nurseries in Louisiana sold products primarily to out-of-state re-wholesalers as was expected. This variable had positive impact on sales to garden center.

Gulf-State Econometric Models and Results – 1998 Data Set

Models for small and large nurseries were also applied to combined data from Alabama, Georgia and Texas, for comparison with the Louisiana results.

<u>Small Nursery Results</u>

- Mass merchandiser model – None of the variables were statistically significant.

- Garden center model – None of the variables were statistically significant.

- 'Other' retailer model – In-person sales and on-telephone sales variables had negative estimates. In-state had a positive effect on the percentage of total sales.

- Landscaper model – Advertising expenditure had an unexpected positive sign. Contract production had negative impact on sales.

- Re-wholesaler model – A negative value was obtained for marketing channel diversification.

<u>Large Nursery Results</u>

- Mass merchandiser model – The estimates of contract production and the use of four or more channels, had positive impact on sales.

- Garden center model – In this model, the intercept and contract production sales had a positive and negative sign, respectively.

- 'Other' retailer model – In this equation none of the parameters was significant.

- Landscaper model – Advertising and in-state sales had a positive sign. On the other hand, repeat customers, contract production, and marketing channel diversification were negatively related to the dependent variable.

- Re-wholesaler model – In this equation, age had a positive sign; meanwhile channel diversification obtained a negative value.

Comparison and Contrast between Gulf States Small and Large Nursery Results

Small – None of the variables of garden centers and mass merchandisers were significant. However the variable in-person and telephone sales had a negative impact on sales to other retailers. The variable advertising expenditure was positive in the landscaper equation, and the variable contract production had an expected negative impact on sales.

The use of three or more channels positively affected the sales to re-wholesalers. Therefore small firms with a diversified marketing strategy will sell more to this channel.

Large – The diversification channel variable had an expected positive and negative effect on sales to mass merchandisers and landscapers, respectively. For large firms, the use of four or more marketing channels reduced the percentage of sales to re-wholesalers.

A positive impact on sales to mass merchandisers was obtained for the contract production variable. However, this variable had a negative sign in the garden center and landscaper equation.

An unexpected positive sign for large firms' equation was obtained for the advertising variable, meaning that advertising expenditure will be directly related with the sales to landscapers.

The age variable had an expected positive impact on sale to re-wholesalers.

Comparison and Contrast between Louisiana and Gulf States Results

The results from the mass merchandiser channel equation in the Gulf-states had similar behavior to Louisiana, so this channel also did not tend to negotiate with small firms. As expected, the use of production contracts and a diversified marketing strategy positively affected large firms' sales to mass merchandisers. On the other hand, sales to garden centers declined when large firms included production contracts as a transaction method. The 'other' retailer channel equation for small firms obtained more significant parameters than the equation for Louisiana. This equation confirmed a significant negative impact for the two major transaction methods, in-person sales and sales over telephone. Therefore, if the small nurseries' sales increased, the percentage of sales through this channel decreased.

The landscaper marketing channel equation showed some unexpected results and many significant estimates mainly for large firms. The expenditure on advertisement favored the sales of both, small and large firms, to this channel. This positive sign for both firms did not follow the expectations because it was believed that advertising would negatively affect the sales to core channels. For large firms another unexpected sign was obtained for the repeat customers' parameter which had a negative effect on sales to this channel. Contract production parameters for large and small firms followed the expectations of negative impact on sales to landscaper channel.

For re-wholesalers, an unexpected negative value was obtained for the marketing diversification variable for large and small firms. That is, the proportion of sales to re-wholesaler channels declined if any producer used four or more marketing channels. Therefore a diversified marketing strategy would first consider other channels before re-wholesalers. The parameter for age followed the expectation with a positive sign for large firms.

Hampton concluded that Louisiana nurseries had an active business relationship with re-wholesaler channel, showing that this middleman was a core channel for large nurseries and a growth channel for small producers.

Analysis of Regional Differences

It is expected that data analyzed by region generate a better explanation of the marketing practices and their situation in each region. However, in the nursery industry, there is limited research about regional differences on marketing activities. Garber and Bondari (2000) reported that the regional/geographic differences in horticultural distribution centers (HDC's) had not been analyzed in the lawn and garden center industry before their work. They included regional distinctions to determine differences in factors that influence HDC's choices of plant purchases and a way for growers to become better suppliers. Data obtained from 158 members of the HDC committee of American Nursery and Landscape Association (ANLA) in 1998 were analyzed by region (Northeast, North Central, Southeast and West). Results

suggested that HDC's selected plant suppliers based on plant quality (89%), delivery on short notice (23%), and price (22%). Among the regional differences, price had greater importance in the West and South regions than in North Central and Northeast regions, while product delivery on short notice had special importance in the Northeast and Southeast regions. These results emphasize regional differences in factors that affect producers' marketing decisions.

Hall and Pate (2000) highlighted that the production of greenhouse and nursery products was concentrated in the West and South regions mainly due to climate and demand factors (proximity to population areas). So, regional concentration of production and consumption of ornamental products might affect the marketing strategy of producers and encourage a higher development of a specific marketing channel in each region.

Hinson and Turner (1994) argued that being located in the Southeast and West may influence the marketing channel choice because of the longer production season and that large producers often have been located there. Moreover, states in these regions had higher level of sales to re-wholesaler channel than states in the Midwest and middle South.

Econometric Models in the Ornamental and Agriculture Industry

Econometric models have been broadly used to estimate economic relationships in agricultural sectors. Selection and estimation of a particular model depends on the data, theory and objectives of the study. For this study, two models (two-limit tobit and multinomial logit) were considered appropriate for the proposed objectives.

Since the multinomial logit model (MNL) has been used to estimate the choice taken by individuals when they face more than two options, this model was applied to determine the type of relationship between business characteristics and marketing channel choice by describing and comparing the regional use of marketing channels by large and small firms.

The objective of estimating the changes in the proportion of sales through each marketing channel was achieved by using the two-limit tobit model. This model was considered to be appropriate for this study, since the dependent variable is limited to values between 0 and 1.

The following section includes a review of selected studies that used these models to estimate relationships.

Multinomial Logit Model

There are few studies where this model was applied within the nursery industry to determine the producer's marketing decisions. However some agricultural and food studies included it to obtain the probability of choosing an option among other alternatives.

Gillespie *et al.* (2006) used the multinomial logit model to estimate the adoption rates and the reasons for non-adoption of 16 best management practices that prevent soil runoff in the beef cattle industry. Grassed waterways, nutrient management, pesticide management and others types of BMPs were the included in this study. In this survey the description of each practice followed the question "Do you use this practice?" where the producers needed to mark one of eight potential answers (i.e. "no, it costs too much"; "yes, at my own expense"; "no, it doesn't apply to my firm"; etc.). These answers represented the choices faced by the cattle producer. In this study, producers' responses were expected to depend upon individual characteristics as age, size, sex, household income or other factors. The authors affirm that the estimates obtained from this model could be used to provide information on the likelihood of individual alternative (answer) choices over the other. However, this study only included the estimation of marginal effects in the results section, where older firms were more likely to have adopted grassed waterways (+) and less likely to answer non-applicability (-) as the reason of not adopting it.

In another recent study, Park and Lohr (2006) applied the multinomial logit model to determine the marketing outlets used by organic producers. The authors reported that the multinomial logit (MNL) and the maximum likelihood procedures provided a framework that supports the use of discrete models for

dealing with selectivity effects and for estimating its parameters. Their paper identified in one stage the factors influencing the farmer's distribution outlets choice and in a second stage, based on the results of the MNL model, how the outlet decision affected their income. In the first stage, farmers chose among three set of alternatives conformed by a combination of the following three marketing outlets: direct-to-consumer (producer's market), retailers (restaurants and/or supermarkets) and wholesalers (supermarket chains). The three alternatives considered were (a) using a single outlet, (b) using two outlets and (c) using a diversified set of the three outlets. In this study, the dependent variable was the logarithm of total gross income from organic production and was estimated based on explanatory variables like acreage (size in acres), labor (managers, full time and part time employees), years certified as an organic farm, etc. The coefficients obtained from the results showed the effect on the probability of using either marketing outlet (a) or (c) with respect to (b). The variable acreage had a positive and significant impact on producer's choices of marketing through a single channel or through all three outlets. Therefore, larger producers were more likely to use option (a) or (b) to market their products.

Marshall and Pushkarskaya (2007) analyzed how tobacco producers spend a government compensation after the Congress eliminated a price support and a quota buyout program for this commodity. In their study, producer's expenditure decisions were expected to be a function of producer's age, education, income and other lifestyle variable. A multinomial logit model was used to estimate the producer's decisions among four expenditure options (debt, business, invest and undecided), where debt was the reference alternative. The theoretical framework was supported on the economic theory of utility maximization where subjects make decisions considering the best alternative use of their resources. As an example, the results from this model found that having a Bachelor's degree positively affected expenditure selection. That is, farmers with this education degree were more likely to choose to start or expand a business or invest financial assets or a retirement fund than to pay off debt with the money received from the government.

In the agro-food sector, the MNL model was used to explain beef buyer's outlets selection. The outlets were grouped into supermarkets, butchers, warehouse supercenters, and other outlet (Medina and Ward, 1999). Since the outlet choices represented alternatives without order or ranking the use of the multinomial logit was appropriate to explain the outlet selection mobility. The outlet choice was expected to vary across the demographics and types and quantities of food purchased, which represented the explanatory variables in the model. The results showed that most of the variables were statistically significant but had different impact in dependent variable. For example, household income negatively affected the choice supermarket but had a positive impact on warehouse. Therefore, movement to largest income group guides to decline the use of supermarkets.

Previous references support the use of these two econometric models because relationships among variables and attributes of the dependent variable are consistent with the present study.

Two-Limit Tobit Model

Previous research about the effects of business characteristics on sales through marketing channels in the ornamental industry have been applied to different problems. For instance, Hinson and Turner (1994), using data collected from the National Nursery Survey of 1989, estimated the proportion of sales allocated by the producer to each marketing channel. The coefficients of the explanatory variables were estimated and evaluated using the tobit model and the standard t-test.

However, some studies have demonstrated that in cases where the dependent variable is a proportion with values between 0 and 1, the use of the two-limit tobit model is justified. Hobbs (1997) used this model in the marketing of beef products to estimate how transaction costs and farm characteristics affected the choice between two marketing channels options (live-ring and direct deadweight sales). In this case, farmers could choose to sell all, a proportion, or none of their cattle through any of these two outlets. The selection of the channel may be affected by the transaction costs imposed on the seller. Therefore, the dependent variable represented the proportion of cattle sold through live-ring auctions,

which was estimated based on transaction costs (information, negotiation and monitoring costs) and farms' characteristics (education, age, experience, etc.). Because the dependent variable was censored at both an upper and lower limit, the two-limit tobit model using maximum likelihood regression was the appropriate analytical approach to use. However, the interpretation of the coefficients for tobit model is complicated because the censoring component and the calculation of the marginal effects is recommended. In this case, the author showed only two components of the McDonald-Moffit decomposition for the calculation of the effects of a change in a explanatory variable on the proportion sold of cattle: "a) change in the dependent variable of observations between the limits weighted by the probability of being between the limits and b) change in the probability of being between the limits, weighted by the expected value of dependent variable if between the limits". The extension of the original McDonald-Moffitt decomposition (third component) needed for a two-limit tobit model was not included in this analysis.

In this study, the grade uncertainty variable (factor within the monitoring costs) positively influenced the proportion of cattle sold through auctions. The calculation of the marginal effect of the estimate of this variable revealed that an increase of one unit in grade uncertainty led to an increase of 6.2% in the proportion of cattle sold in the auction ring, which correspond to a decrease in the proportion sold to packers.

A similar procedure was applied by Mensah (2005) to examine the impact of farmer characteristics (total acreage, land tenure experience and farmer attitudes towards risk) on the decision to adopt and the intensity of adoption of Roundup Ready soybean technology. In this study, the dependent variable had a censored distribution (between 0 and 1) and represented the proportion of the farmer's total acreage used for this technology. In this case, the three effects of the McDonald-Moffit decomposition were used because the coefficients of the dependent variables in a two-limit tobit model cannot be interpreted directly as estimates of the magnitude of the marginal changes. Thus, the interpretation of the total

marginal effect considers the fact that a change in an independent variable will affect simultaneously the number of participants, and the land allocated to RR soybean by current and new adopters of the technology. The results showed that among other variables, years of farming and farm size had significant and positive impact on the adoption of the new technology. The interpretation of the total marginal effect for the years of farming affirmed that an increase of one unit in this variable will increase by 16% the total acreage of land cultivated with RR soybean.

In another study, the two-limit tobit model was estimated to examine the factors that influenced the adoption of genetically engineered crops and precision agriculture in corn and soybean production (Fernandez-Cornejo *et al*., 2001). This model was used because the dependent variable was the proportion of the acreage that used the new technology. Again, in this case the dependent variable was regressed against factors like farm size, farmer risk attitudes, education, land tenure and a regional dummy variable to consider farm location. According to the extension of the McDonald-Moffit decomposition, the total marginal effect of a two-limit Tobit equation has three components equal to a weighted sum of: a) change in the probability of adoption, b) change in the percentage of acreage under adoption for farmers that have already adopted, and c) change in the probability that 100% of the acreage is under the technology adoption. In this paper, the results were expressed in the form of elasticities with respect the significant dependent variables. Thus, an increase of one percent from the mean farm size (harvested acres) led to an increase of 0.258% in the expected proportion of corn acres planted.

Theoretical Framework

The analysis of economic theories is necessary to understand the behavior of sellers and buyers in the market. This social science explains the conduct of individuals at the time of making production and consumption decisions to obtain the highest benefit. Thus, knowledge of theory is indispensable to identify the relationship between demand and supply and the variables affecting their equilibrium.

The discussion below is general taking from Microeconomics textbooks (by Pindyck, 2001 and Perlof, 2004) and other related studies.

Preference Theory

The demand of goods or services reflects consumer's decision of buying a particular product based on the level of utility obtained by that choice. In terms of economics, utility is a term used to measure the satisfaction or preference of consuming a particular bundle of goods or services. This method assumes that people make decisions rationally and is the base of explaining consumer behavior. The consumer preference theory is evaluated considering six axioms: a) Preferences are complete, b) preferences are reflexive, c) preferences are transitive, d) preferences are continuous, e) non-satiation, and f) diminishing marginal rate of substitution.

The first axiom affirms that consumer establish a preference for one bundle to another ($A^P B$) or ($B^P A$) or is indifferent among the two options ($A^I B$). The preferences are reflexive when two bundles are equal (A=B) and consumer is indifferent on choosing A over B or vice versa. Transitive states that consumer preferring one bundle over a second ($A^P B$) and the second bundle over a third one ($B^P C$), he or she must prefer the first bundle over the third bundle ($A^P C$).

The preference is continuous when consumer choosing bundle A over B, also chooses A over C, if C lies in the proximity or in the same indifference curve of bundle B.

The fifth axiom states that consumer prefers a bundle with more quantity of goods over another with less quantity of products. Consumers always prefer more consumption because they are never satisfied.

Finally, consumers of nursery products face diminishing marginal rate of substitution when they must sacrifice successively less of one good (i.e. roses) to obtain an additional unit of other good (i.e. any other ornamental plant), holding utility constant.

Thus, the marginal rate of substitution (MRS) reflects the rate at which the consumer is willing to exchange one good (product x) for another (product y) and is equal to the slope of the indifference curve.

This curve represents the combination of two goods that provides a constant level of satisfaction and is symbolized by Ic in figure 2.

The demand of products is determined by considering consumers' limitations. The amount of consumption of products is found when consumers' preferences equal their budget constraint, which in figure 2 is represented by line Bc. Since the individual is subject to a fixed budget, the maximum consumption in a perfectly competitive market is obtained when the MRS equals to the ratio of price of product x over the price of product y represented by point A in figure 2.

$$\frac{\Delta_X}{\Delta_Y} = \frac{P_X}{P_Y} = MRS_{xy}$$
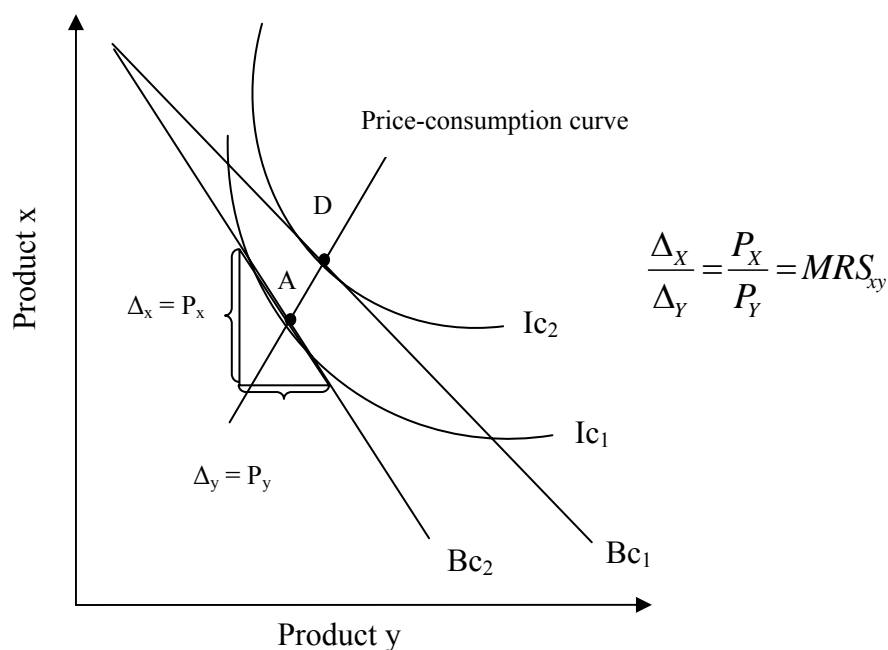
Figure 2 – Indifference curves and budget constraint

Changes in prices of one product while holding constant the price of the other will modify the slope of the budget constraint. For instance, a drop in price of product y makes this product cheaper and consumers may buy more of it with the same budget. The change in price will rotate the Bc1 to the new Bc2 line which has different slope and is tangent to a higher indifference curve on point D (See Figure 1).

At the new point consumers can buy more of the two goods and reach a higher satisfaction level due to the reduction in price of product y. Finally, the line formed by point A and point B represents the price consumption curve for good y and indirectly shows the consumption of this good at different level of

prices. Thus, if this curve is placed in a graph with price and quantity in the vertical and horizontal axis, respectively, the resulting line will be the demand curve for product y.

Producer Behavior

In the market, besides costs and quantities of inputs, there are other factors affecting producers' behavior and production decisions. In the ornamental industry, these decisions must also deal with budget, labor, land, and managerial experience constraints (Hampton 2001). Due to the presence of these constraints, firms try to efficiently allocate production resources (land, labor, fertilizers, etc.) for obtaining the best feasible combinations of products which are represented by the curve of production possibilities frontier (PPF). The curve is graphically illustrated in Figure 3 and shows the most efficient combination of two ornamental products at any point along the curve, meanwhile any point inside the PPF curve represents an inefficient use of limited resources. The slope of the PPF curve is the marginal rate of transformation (MRT), which reflects the opportunity cost of producing more quantity of a good by reducing the quantity produced of the other good. Moreover, the MRT is equal to the ratio of the marginal costs of a product x over the marginal cost of a product y.

Although the efficient use of production resources represents nursery producers' main concern, nurserymen also need to consider nursery products consumption trends and products preference at the time of planning a production strategy. Therefore, the determination of the quantity, type and quality of goods produced has to be consistent with what is demanded in the ornamental market.

Perfect Competitive Model

Since most of agricultural producers have often been analyzed as examples of perfectly competitive firms, it is important to understand the assumptions of this model (Kohls and Uhl, 2002). Perfect competitive model basically assumes that market has large number of buyers and sellers, who cannot influence product's price. A market under perfect competition allows the entry of any firm to commercialize identical products and complete information about their prices. Furthermore, the activities

of consumers and producers in the ornamental market tend to be addressed to maximize utility and profits, respectively. Since the ornamental industry typically follows most of the perfect competition assumptions, the analysis of the demand and supply of nursery goods should be based on this model.

<u>Market Efficiency</u>

A combined analysis of consumer and producer behavior is needed to determine the point at which the ornamental market is efficient. Economically, market efficiency is achieved when the marginal rate of substitution (MRS) in the consumption of two goods equals the marginal rate of transformation (MRT) in the production of the same goods.

$$MRT_{xy} = \frac{MC_X}{MC_Y} = \frac{P_X}{P_Y} = MRS_{xy}$$

In the perfect competition model, consumption is maximized when the marginal rate of transformation between two nursery products equals the price ratio of those goods. On the other hand, producers maximize profits when a product's price equals the marginal cost of producing that product ($MC_x = P_x$). Therefore, the market is efficient when the marginal cost ratio equals the price ratio between two products, which is indicated by the point F in figure 3.
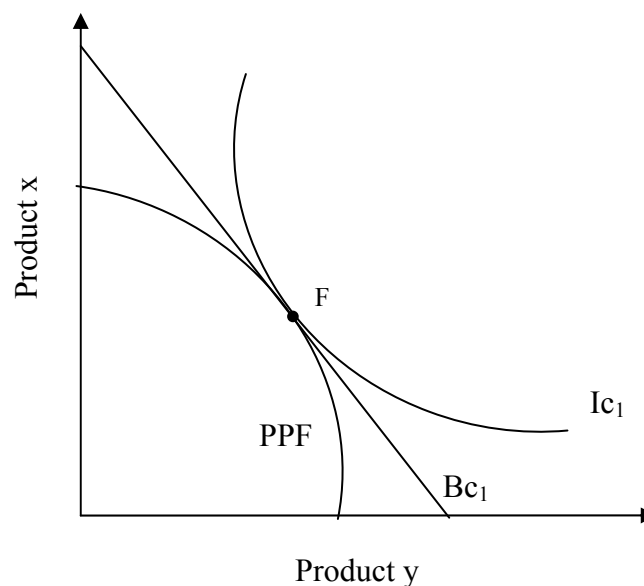
Figure 3 – Production possibilities frontier curve and market efficiency

The figure below, includes the producer's curve of production possibilities frontier (PPF) and the consumer's indifference curve (Ic) for both, product x and product y. Along the PPF curve the production of these two nursery goods is efficient, however producers will determine the combination of both products that coincides the point F at which consumer's level of satisfaction is maximized under budget restrictions. However, although the optimal solution is obtained for a perfect competitive model, all of its assumptions are rarely achieved because of existing market distortions.

Market Distortions

The commercialization of products in the nursery industry faces distortions that modify the structure and efficiency of the market.

Hampton (2001) affirmed that the consumption side of the nursery industry market has changed from many small garden centers and other outlets to a system where mass merchandisers have more market participation. Large retailers such as Walmart and Home Depot have great market power that lets them dictate product prices. Therefore, this change suggests that the market of ornamental products may behave more like monopsony rather than perfect competition. Another distortion is given because the lack of perfect information during the marketing process. The use of one or another type of marketing channel varies the distance between producers and consumers. When this distance is short, the information is more precise; meanwhile some information is lost when this distance is larger.

These factors clearly modify the performance of the nursery market and the flow of ornamental products from sellers to buyers.

Marketing Channel Benefits

Middlemen exist because the specialization in marketing activities facilitates a more efficient flow of products than a direct exchange between producers and final client. Therefore, the use of middlemen helps to reduce the total number of exchange contacts and transactions between producers and consumers. The middlemen allocate most of their resources in marketing functions as exchange, physical distribution

and facilitating (standardization, financing market information, etc.) that let them to meet specific consumers' needs and to provide a better client service. Moreover, the expertise and customer knowledge of the marketing channels might simplify the marketing efforts of the producers (Hartly, 1983). Thus, the presence of middlemen in the nursery industry benefits the market and its participants by efficiently distributing ornamental products.

Producer Strategy

After choosing the best combination of products, nursery producers have to complement the production strategy with a marketing strategy that gives them the highest economics benefits and the desired sales outcome.

The marketing strategy should define the choice and use of the best combination of wholesale marketing channels. However, the decisions of dealing with one or some particular channels depend on different factors like customer characteristics, product characteristics, producer characteristics and environmental characteristics (Hartly, 1983). The geographical dispersion, preferences and the willingness of the customers to deal with middlemen are important characteristics to consider at the time of implementing a marketing strategy. From the producer point of view, the marketing channel choice is influenced essentially by financial and managerial resources and breadth and diversity of product lines. A nursery with strong marketing experience, financial situation, and broad and varied ornamental products line may choose to implement its own marketing organization to directly sell to retail customers.

Hampton (2001) mentioned that another concern in choosing a type of middlemen is the producer's degree of bargaining power within that channel. The bargaining power of small nurseries will be very little when they negotiate with large retail chains. Therefore, growers should consider these characteristics to take the marketing decisions that best help to accomplish the goals of the firm.

Even though all the considerations mentioned above will affect the production and marketing decisions taken by producers, the result of a change in one factor is usually analyzed by isolating it from

the whole. That is, the effect of a change in one of these considerations is determined by modifying one factor and holding the rest of the factors constant (ceteris paribus). Therefore, in the present study the relationship between business characteristics and the nursery producers' decision about the wholesale outlet use and the proportion of wholesale sales allocated trough each marketing channel is estimated by holding the production considerations as constant.

CHAPTER 3 - METHODOLOGY

History of the Survey Instrument

This study used data from the last of four mail surveys of nursery producers across the United States that collected information about trade flows and selected marketing practices. These surveys were conducted by the Multi-state Regional Project S-1021, which is a regional research committee sponsored by the Southern Association of Agricultural Experiment Station Directors.

The first of these four surveys was mailed in 1989 to producers in 23 states including the top 10 states except for Texas. This exception was due to the lack of representation of this state on the research committee and the effort to contact a person responsible of mailing the questionnaires to the nurseries in that state did not have positive results. Total participants of this survey represented 75.6% of the total cash receipts of nurseries crop in 1989 (Brooker and Turner, 1990). For this specific survey, the participant selection process varied among states; the questionnaire was mailed only to licensed nurseries in some states and in others, a minimum acreage or a membership on the nursery associations was required. However, this selection criterion applied to obtain each state's sample was a limitation for statistical analysis.

The second survey was conducted in 1994 and used the previous questionnaire as the basis. From a total sample of 4,890 firms, 1,316 questionnaires were returned. Participants from 24 states represented about 79% of the nation's total producer cash receipts. The list of the firms by state came from nursery associations, lists of licensed nurseries, or extension specialists (Brooker *et al.*, 1995).

In 1999, 22 states representing 69% of U.S. growers' cash receipts in 1998 participated in the survey. The list of participants was again selected from nursery associations, lists of licensed nurseries and extension specialists (Brooker *et al.*, 2000). The response rate for this survey was 24% (1756 questionnaires returned).

The Survey and Its Characteristics

Data for this research was collected in a 2004 survey conducted by the S1021 research group that collected information about the 2003 calendar year. The questionnaire was based on the 1999 survey, but included adjustments regarding the classification of the wholesale distribution outlets. Similar to the previous surveys, this one kept the same objective of providing information to producers, industry professionals, researchers and input suppliers about production and marketing activities in the nursery industry.

The selection process for this survey was improved. Previously, the list of the nursery firms was assembled by different groups (state nursery associations, licensed nurseries in the state, or list developed or maintained by specialists), but for the 2004 survey the list was obtained directly from the appropriate agricultural regulatory office in each state. The sample was stratified to include better representation of small, medium, and large producers. Forty four states representing 93% of total cash receipts for greenhouse and nursery crops in the United States were included in the final list that contained a total of 15,588 firms after budget and statistical considerations. The total number of respondents was 2,485 firms, which is equivalent to 15.9% of the total sample. Texas had the lowest response rate with 8.8% and North Dakota had the highest with 36.4%.

This survey had another important adjustment related to the marketing section. The 1998 questionnaire had five categories of wholesale outlets: garden centers, mass merchandisers, landscapers, re-wholesalers, and other retailers. In the survey of 2003, "other retailers" outlet was not incorporated as a category and at the same time the home center outlet was included as a main category to capture the sales, which had been part of the "mass merchandisers" category (Brooker *et al*., 2005). Furthermore, the garden center category was split in two new categories: garden center single location and garden center multiple locations. Given these changes, six main categories were incorporated in the questionnaire of 2003.

Dillman's protocol was used to design and implement the survey. This protocol maximizes response rates through a follow-up strategy that includes the initial questionnaire/explanation letter, a reminder post card mailed to those who had not answered at a given point in time, and a second questionnaire with a letter encouraging response (Brooker *et al.*, 2005).

Data Issues

The data collected from the survey were first analyzed and classified to eliminate responses that had incomplete or inconsistent information about the amount of sales, percent of wholesale and retail sales, and/or establishment year. Firms were asked to report the percentage of wholesale sales through each of the marketing channels. For some observations, summation across channels did not equal 100%. If other information in the observation was acceptable, a procedure was implemented, with the objective of increasing the number of observations in the final data set, to modify the percentages. For those observations that summed to at least 90%, this procedure increased the values proportionally to sum to 100%. After this correction, observations that did not sum to 100% were not considered. Additionally, observations with irrational values about year (establishment year older than 1725, that was the oldest year reported, or later than 2003) and sales not reported were not included in the analysis. This condition eliminated 746 observations from the initial data set for sales and summations problems, and 31 observations for the problems in the year values. Furthermore, since the target population of this study was wholesale production nurseries, and the lists of growers contained unidentifiable small operations (primarily retailers), firms with $10,000 or less annual sales were also excluded from the final data set. The percentage of retail sales was used to identify the retailers and firms with 70% or more retail sales were not included in the analysis. This situation reduced the data set by 393 observations. All these situations reduced the number of observations from 2,485 to 1,315 in the data set; therefore, a total of 1170 observations were not included in the final data set.

Six wholesale outlet categories were included in the survey; however, due to similarities between garden centers single location and garden centers multiple locations, both categories were merged into a single category named garden centers (gc). The same procedure was considered for mass merchandisers and home centers categories which were combined in a single category named mass merchandisers (mhc). These wholesale outlets or marketing channels were merged because they generally are believed to have similar sales characteristics: terms and conditions, quality and quantity standards, price policy and line of products. Furthermore, the comparison analysis of the data showed that producers allocated their percentage of sales and category of products similarly to both channels. Additionally, the estimation of the multinomial logit model had incomplete convergence because the data set for producers choosing mass merchandisers (82 obs.) or home centers (42 obs.) had substantially fewer observations compared to the data sets of the other three channels. Finally, after the combinations of channels, a total of four categories were incorporated in the final analysis.

The data were organized in four regions. Regional analysis was considered appropriate because the geographic location of producers was expected to affect their production and marketing strategies. Although there are many regional alternatives to divide the country, this study included the standard regional division used by the U.S. Census Bureau (Northeast, Midwest, West and South). The number of observations and states included in these four regions are shown (Table 2).

The relationship of different business characteristics to the marketing channel used and proportion of channel sales was analyzed by size as measured total annual sales, and classified into large and small nurseries. Intuition and a similar number of observations for both size firms were used to determine the $500,000 separator line. This value was also considered possible differences in management behavior between large and small producers. This division generated 560 observations for large nurseries with annual sales equal or greater than $500,000 and 755 observations for small nurseries with less than the separator line. All these modifications were applied to achieve the final data set of this study.

Table 2 – States by U.S. Census Bureau regional division

Region	Obs.	States
Northeast	231	Connecticut (CT), Maine (ME), Massachusetts (MA), New Hampshire (NH), New Jersey (NJ), New York (NY), Pennsylvania (PA), Rhode Island (RI), Vermont (VT)
Midwest	189	Illinois (IL), Indiana (IN), Iowa (IA), Kansas (KS)*, Michigan (MI), Minnesota (MN), Missouri (MO), Nebraska (NE), North Dakota (ND), Ohio (OH), South Dakota (SD), Wisconsin (WI)*
South	670	Alabama (AL)*, Arkansas (AR), Delaware (DE), District of Columbia ()*, Florida (FL), Georgia (GA), Kentucky (KY), Louisiana (LA), Maryland (MD)*, Mississippi (MS), North Carolina (NC), Oklahoma (OK), South Carolina (SC), Tennessee (TN), Texas (TX), Virginia (VA), West Virginia (WV)
West	225	Alaska (AK)*, Arizona (AZ)*, California (CA), Colorado (CO), Hawaii (HI), Idaho (ID), Montana (MT), Nevada (NV), New Mexico (NM), Oregon (OR), Utah (UT), Washington (WA), Wyoming (WY)

*States not included in the survey of 2003

Nursery Industry Description

Frequencies and percentages were calculated with the final data set in order to have a better perspective of the industry's situation and the nurseries' activities. The number of firms on each sales category is reported in Table 3.

Table 3 – Categories of total sales of nurseries, by region

Sales category	Number of observations				
	Northeast	Midwest	West	South	Total
Less than 50,000	10	8	7	31	56
$50,000 – $99,999	9	5	4	8	26
$100,000 - $ 249,999	88	78	86	245	497
$250,000 - $499,999	29	26	22	99	176
$500,000 - $ 999,999	30	24	29	102	185
$1,000,000 - $1,999,999	25	19	24	79	147
$2,000,000 - $3,499,999	15	11	12	41	79
$3,500,000 - $ 4,999,999	4	2	18	22	46
$5,000,000 - $9,999,999	9	9	14	25	57
$10,000,000 or above	12	7	9	18	46
Total	231	189	225	670	1315

Source: Multi-state Regional Project S-1021 survey, 2004

Most of the nurseries in the survey had sales from $100,000 to $249,999. The South region accounted for most of these nurseries. The rest were very equally distributed between the other three regions. In

terms of number of firms per sales category, the northeast region was the second in importance after the South. The South had the higher frequency of firms in all the sales categories but one ($50,000 to $99,999). Furthermore, a large majority of nurseries was clustered in a group with sales from $100,000 to $1,999,999.

General information about large and small nurseries is presented in Table 4. The average age of large nurseries was higher than age of small nurseries in total and in each region. On average, oldest large nurseries were located in the Northeast and youngest in the West. Moreover, younger small firms were located in the South and West. On average, small firms used more temporary employees than permanent employees in the Northeast, Midwest and West. The reverse situation was observed for large firms in the Northeast and Midwest.

Table 4 – Age, kind of employees and sales, by size and by region

Category by size	No. of obs.	Average age	Average no. of employees		Average annual sales ($)
			Permanent	Temporary	
Small (< $500 K)	755	20.47	2.56	3.47	175,484
Northeast	136	26.52	2.09	3.68	167,205
Midwest	117	21.74	2.30	5.56	173,277
West	119	19.79	2.58	4.33	165,624
South	383	18.14	2.79	2.49	182,162
Large (≥ $500 K)	560	32.08	30.64	21.30	3,629,940
Northeast	95	45.15	25.68	28.06	4,226,230
Midwest	72	38	13.56	33.51	3,611,220
West	106	25.98	44.63	26	4,238,790
South	287	28.52	31.39	14.27	3,212,380

Source: Multi-state Regional Project S-1021 survey, 2004

There is a clear difference between the number of employees hired by large and small firms, and in the relationship between permanent and temporary employees. Large firms used twelve times more permanent employees and six times more temporary employees than small firms. This difference was more pronounced in the West, where large nurseries hired 17 times more permanent employees than small firms. Furthermore, this region had the highest number of permanent employees for large firms compared with the other regions. In total, small firms had more temporary than permanent employees, but the reverse for large firms.

Table 5 reports the percentage of sales through each of five marketing channels organized by nursery size and by region. The highest average percentage for both small and large nurseries was to the landscaper channel with values of 37.90% and 28.96%, respectively. This channel had also most of the sales from firms located in the Midwest and South. Garden center was the main channel in the Northeast with average percentage of sales of 36.64% for small and 29.20% for large firms. In the West, re-wholesalers had the highest percentage of sales for both small (38.14%) and large (33%) firms. For large firms, a very small percentage of sales was observed in the Midwest due to the few respondents that assigned value to this channel.

Table 5 – Percentage of sales, by size, by region and by channel

Category by size	Marketing Channels				
	Mass Merchandisers	Home Centers	Garden Centers	Landscapers	Re-wholesalers
Small (< $500 K)	3.33	1.56	23.72	37.90	33.48
Northeast	3.06	2.20	36.64	34.97	23.13
Midwest	0.11	1.38	23.82	45.96	28.73
West	9.88	2.26	22.41	27.32	38.14
South	2.37	1.22	20.14	39.73	36.54
Large (≥ $500 K)	9.60	13.64	21.48	28.96	26.33
Northeast	6.69	16.62	29.20	26.66	20.83
Midwest	3.82	1.57	19.64	52.27	22.71
West	10.27	16.38	18.94	20.53	33.87
South	12.03	14.12	19.87	28.05	25.94

Source: Multi-state Regional Project S-1021 survey, 2004

Furthermore, the lowest percentages of sales were made through mass merchandisers and home centers, but recall that these are simple averages and do not show dollars of sales. In general, these results indicate a shift from the landscaper and re-wholesaler channels for smaller nurseries to mass merchandiser and home center channels for larger nurseries.

The total amount of sales was presented in Table 6. The total large nurseries sales was 16 times more than the total aggregated sales of small nurseries in the country. The biggest difference was seen in sales through home centers where large producers sold an average of 143 times more to this channel than small firms. The highest difference between size of growers was seen in the West where large firms had an

average of 24 times the sales of small firms. The lowest difference was in the South where small firms

sold 13 times less than large firms.

Table 6 – Total sales by marketing channel, by size and by marketing channel

Category	Marketing Channels				
by size	Mass Merchandisers	Home Centers	Garden Centers	Landscapers	Re-wholesalers
Small (< $500 K)	3,937,345	1,850,063	28,076,610	44,857,814	39,624,737
Northeast	596,125	429,438	7,147,558	6,821,905	4,512,675
Midwest	18,250	228,025	3,949,703	7,619,805	4,763,418
West	1,803,870	412,075	4,089,574	4,986,620	6,960,808
South	1,519,100	780,525	12,889,775	25,429,483	23,387,837
Large (≥$500 K)	187,154,795	265,856,622	418,830,096	564,559,927	513,356,545
Northeast	25,846,481	64,207,760	112,790,631	102,970,560	80,476,970
Midwest	8,836,000	3,625,000	45,479,535	121,040,734	52,583,900
West	45,118,475	71,943,650	83,182,675	90,172,875	148,724,927
South	107,353,839	126,080,212	177,377,255	250,375,759	231,570,748

Source: Multi-state Regional Project S-1021 survey, 2004

The percentage of total sales by group of plants was presented in Table 7. For all regions, large and

small firms had the highest percentage of sales of plant group 1 (deciduous shade and shrubs, evergreen

shrubs and azaleas). The higher percentage of sales of this group was observed in the Midwest. Across

regions, foliage was the category with the lowest percentage of sales of large and small firms.

Table 7 – Percentage of total sales, by plant groups, by size and by region

Plant Groups	Percentage of total sales							
	Small				Large			
	Northeast	Midwest	West	South	Northeast	Midwest	West	South
Group 1	40.87	72.22	42.29	49.94	45.91	60.34	55.73	38.07
Group 2	24.08	2.61	12.26	10.13	20.62	5.54	17.69	20.85
Group 3	9.82	8.33	13.89	6.27	20.13	18.11	10.24	12.80
Group 4	0.70	0.50	2.56	8.92	0.70	0.26	4.10	7.14
Group 5	22.83	16.32	25.80	22.29	12.12	14.87	8.70	20.30

Source: Multi-state Regional Project S-1021 survey, 2004

Table 8 reports the percentage of computer functions by size and by region. For most of the functions

(except landscape design) large firms had almost doubled the level of computerization functions use

compared to the level used for small firms. This difference in use is more observable for CDs for

marketing and bar coding. These functions could be more frequently used by large nurseries because their

software and hardware requirements could be very costly for small producers. In the Midwest (17.09%)

and South (10.96%) the use of landscape designing software by small firms was higher than large firms.

This may imply that small producers located in both regions had a close business relationship with

landscapers.

Table 8 – Percentage of computer function use, by size and by region

Computer Function	Percentage of computer use							
	Small				Large			
	Northeast	Midwest	West	South	Northeast	Midwest	West	South
Inventory	40.44	48.71	52.10	44.90	73.68	90.27	83.01	70.38
Internet commerce	27.20	21.36	30.25	24.54	56.84	56.94	50.94	48.78
CDs for marketing	8.08	10.25	10.92	10.18	27.36	41.66	29.24	26.13
Communications e-mail	47.05	56.41	68.06	56.65	77.89	90.27	92.45	82.23
Landscape designing	8.08	17.09	4.20	10.96	13.68	16.66	4.71	8.01
Bar coding	9.55	7.69	11.76	6.52	44.21	36.11	45.28	34.14

Source: Multi-state Regional Project S-1021 survey, 2004

The percentage of expenditure in selected advertising methods by large and small firms is shown in

Table 9. Most of the expenditure of these firms was allocated in catalogs and trade shows. In the South,

these two advertising methods accounted by 64% of the total expenditure of large firms.

Table 9 – Advertising expenditures as a percentage of total sales, by size and by region

Advertising methods	Percentage of total sales							
	Small				Large			
	Northeast	Midwest	West	South	Northeast	Midwest	West	South
Websites	4.27	4.86	12.47	9.03	7.72	5.69	4.91	3.86
Yellow pages	13.57	27.15	9.92	8.90	4.88	4.41	10.00	3.05
Radio	0.90	6.89	0.82	2.36	2.10	19.14	1.99	1.89
Billboards	1.54	0.98	0.28	0.99	0.06	0.10	0.02	0.04
Gardening	4.59	3.56	2.10	4.64	11.54	0.89	2.66	4.74
Catalogs	19.82	22.04	27.64	11.13	35.59	24.52	20.01	13.46
Trade journals	3.46	5.59	6.02	17.56	4.34	9.19	9.98	8.05
Newsletters	5.05	6.37	6.14	6.17	4.93	5.79	19.11	2.05
Trade shows	6.58	8.31	18.86	16.53	20.69	14.68	24.98	50.69
Other	8.04	0.77	8.32	10.49	6.29	3.81	4.83	6.65

Source: Multi-state Regional Project S-1021 survey, 2004

The use of radio was higher in the Midwest compared to other regions for both, large (19.1%) and small (6.8%) firms. Furthermore, the less frequently used method to advertise ornamental products was the billboards.

Table 10 shows the percentage of total sales and the total dollar value expended in advertising by large and small nurseries. For all the regions, the average expenditure was slightly higher for small producers compared with large. In most cases, the percentage of advertising expenditure of large and small nurseries located in the same region was very similar. Producers in the Midwest had the highest percentage of sales allocated in advertising expenditure compared with firms located in other regions. However, large nurseries in the Northeast had the largest amount on dollars addressed to this matter.

Table 10 – Advertising percentage of total sales and total advertising expenditures, by size and by regions

Category by size	Percentage	Advertising Expenditure
Small (< $500 K)	3.29	3,967,032
Northeast	2.54	533,985
Midwest	3.70	691,870
West	2.72	494,910
South	3.58	2,246,267
Large (≥$500 K)	2.58	48,276,595
Northeast	2.69	10,220,429
Midwest	3.39	7,379,598
West	1.34	5,583,222
South	2.93	25,093,347

Source: Multi-state Regional Project S-1021 survey, 2004

All descriptive information presented in previous tables provided an understanding of how producers behaved related to marketing and production characteristics. Furthermore, this information would aid to determine the expected impact of explanatory variables in econometric models.

Econometric Modeling Procedures

The marketing channel use and the proportion of sales made through each wholesale outlet (dependent variables) were hypothesized to be functions of ornamental growers' characteristics. The set of relevant independent variables was identified taking into account economic theory and expected relationship with

each of the dependent variables. Construction of the variables and arrangements of the data were handled using SAS software package (SAS Institute Inc., 2006).

<u>Dependent Variables</u>

The dependent variables marketing channel choice and percentage of sales through each channel were determined based on the objectives proposed in the beginning of this study.

Marketing channel choice was used in the multinomial logit model. In this case, the producer's primary marketing channel was needed, although this information was not explicitly identified in the survey. Therefore, since the percentage of sales made through each wholesale channel was reported, the primary channel was assumed to be the outlet with the highest percentage of sales. In other cases, two or more channels had equal percentage of sales. In total there were 128 ties in the final data set, most commonly observed for garden centers with landscapers and landscapers with re-wholesalers. These ties were solved by considering three measures calculated from the complete data set: 1) the highest average of the percentage of sales for each channel, 2) the correlation between channels and sales, and 3) the correlation between channels and plant group. The respondent's main channel was assigned subjectively after the evaluation of these three measures. Finally, the variable contained numbers from 1 to 4 to represent the choice of each marketing channel, assigned in the following manner: mass merchandiser = 1, garden center = 2, landscaper = 3 and re-wholesaler = 4.

The dependent variable used in the two-limit tobit model was the percentage of wholesale sales made through each marketing channel. This limited dependent variable included the values reported by each producer and ranged from 0 to 100.

In total, there were four equations with four dependent variables representing each marketing channel.

<u>Independent Variables</u>

The final set of independent variables used in the two econometric models is described in Table 11. The variables were included in the model because they were expected to have some impact on either the

choice of channel or the portion sold through a channel. Many of these variables shown in this table were structured based on the survey's questions that collected the percentage of total annual sales.

Table 11 – Description of the independent variables used in the econometric models.

Variable	Description
Size	Dummy for size - whether the firm's annual sales are equal or greater $500,000 (0 if false, 1 if true)
Northeast, West, Midwest and South	Dummy for region - Northeast, West, Midwest and South (0 if false, 1 if true)
Firm age	2004 minus the year established
Computer aided management	Dummy - the firm used, or planned to use within the next five years, four or more computer technology functions from a list of 11 (0 if false, 1 if true)
Channel diversity	Dummy - the firm had diverse market channels, indicated by sales to three or more of the 5 marketing channels (0 if false, 1 if true)
Plant group 1, 2, 3, 4 and 5	Variables indicating the proportion of total sales to each of five plant categories (defined below)
Trade shows attended	Number of trade shows attended in 2003
Prop. of negotiated sales *	Dollars of sales for which one or more conditions of sale were negotiated
Contract production (dollars)* [a]	Amount of total sales contracted or sold before it was produced
Contract, other producers [a]	Dummy - the firm produces under contract for other producers (0 if false, 1 if true)
Contract, garden centers [a]	Dummy - the firm produces under contract for retail garden center customers (0 if false, 1 if true)
Contract, mass merchandisers [a]	Dummy - the firm produces under contract for mass merchandisers (0 if false, 1 if true)
Product uniqueness	Dummy - rating of importance of product uniqueness to price determination (0 if not importance or minor importance, 1 if important or very important)
Website advertising share*	Dollar value measure of web sites advertising
Trade show advertising share*	Dollar value measure of trade show advertising

*Sales weighted variable
[a] The 'contract' described here almost always is informal and unwritten
Note: For construction of variables, see survey instrument in Appendix A

Given that this percentage may be similar for small and large nurseries and considering that firms with smaller total sales should have less influence on the estimated parameter, the variables plant groups, negotiated sales, contract sales web sites and trade shows expenditures were sales-weighted. To accomplish this, the proportions were multiplied by the reported total annual sales. In the survey, respondents had two alternatives to report sales: a) write-in the actual value of sales, or b) choose one of

11 sales categories. If the actual value of sales was not reported, the midpoint of the category chosen was used as the value of total sales for the observation. All the sales-weighted variables were put in $100,000 basis.

The dummy variable *size* was included as independent variable to observe the different marketing strategies of small and large firms and it was used only in the multinomial logit model.

The four *regional dummy variables* were created because the business characteristics and the marketing strategy were assumed to vary according to the region that the firm is located. The use of the variable *age* was based on the assumption that older firms were expected to be larger, more experienced and to have more diversified marketing strategy that would favor to choose growth channels. This definition, suggested by Hampton (2001), was based on the growth and volume of mass-merchandiser and re-wholesaler channels that had made them an important growth option for nursery growers

In the survey, percentage of sales was reported in 17 plant categories (see Appendix A). Groups of categories of plants were considered an option after including and testing each category as independent variables and having few significant estimated parameters. Therefore, these plant categories were organized in five groups (Table 12). Within the first four groups, management of the production process was similar. Group 5 was an all other plants category, with no reason to expect similarity of production practices.

Table 12 – Categories of plants organized by groups and by similar production characteristics

Plants Group	Category of plants
Group 1	Deciduous shade and flowering trees, deciduous shrubs, broad-leaved evergreen shrubs, narrow-leaved evergreen shrubs, azaleas, tree fruits, evergreen trees
Group 2	Bedding plants (flowering annuals and vegetables, fruits and herbs), flowering potted plants
Group 3	Vines and ground covers, roses, herbaceous perennials
Group 4	Foliage
Group 5	Christmas trees, propagated materials (liners, cuttings, plugs, etc.), others (palms, orchids, ornamental grass, etc.)

Channel diversification variable was constructed using five marketing channels to better represent the diversification of the marketing strategy. *Negotiated sales* variable involved concessions on quality, price or other terms of sale and *Contract sales* represented the commitment to sell products before they had been planted.

Several other explanatory variables were expected to have an effect on either the choice of channel or the portion sold through a channel based on the literature review or on theoretical considerations. These were considered in the preliminary modeling process, but were not included in the final model because they were not significant based on this data set.

Bar Coding and Landscape Design Software – These dummy variables represented specialization of computer functions that were expected to be related with mass merchandisers and landscapers.

Contract with Cooperatives - Production engaged under this type of contracts was assumed to explain the use of a specific channel by producers, but it did not have significant estimates.

Employees - The number of employees (temporary and permanent) was considered good indicator of size but was not useful in the models.

Advertising Expenditure – Yellow pages, billboards, newsletter and other alternatives of advertisement were continuous variables hypothesized to explain the use of marketing channel but they were not significant.

Sales – This continuous variable was expected to be important for channel choice. However, this variable interacted with others generating incomplete convergence of models. Sales squared, a nonlinear version of the sales variable, was also tested.

Interactions between variables: sales-age, size-groups of plants, trade shows-group of plants were also tested without significant result. All these variables with insignificant results or interaction with other variables were dropped from the final model.

<u>Statistical Analysis</u>

Two models that best fit the data set were used to achieve the objectives of this study. The procedure to estimate the multinomial logit model and two-limit tobit model are discussed in the following section.

<u>Multinomial Logit Model</u>

Standard maximum-likelihood estimation was used to determine the impact of nurseries' characteristics (*explanatory variables*) on producers' choice of market channel (*dependent variable)* by size and region in the United States. For the qualitative dependent variables, where the decision maker (nursery producer) must choose between three or more mutually exclusive and unranked alternatives (marketing channels), the multinomial logit model was considered the most appropriate (Pindyck and Rubinfeld, 1998).

This model was calculated using the -mlogit- command of the STATA software package (StataCorp, 2005), algebraically shown as:

$$\log\left(\frac{P_{ji}}{P_{4i}}\right) = \beta_{j4} + \beta_{j4}X_i + \beta_{j4}Y_i + \beta_{j4}Z_i + ... + \mu_i$$

where: β= unknown parameters

  i = individual firm

  j = 3 categories (j = (1) Mass merchandiser, j= (2) Garden center, j= (3) Landscape firms)

  P_{ji} = Probability that individual i will chose category j

  P_{4i} = Probability that individual chose the baseline category which in this case is (Re-wholesalers (4))

  X, Y, Z = Explanatory (independent) variables shown in Table 11

  μ_i = Residual assumed to be independently and normally distributed

The model predicts the relative probability that a producer would choose one of the four categories based on the nursery's characteristics. For this analysis, the marketing channel re-wholesaler was used as comparison base because our study was focused in determining the importance of this channel in the

industry compared with other channels. The marginal effects were calculated using the command -mfx- for the four categories. This command by default evaluates the marginal effect at the mean values of explanatory variable.

Since the channel choice was expected to be influenced by both region and firm size, the estimation of two groups of multinomial logit models was included in this study. For the first group, separate models were run for large and small nursery data sets. In these models, dummy regional variables were included among the explanatory variables. In preliminary modeling for the second group, four models were constructed and run with individual regional data sets (Northeast, Midwest, West and South). However, the estimation of the Midwest and Northeast data set had inconclusive results mainly because of small sample size in each region. To obtain reliable results, the data sets of these two regions were combined. As result, three models were included in the second group. To estimate the effects of size within these regional models, the dummy variable size was included.

The dependent variable (channel choice) was the same for both groups of equations.

An important assumption of the multinomial logit model is that the odds ratios, equal to the ratio of the probability of choosing one channel over the probability of choosing the reference channel, are independent of the other alternatives. This property is called the independence from irrelevant alternatives (IIA). It is appropriate to test this assumption before the estimation of this model. Hausman and McFadden (Greene, 2003) developed a test to validate this assumption. In STATA, the command -mlogtest- followed by the option -iia- includes a total of three different tests for this assumption: the Hausman test, the suest-based Hausman test and the Small–Hsio test. Since the Hausman test and Small-Hsio test provide conflicting information in determining violations of this assumption (Long and Freese, 2005) , the suest-based Hausman test, which is a modification of the Hausman and McFadden test, was used to evaluated whether the IIA assumption holds.

Table 13 shows the results obtained from the suest-based Hausman test of the first group of models. The null hypothesis of this test is that odds P(outcome-marketing channel choice) vs P(outcome-reference) are independent of other alternatives. Since the p>chi2 values are greater than the level of confidence (0.10) in all cases, the null is not rejected. Thus, there is evidence that the IIA assumption is not violated.

Table 13 – Results from the suest-based Hausman tests for testing the independence from irrelevant alternatives (IIA) assumption, by firm size and by omitted channel alternative

	Large Firms			Small Firms		
	Mass Merchandiser	Garden Center	Landscaper	Mass Merchandiser	Garden Center	Landscaper
Chi^2	27.176	25.463	23.141	14.16	24.097	33.407
DF	42	42	42	42	42	42
P>chi^2	0.963	0.979	0.992	1	0.988	0.825

Table 14 shows the results obtained from the suest-based Hausman test for the second group of models. As before, since the p>chi2 values were greater than the level of confidence (0.10) in most of the cases, the null was not rejected for the South and West models. However, the Midwest/Northeast model for garden centers showed p>chi2 values smaller than 0.10 which rejected the null that the alternatives were independent. For this model, the results differed depending on the category chosen as the base category, which indicates that this test also seemed to produce contradictory results similar to the other tests computed by the command –mlogtest- in STATA.

Table 14 – Results from the suest-based Hausman tests for testing the independence from irrelevant alternatives (IIA) assumption, by region and by omitted channel alternative

	South			West			Midwest/Northeast		
	Mass Merchandiser	Garden Center	Landscaper	Mass Merchandiser	Garden Center	Landscaper	Mass Merchandiser	Garden Center	Landscaper
Chi^2	24.76	19.52	30.66	15.56	28.07	20.77	12.65	60.57	28.64
DF	38	38	38	38	38	38	38	38	38
P>chi^2	0.952	0.994	0.795	1	0.881	0.99	1	0.011	0.864

Two-Limit Tobit Model

The two-limit tobit was used to estimate the change in the proportion of total sales through each marketing outlet as a function of firms' business characteristics. This model was used because the dependent variable was censored at an upper and lower limit with values equal to zero and 100%,

respectively. The tobit analytical approach with maximum likelihood estimation techniques was considered appropriate for this model (Hobbs, 1997; Hill *et al.*, 2001)

In the STATA program, the command -tobit- with the limits -ll (0) ul (1)- was used to estimate the coefficients of this model which is presented algebraically as:

$$y_i^* = \beta_0 + \beta_1 X_i + \beta_2 Y_i + \beta_3 Z_i + ... + \mu_i$$

and
$$y_i = 0 \quad \text{if } y_i^* \leq 0$$

$$y_i = y^* \quad \text{if } y_i^* > 0 \text{ and } y_i^* < 1$$

$$y_i = 1 \quad \text{if } y_i^* \geq 1$$

where: β_i = unknown parameters

y_i = sales of producers to a market channel

y_i^* = Unobserved variable that qualifies as latent variable because is observed only when it lies between the two limits

i = individual firm

X, Y, Z = Explanatory (independent) variables shown in Table 11

μ_i = Residual assumed to be independently and normally distributed

As Fernandez-Cornejo *et al.*, (2001) affirmed, the regression coefficients of the two-limit tobit model cannot be interpreted as traditional regression coefficients that give the magnitude of the marginal effects. Instead, a marginal effect can be calculated to measure the effects of a change in the explanatory variable on both probability and intensity of selling to a channel.

Since the coefficients do not represent the traditional marginal effect, McDonald and Moffitt (1980) proposed a useful decomposition of the marginal effects that was extended by Gould *et al.* (1989). From the likelihood function of this model, Gould *et al.* (1989) showed the equation of three marginal effects:

1) The unconditional expected value of the dependent variable (E(y))

$$\frac{\partial E(y)}{\partial X_j} = [F(Z_2) - F(Z_1)]\frac{\partial E(y^*)}{\partial X_j} + E(y^*)\frac{\partial[F(Z_2) - F(Z_1)]}{\partial X_j} + \frac{\partial(1 - F(Z_2))}{\partial X_j}$$

2) The expected value of the dependent variable conditional upon being between the limits ($E(y^*)$)

$$\frac{\partial E(y^*)}{\partial X_j} = \beta_j \left[1 + \frac{\{Z_1 f(Z_1) - Z_2 f(Z_2)\}}{\{F(Z_2) - F(Z_1)\}} - \frac{\{f(Z_1) - f(Z_2)\}^2}{\{F(Z_2) - F(Z_1)\}^2} \right]$$

3) The probability of being between the limits.

$$\frac{\partial [F(Z_2) - F(Z_1)]}{\partial X_j} = \frac{\beta_j}{\delta} [f(Z_1) - f(Z_2)]$$

where: $F(.)$= the cumulative normal distribution

f(.)= the normal density function

$Z_1 = - \beta'X/\delta$ and $Z_2 = (1- \beta'X)/\delta$ are standardized variables that come from the likelihood function given the limits of y*.

δ= standard deviation of the model

These three marginal effects represented by the equations above were calculated by the command -mfx- in the STATA software package which calculates the marginal effects at the mean values of the dependent variables. This command was complemented by three specific options that allowed the estimation of each of the three marginal effects mentioned above: 1) - predict (ys(0,1)) -, 2) - predict (e(0,1)) -, 3) - predict (p(0,1)) -.

The components of the equation (1) correspond to the three decomposition elements discussed by Gould *et al.* (1989) and McDonald-Moffitt (1980); however, these components were not included in this study because the marginal effects provided enough information to support the objectives of this study.

Finally, the two-limit tobit model was used to analyze the channel choice of small and large nurseries separately; thus, the entire data set was divided by firm size in two subsets. Four marketing channels were identified and a total of eight similar equations with different dependent variables were estimated with the two-limit tobit model.

Expected Relationship of Variables for the Multinomial Logit Model

In the multinomial logit model, the dependent variable is equal to the log ratio of the probability of choosing a specific marketing channel over the probability of choosing the re-wholesaler channel (reference channel). Therefore, a positive expected sign for the estimated coefficient of an explanatory variable means that there is higher likelihood of choosing the alternative channel (numerator of the ratio) than choosing the re-wholesaler channel. The opposite would be observed for coefficients with negative sign. Therefore, since the expected inverse (-) or direct (+) relationship between explanatory and dependent variables is different for the multinomial logit and two-limit tobit model, the signs for both models were analyzed separately. The expected impacts of the independent variable on the use of marketing channel are shown in Table 15. The expectations of the signs were stated considering the characteristics of the wholesale outlets presented by Hampton (2001) and other authors mentioned in the first section of this research.

Size – The variable size was included in one of the two multinomial logit models and was used to identify the differences between large and small nurseries. This variable was created after running preliminary models with two separate data sets (large and small nurseries) that did not completely converge generating an error in the estimation, mainly because the smaller sample size for large firms.

Region – In the Midwest, firms are usually greater in number but smaller in size compared to nurseries in the West and South. When compared to the South region (the base), the West was expected to have a higher odds ratio for the mass merchandiser compared to the re-wholesaler channel. The Northeast, with higher average sales, was expected to be influenced similarly to the West. The sign for the Midwest region, with smaller firms, was uncertain because these firms might focus more on quality. The lower price-sensitivity of garden center and landscaper channels might positively affect the use of these channels over re-wholesalers.

Firm Age – Older firms were expected to have more diversified marketing strategy that implies use of re-wholesaler over landscaper and/or garden center channels. Therefore this variable was expected to have a negative sign. However, the opposite was expected for the mass merchandiser channel, since it has a stronger market position and offers nurseries a better opportunity to grow because of its product volume.

Computer-assisted Functions - Nurseries need a higher level of computer technology (hardware and software) to fulfill the business conditions and terms required by the mass merchandiser channel, so this sign was expected to be positive. For the garden center and landscaper channels, the expected impact of more computer functions on portion of sales was uncertain.

Channel Diversification – When compared to the re-wholesaler channel, mass merchandiser, landscaper and garden center channels were expected to be preferred. Mass merchandisers might offer the certainty of large volume of sales, while the other two may be less price-sensitive for the nursery products.

Plant Diversification – Producers generally focus on plants most in demand, and they diversify by kind of plants. Groups 2 and 3 were expected to have a positive sign for all marketing channels, as they attempt to increase sales through more decorative, colorful and visually appealing plants. As before, faster pace of growth were the likely reason for producers to favor sales to the mass merchandiser channel over the re-wholesaler channel. The sign of the variables plant groups 1 and 4 was uncertain for the mass merchandiser channel. These plant groups were expected to have a positive impact for garden centers because they provide variety and more uncommon nursery products including large size tree, shrubs and foliage. For the landscaper channel these plant groups were expected to have a negative sign because growers should sell more of these plants to re-wholesalers who may place less emphasis on foliage plants. The impact of the plant group 5 is unknown for all the marketing channels.

Trade Shows – Since these events are costly and require certain stock of products and large nurseries are more likely to participate, this variable would have a positive relationship to growth channels. Large

nurseries want to serve landscaper and garden center channels compared to the re-wholesaler channel because they provide better margins, so a positive sign was expected. The impact of this variable on producers' marketing strategy was uncertain for the mass merchandiser channel because this channel might behave similar to the re-wholesaler channel at the time of selecting suppliers. These channels might have existing business relationships with suppliers, and were expected to attend these events less frequently.

Negotiated Sales – This activity may be more frequent between large nurseries and growth channels, since re-wholesalers and mass merchandisers buy great volume of products and need to obtain the lowest possible price. In comparison with re-wholesalers, mass merchandisers were expected to negotiate sales because the high volume of products bought. Although sales negotiation is also made by garden centers and landscapers, these channels are more quality oriented, so the relationship was expected to be negative.

Contract Sales – Because mass merchandisers seek assurance of supply more than do the other channels, a positive relationship was expected for this channel while a negative relationship was expected for the other channels. These contracts were expected to be more common for mass merchandiser channel, and less frequent for the garden center and the landscaper channels, who usually buy smaller volume of specific plant categories and with more variation in time between purchases.

Contract Production with Other Producers – This variable should have negative impact on sales to the other channels compared to the re-wholesaler channel because, as stated by Hampton (2001), some are wholesale production nurseries that purchase material from other nurseries.

Contract Production with Garden Centers and with Mass Merchandisers – Producers with retail garden centers contracts and mass merchandisers contracts were expected to have different impacts on sales to re-wholesalers. A positive sign was expected for the mass merchandiser contract variable and negative for landscapers and garden centers. The opposite impact was expected for the garden center contract. These signs were expected because producers using these types of contracts would compromise

their production activities to satisfy the demands of the contract partner or other buyers with similar demands (growth or core channels).

Table 15 – Expected sign for independent variables included in the multinomial logit model

Variable	Expected sign		
	MM	GC	LD
Size	+	-	-
Northeast region**	+	-	-
West region**	+	-	-
Midwest region**	?	+	+
Age	+	-	-
Computer/electronic technology use	+	?	?
Channel diversification	+	+	+
Plant Group 1 *	?	+	-
Plant Group 2 *	+	+	+
Plant Group 3 *	+	+	+
Plant Group 4 *	?	+	-
Plant Group 5*	?	?	?
Number of trade shows	?	+	+
Negotiated sales*	+	-	-
Contract sales*	+	-	?
Contract production with other producers	+	-	-
Contract production with retail garden center	-	+	+
Contract production with mass merchandisers	+	-	-
Product uniqueness	?	+	+
Web sites expenditures *	+	+	+
Trade shows expenditures*	?	+	+

*Sales weighted variable
**Base= South

Product Uniqueness – The impact of prices based on product uniqueness was uncertain for the mass merchandiser channel and positive for the other two channels. The positive impact was expected for landscapers and garden centers because they are more specialized channels and demand unique and rare products.

Web Sites and Trade Show Expenditures – Advertising expenditure allocated to web sites and trade shows was expected to have a positive impact on the garden center and landscaper channels because these channels have less resources to devote to purchasing. Buyers for mass merchandisers normally use

regional buyers who work with a small, selected group of growers, so the expected impact was negative. Website and tradeshows expenditure were expected to have a positive and unknown impact for using mass merchandisers over re-wholesalers, respectively.

<u>Expected Relationship of Variables in the Two-Limit Tobit Model</u>

The interpretation of the estimated coefficients of the two-limit tobit model is similar to the standard regression model, not like the ratio in the multinomial logit model previously discussed. Therefore, the expected signs of the independent variable are directly associated with the sales to each of the channels. Table 16 shows the expected sign for the parameters estimated with the two-limit tobit model.

Table 16 – Expected sign for independent variables included in the two-limit tobit model

Variable	Expected sign			
	MM	GC	LD	RW
Northeast region**	-	+	+	-
West region**	+	-	-	+
Midwest region**	-	+	+	-
Age	+	-	-	+
Computer/electronic technology use	+	?	?	+
Channel diversification	+	-	-	+
Plant Group 1*	-	?	-	?
Plant Group 2 *	+	?	+	?
Plant Group 3 *	+	?	+	?
Plant Group 4 *	-	+	-	+
Plant Group 5*	?	?	?	?
Number of trade shows	?	+	+	?
Negotiated sales*	+	-	-	+
Contract sales*	+	-	-	?
Contract production with other producers	+	-	-	+
Contract production with retail garden centers	-	+	+	-
Contract production with mass merchandisers	+	-	-	+
Product uniqueness	-	+	+	?
Web sites expenditures*	?	+	+	?
Trade shows expenditures*	?	+	+	?

*Sales weighted variable
**Base= South

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Regions - The presence of smaller firms in the Midwest and Northeast was associated with less marketing channel mix. Although, nurseries in the Northeast are slightly bigger than firms in the Midwest, these firms were expected to have more similarities with producers in the Midwest than in the other two regions. Positive relationships were expected for garden center and landscaper channels because less diversified firms would tend to sell first to higher margins channels; the opposite was expected for growth channels. This expectation is opposite for firms in the West where the presence of larger firms would favor the sales to the mass merchandiser and re-wholesaler channels.

Firm Age – This variable is expected to have a positive sign for growth channels because older firms have enough inventories of products to fulfill the demand of the mass merchandiser and re-wholesaler channels. Younger firms might have less experience in the industry and would not have enough volume required to satisfy the requirements of growth channels; therefore, these firms would tend to sell to the garden center and landscaper channel.

Computer-assisted Functions – The use of alternative computer technologies was assumed to have a positive relationship with growth channels (re-wholesaler and mass merchandiser channels) because these outlets might have higher business requirements that encourage producers to implement computer functions in most activities regarding inventory, communication, production controls and administrative functions. The effect of this variable on the garden center and landscaper channel use was uncertain.

Channel Diversification – The use of three or more channels was believed to have a positive impact on the growth channels and negative for the core channels. Larger growers were expected to have a marketing strategy more focused on increasing sales to the re-wholesaler and mass merchandiser channel that ensured them a steady and high-volume demand of products.

Plant Group – The impact of most of the groups of plants on the re-wholesaler and garden center channels were unknown, however the sales of foliage were expected to have a positive effect on these channels. The variable plant groups 2 and 3 were expected to be positively related to the mass

merchandiser and landscaper channels because their customers might continuously demand more appealing and attractive flowered plants. On the other hand, a negative impact on sales to these channels was expected for plant groups 1 and 4. The groups 2 and 3 had an uncertain effect for the garden center and re-wholesaler channels because they might buy more plants that were not demanded by the other channels; however, they also need to have in inventories plants usually demanded by clients. For these channels, plants of group 4 were expected to be positive because foliage plants usually were demanded by channels with more diversified categories of plants. The impact of plants of group 5 was unknown for all the channels.

Trade Shows – This variable was expected to be positive for core channels and was unknown for growth channels. Since the landscaper and garden center channels demand more specialized and quality products, they need to constantly search for supplier that fulfill these requirements. Therefore, these channels might attend more trade shows because these events provide, at one place, a wide opportunity to see in person the product's characteristics and variety of many producers.

Negotiation of Sales - Higher levels of sales negotiation were associated with growth marketing channels. The mass merchandiser and re-wholesaler channels might want to make clear the terms of sales and prices of products before commit themselves in buying high volume of products and in establishing a long term relationship with producers. For garden center and landscaper channels this variable was expected to be negative because these channels usually give more importance to quality than other terms of sale.

Contract Sales – The variable contract sales, that committed the sale of the product before it was planted, was expected to have a positive impact on sales to mass-merchandisers and negative for core channels. The sign of this variable for the re-wholesaler channel was uncertain.

Contract Production with Other Producers and Mass Merchandisers – Higher levels of contracted production to other producers and to mass merchandisers was expected suggest a positive relationships with the two growth channels. These types of contracts were associated with lower sales to core channels.

Product Uniqueness – Firms determining price based on unique products were expected to have higher sales to landscaper and garden center channels because these channels usually provide their clients with more specialized category of products that are not commonly found in the mass merchandiser channel. For the re-wholesaler channel, the sign of this variable was uncertain.

Web Sites and Trade Shows Expenditure – These variables were expected to have a positive sign for the core channels. These channels were believed to use these kinds of advertising alternatives to find suppliers and increase their contacts with other producers. This variable had an uncertain sign for re-wholesaler and mass merchandiser channels. Although these channels were expected to have business relationships with previous established suppliers, they might use these alternatives to compare prices and to update their knowledge about possible demand trends in the industry.

CHAPTER 4 - RESULTS

Impacts of Business Characteristics on Marketing Channel Use - Multinomial Logit Model

Two groups of multinomial logit models were estimated to analyze the use of market channels in the ornamental plants industry by (i) size of producer firm, and (ii) by region. This model was used to understand the impacts of business characteristics on the producer´s marketing channel choice by the large/small firm distinction and by the location of producers considering four regions.

The Nursery Size Issue: Differences in Channel Choice between Large and Small Nurseries

The model significance and goodness of fit values for large and small equations are reported in Table 17. The likelihood-ratio chi-squared had a value of 399.63 for large firms and 370.25 for small firms. These models are statistically significant since the p-value for the chi-squared was equal to 0.0 for both equations. Pseudo-R^2 is a measurement of goodness of fit that indicates how well the model explains the variation in channel choice. Therefore, 27% and 19% of the variation of marketing channel choice were explained by the large and small models, respectively. Although, the pseudo-R^2 is not equivalent to the R^2 that is found in the ordinary linear regression model, the values of our measurement of goodness of fit are considered high for qualitative variables models.

Table 17 – Measurements of goodness of fit from multinomial logit model, by size

	Large Nursery	Small Nursery
Log likelihood	-538.811	-748.221
Number of observations	560	755
LR chi^2 (60)	399.63	370.25
Probability > chi^2	0.00	0.00
Pseudo R^2	0.2705	0.1983

Source: Trade Flows and Marketing Practices Survey

The results from the equations for large and small nurseries are reported in Table 18. As noted above, results from the multinomial logit model are in the form of log odds ratios that relate alternatives choices to a base or reference (re-wholesaler channel). The log odds ratio then shows whether a change in the independent variable makes the choice of more or less likely.

Table 18 – Estimated coefficients from multinomial logit models, by size and by marketing channel

Variable	Mass Merchandiser / Re-wholesaler		Garden Center / Re-wholesaler		Landscaper / Re-wholesaler	
	Large nursery	Small nursery	Large nursery	Small nursery	Large nursery	Small nursery
Region Northeast	-0.9989	-0.1082	0.2607	0.5389[a]	-0.4639	0.0383
	(0.682)	(0.571)	(0.388)	(0.325)	(0.353)	(0.293)
Region Midwest	-0.4565	-0.0713	-0.9710[a]	0.5322	0.4412	0.2338
	(0.801)	(0.840)	(0.579)	(0.352)	(0.376)	(0.287)
Region West	-0.5455	0.7018	-0.3116	-0.3987	-1.1877[b]	-0.7692[b]
	(0.498)	(0.458)	(0.367)	(0.340)	(0.327)	(0.282)
Firm age	-0.0001	-0.0097	-0.0058	0.0019	-0.0116[b]	-0.0003
	(0.009)	(0.011)	(0.006)	(0.007)	(0.005)	(0.006)
Computer use in mgt.	0.4045	0.1665	0.2028	-0.0117	-0.0479	0.3287
	(0.585)	(0.405)	(0.389)	(0.247)	(0.314)	(0.203)
Channel diversity	1.1372[b]	1.2810[b]	0.7079[b]	0.3758	0.0023	-0.2449
	(0.468)	(0.422)	(0.321)	(0.271)	(0.249)	(0.237)
Plant group 1	-0.0139	-1.8720[b]	0.0176[b]	-0.0868	0.0225[b]	0.4265[b]
	(0.013)	(0.539)	(0.009)	(0.154)	(0.008)	(0.117)
Plant group 2	0.0218[b]	0.5448	0.0310[b]	0.6489[b]	0.0165	-0.0284
	(0.011)	(0.335)	(0.013)	(0.253)	(0.013)	(0.272)
Plant group 3	0.0691[b]	1.0446[b]	0.1139[b]	0.9072[b]	0.0901[b]	0.9041[b]
	(0.028)	(0.392)	(0.026)	(0.350)	(0.025)	(0.327)
Plant group 4	0.0167	-0.4682	-0.1074[b]	-0.4189	-0.1204[b]	-0.5474[b]
	(0.019)	(0.346)	(0.054)	(0.273)	(0.043)	(0.267)
Plant group 5	-0.0391[b]	-0.6698[b]	-0.0110	-0.3661[b]	0.0015	-0.0550
	(0.015)	(0.268)	(0.016)	(0.177)	(0.007)	(0.135)
Trade shows attended	-0.1434[b]	-0.3542	-0.0387	-0.0535	-0.0585	-0.1168
	(0.064)	(0.217)	(0.049)	(0.096)	(0.040)	(0.083)
Prop. of negotiated sales	0.0393[b]	0.2070	0.0005	-0.3500[a]	-0.0009	-0.3766[b]
	(0.013)	(0.320)	(0.011)	(0.210)	(0.008)	(0.147)
Contract production (dollars)	-0.0067	-1.0702[b]	-0.1190[b]	-0.5781[a]	-0.0371[b]	-0.1702
	(0.015)	(0.498)	(0.039)	(0.310)	(0.016)	(0.219)
Contract, other producers	-0.6075	-1.9903[b]	-1.6109[b]	-2.2524[b]	-1.0014[b]	-1.4711[b]
	(0.453)	(0.554)	(0.407)	(0.360)	(0.296)	(0.254)
Contract, garden center	-0.8825	1.8056[b]	1.9004[b]	2.1627[b]	0.1497	0.7218[b]
	(0.590)	(0.493)	(0.425)	(0.333)	(0.393)	(0.317)
Contract, mass merch.	2.8339[b]	2.0026[b]	-0.6335	0.1035	-1.2331[b]	-0.7400
	(0.517)	(0.633)	(0.615)	(0.615)	(0.617)	(0.654)
Product uniqueness	-0.0314	-1.0558[b]	0.0196	-0.5755[b]	-0.0193	-0.4821[b]
	(0.406)	(0.395)	(0.301)	(0.249)	(0.247)	(0.209)
Website adv. share	-0.1024[a]	1.0176	-0.0380	0.8146[a]	-0.0376	0.5421
	(0.053)	(0.648)	(0.038)	(0.468)	(0.034)	(0.435)
Trade show adv. share	0.0031	0.7728[b]	-0.0406[b]	-0.0303	-0.0262[b]	-0.1824
	(0.010)	(0.370)	(0.017)	(0.249)	(0.012)	(0.195)
Constant	-2.1287[b]	-0.8327	-0.5388	0.0477	1.2880[b]	0.7278[b]
	(0.774)	(0.535)	(0.505)	(0.335)	(0.395)	(0.278)

Source: Multi-state Regional Project S-1021 survey, 2004
Note: Re-wholesaler is the reference group and standard errors are in parenthesis.
The superscript "a" represents significance at the 0.10 level and "b" at the 0.05 level.

An example interpretation of significant coefficients of dummy and continuous variables is provided in the following section. For the interpretation of the sales-weighted estimated coefficients, the unit change refers to a $100,000 change in the independent variable. The discussion of each channel below reports variables that were significant in the results.

Large and Small Model Estimated Coefficients

The estimated coefficients values of the multinomial logit model have different interpretation compared to the marginal effects. However, the estimates of this model provide useful information about how the use of the marketing channels varies when is compared to the re-wholesaler channel. The following section includes the interpretations of the estimated coefficients for large and small firms organized by channel.

Mass Merchandiser Channel - Level of market channel diversification had the expected positive sign for large and small firms. Since the dependent variable is the log ratio of the probability of the choice being analyzed (mass merchandiser) over the reference choice (re-wholesaler), the positive coefficient (direct relationship) meant that large and small firms using three or more marketing channels were more likely to choose the mass merchandiser over the re-wholesaler channel.

The sales of plant group 1 for small firms favored the choice toward the re-wholesaler channel. Therefore, if small nurseries increased their sales of plants of group 1, the multinomial log-odds of choosing mass merchandisers rather than re-wholesalers would decline. Trade shows variable had negative sign for large firms. The more trade shows attended during a year, the more the growers were prone to use the re-wholesaler over the mass merchandiser channel.

The variable other producers contract was negative as expected. This variable indicated that small nurseries using production contracts with other producers had a lower likelihood of choosing the mass merchandiser channel and a greater likelihood of using the re-wholesaler channel.

Garden Centers Channel - Two regional estimates were significantly different from zero for the garden center/re-wholesaler comparison.

Small firms located in the Northeast were more likely to choose the garden center channel than the re-wholesaler channel compared to small producers in the South, but large firms in the Midwest were more likely to choose the re-wholesaler channel. Contracted production was negative and significant for small and large nurseries, indicating these nurseries were more likely to choose to the re-wholesaler than the garden center channel.

Landscaper Channel - Firms located in the West region had negative significant coefficients for large and small nurseries, meaning that both were more likely to use the re-wholesaler than the landscaper channel compared to firms located in the South. This situation could suggest that re-wholesalers had high market share in the West region.

The significant parameter estimates for the plant groups suggested that small and large nurseries selling specific plant categories made similar market channel choices. Thus, both size firms selling plants like deciduous shade and flowering trees, azaleas, vines and groundcovers and roses (group 1 and 3) had a greater likelihood of choosing the landscaper over the re-wholesaler channel. The opposite was observed for firms selling plants of group 4 (foliage).

Large and Small Nurseries Model Marginal Effects

The marginal effects calculated by the multinomial logit models are shown in Table 19 and their discussion was organized by marketing channel. Since the interpretation of the marginal effects is directly related to the choice of one channel without any comparison to a reference, the expected sign for the explanatory variables for this model were expected to be similar to the expectations for the two-limit tobit model (Table 16).

Re-wholesaler Channel - The variable West had positive and significant sign for large and small nurseries. Therefore, firms located in this region were more likely to sell products through the re-

wholesaler channel than firms in the South, holding everything else constant. Likewise, older large firms were associated with greater probability of using this channel.

Table 19 – Marginal effects from multinomial logit model, by size and by marketing channel

Variable	Re-wholesaler		Mass Merchandiser		Garden Center		Landscaper	
	Large nursery	Small nursery	Large nursery	Small nursery	Large nursery	Small nursery	Large nursery	Small nursery
Region Northeast	0.07370	-0.04439	-0.05045 [a]	-0.00359	0.07963	0.09751 [a]	-0.10288	-0.04952
	(0.07508)	(0.05464)	(0.03053)	(0.00668)	(0.05276)	(0.05295)	(0.06914)	(0.05735)
Region Midwest	-0.02932	-0.06722	-0.03645	-0.00417	-0.10789 [b]	0.07269	0.17366 [b]	-0.00130
	(0.07796)	(0.05344)	(0.03873)	(0.00973)	(0.03526)	(0.05639)	(0.07965)	(0.05760)
Region West	0.20472 [b]	0.13348 [b]	-0.00147	0.02453	0.03284	-0.00385	-0.23608 [b]	-0.15416 [b]
	(0.06808)	(0.06043)	(0.03432)	(0.01574)	(0.04445)	(0.05171)	(0.05869)	(0.05660)
Firm age	0.00198 [b]	-0.00004	0.00047	-0.00015	0.00003	0.00038	-0.00248 [b]	-0.00019
	(0.00103)	(0.00121)	(0.00067)	(0.00016)	(0.00065)	(0.00103)	(0.00113)	(0.00127)
Computer use in mgt.	-0.01201	-0.04603	0.02673	0.00024	0.02302	-0.03566	-0.03774	0.08145 [a]
	(0.06467)	(0.04010)	(0.03410)	(0.00565)	(0.03844)	(0.03556)	(0.06848)	(0.04236)
Channel diversity	-0.06069	-0.00362	0.06908 [b]	0.02650	0.07073 [b]	0.08695 [b]	-0.07912	-0.10982 [b]
	(0.05172)	(0.04598)	(0.02782)	(0.01315)	(0.03243)	(0.04331)	(0.05440)	(0.04759)
Plant group 1	-0.00377 [b]	-0.04520 [a]	-0.00205 [b]	-0.03034	0.00092	-0.05176 [b]	0.00490 [b]	0.12730 [b]
	(0.00200)	(0.02400)	(0.00100)	(0.00800)	(0.00100)	(0.02300)	(0.00100)	(0.02500)
Plant group 2	-0.00451 [a]	-0.04292	0.00067	0.00610	0.00253 [a]	0.11305 [b]	0.00131	-0.07622
	(0.00200)	(0.05100)	(0.00100)	(0.00500)	(0.00100)	(0.03500)	(0.00300)	(0.05500)
Plant group 3	-0.02059 [b]	-0.19366 [b]	0.00059	0.00626	0.00757 [b]	0.06190	0.01242 [b]	0.12550 [b]
	(0.00500)	(0.06600)	(0.00200)	(0.00500)	(0.00200)	(0.04100)	(0.00400)	(0.05700)
Plant group 4	0.02239 [b]	0.10759 [b]	0.00683 [b]	-0.00179	-0.00584	-0.01552	-0.02339 [b]	-0.09027
	(0.00800)	(0.04600)	(0.00300)	(0.00500)	(0.00700)	(0.04800)	(0.01000)	(0.06500)
Plant group 5	0.00137	0.03586	-0.00285 [b]	-0.00832 [a]	-0.00100	-0.05542 [b]	0.00248	0.02788
	(0.00200)	(0.02700)	(0.00100)	(0.00500)	(0.00200)	(0.02700)	(0.00200)	(0.03000)
Trade shows attended	0.01433 [a]	0.02168	-0.00817 [a]	-0.00427	0.00063	0.00372	-0.00680	-0.02113
	(0.00796)	(0.01609)	(0.00475)	(0.00333)	(0.00517)	(0.01453)	(0.00856)	(0.01806)
Prop. of negotiated sales	-0.00096	0.07579 [b]	0.00297 [b]	0.00681	-0.00035	-0.02312	-0.00166	-0.05947 [a]
	(0.00200)	(0.03000)	(0.00100)	(0.00500)	(0.00100)	(0.03300)	(0.00200)	(0.03400)
Contract production (dollars)	0.01138 [b]	0.06837	0.00223 [a]	-0.01275	-0.01234 [b]	-0.07906	-0.00128	0.02345
	(0.00300)	(0.04400)	(0.00100)	(0.00900)	(0.00400)	(0.04900)	(0.00400)	(0.05100)
Contract, other producers	0.24923 [b]	0.39297 [b]	0.00255	-0.01107 [a]	-0.11042 [b]	-0.19388 [b]	-0.14136 [b]	-0.18802 [b]
	(0.06149)	(0.05200)	(0.03236)	(0.00595)	(0.03567)	(0.03049)	(0.06319)	(0.05003)
Contract, garden center	-0.13544 [b]	-0.23280 [b]	-0.07312 [b]	0.01393	0.33934 [b]	0.34714 [b]	-0.13077 [a]	-0.12828 [b]
	(0.06166)	(0.03816)	(0.02286)	(0.01065)	(0.07806)	(0.05548)	(0.07496)	(0.05399)
Contract, mass merch.	-0.09080	0.04631	0.57070 [b]	0.10216	-0.09268 [b]	0.06054	-0.38723 [b]	-0.20901 [a]
	(0.07520)	(0.11627)	(0.09410)	(0.06247)	(0.03784)	(0.10510)	(0.06355)	(0.11244)
Product uniqueness	0.00273	0.10815 [b]	-0.00190	-0.01158	0.00403	-0.04623	-0.00487	-0.05034
	(0.04986)	(0.03859)	(0.02903)	(0.00771)	(0.03192)	(0.03707)	(0.05240)	(0.04321)
Website adv. share	0.01013	-0.13644	-0.00586	0.00864	-0.00111	0.08253	-0.00316	0.04527
	(0.00700)	(0.09000)	(0.00400)	(0.00800)	(0.00400)	(0.05300)	(0.00700)	(0.07500)
Trade show adv. share	0.00572 [b]	0.02407	0.00165 [b]	0.01279 [a]	-0.00341 [a]	0.01059	-0.00397	-0.04746
	(0.00200)	(0.03800)	(0.00100)	(0.00700)	(0.00200)	(0.03900)	(0.00300)	(0.04400)

Source: Multi-state Regional Project S-1021 survey, 2004
Note: Re-wholesaler is the reference group and standard errors are in parenthesis. The superscript "a" represents significance at the 0.10 level and "b" at the 0.05 level.

Firms with increasing sales of plants within groups 1, 2, and 3 were less likely to use the re-wholesaler channel. On the other hand, large and small producers had a greater probability of using re-wholesalers when they sold plants of group 4. The variable trade shows had also a positive sign for large firms, so large producers who attended more trade shows were more likely to use this channel. As expected, large and small firms who produced under agreement for other producers were more likely to use this channel than firms without this type of contract. Large firms were more likely to sell ornamental products through re-wholesalers if they had more attendance at trade shows, and if a larger share of their total production was on contract. As expected, the use of contracts with garden centers was associated with a lower selling probability to this channel. Furthermore, large nurseries with a higher promotion activity at trade shows were more likely to use the re-wholesaler channel.

Mass Merchandiser Channel - Large firms in the Northeast were associated with lower probability of selling to the mass merchandiser channel than firms located in the South. Large and small nurseries with production of plants of groups 1 and 5 were less likely to sell through this channel. The variables channel diversity and trade shows advertising expenditure were positive and significant for large and small nurseries. Therefore, firms with more marketing channel mix or higher promotion of expenditure at trade shows were more likely to sell to mass merchandisers. For large firms, the use of negotiation and production contracts favored the choice toward this channel.

Garden Center Channel - Small firms in the Northeast were more likely to use this channel to sell their products compared with similar firms in the South. The opposite was observed for large firms in the Midwest. A more diversified marketing strategy was associated with greater probability of selling to the garden center channel. Large and small firms using production contracts with garden centers had greater probability of using this channel. On the other hand, if production contracts were signed with other producers, firms were less likely to use garden centers.

Landscaper Channel - In the West, large and small firms' marginal effects were negative and significant. Therefore, firms in this region were less likely to use the landscaper channel than firms with similar characteristics in the South. This was different in the Midwest, where large firms were associated with greater probability of choosing this channel. The variable age had negative sign, meaning that older large firms were less likely to choose landscapers. Nurseries using contracts with other producers, garden centers or mass merchandisers were associated with lower probability of selling ornamental products through this channel.

The Regional Issue: Differences in Channel Choice between Nurseries in Four Regions

Producers´ marketing channel choice was analyzed regionally running three separate models for South, West and Midwest/Northeast. Table 20 includes the significance and goodness of fit values for the regional analysis. The likelihood-ratio chi-squared had a value of -667.35 for the South, -216.97 for West and -399.49 for the combination of the other two regions. For the three models the p-values were equal to 0.0, which confirmed that each model was statistically significant as a whole. The pseudo-R^2 measurement had value of 21% for the South, 26% for the West and 21% for the Midwest/Northeast models.

Table 20 – Measurements of goodness of fit from multinomial logit model for regional nurseries

	South	West	Midwest/Northeast
Log likelihood	-667.356	-216.976	-399.495
Number of observations	670	225	420
LR chi^2 (60)	372.37	156.27	218.27
Probability > chi^2	0.00	0.00	0.00
Pseudo R^2	0.2181	0.2648	0.2146

Source: Trade Flows and Marketing Practices Survey

Regional Nurseries Model Estimated Coefficients

Table 21 includes the estimated coefficients of three regional models for mass merchandisers, garden centers and landscapers over re-wholesalers. In this analysis the dependent variables of the multinomial logit models were the log ratio of the probability of choosing one of the three channels over the probability of choosing the re-wholesaler channel.

Mass Merchandiser Channel - The variable channel had positive and significant values for firms in the South and West, respectively. This positive sign implied that nurseries in these regions, using three or more marketing channels, were more likely to choose the mass merchandiser over the re-wholesaler channel than firms using only two channels. Producers located in the West and growing plants of group 1 had a lower likelihood of choosing this channel compared to the re-wholesaler channel. Sales of plants of group 5 for firms in the West and Northeast/Midwest were associated with higher probability of choosing the mass merchandiser instead the re-wholesaler channel. Furthermore, the multinomial log-odds for choosing mass merchandisers to re-wholesaler channel would decrease if nurseries in the West and South increased their sales of plants of groups 2 and 3, respectively. As expected, firms using contract with other producers were more likely to use re-wholesalers over mass merchandisers than firms in the same region without this type of contracts.

Garden Center Channel - The variable size had an unexpected positive and significant sign for nurseries located in the West. Large firms located in this region were more likely to choose the garden center over the re-wholesaler channel compared to small firms. Moreover, this choice was similar for nurseries with more diversified marketing channel strategy. Producers growing plants of groups 1 and 3 in the South and Midwest/Northeast had a greater likelihood of selling products to this channel and lower likelihood of selling to the re-wholesaler channel.

Landscaper Channel - The negative coefficient (inverse relationship) for the variable age meant that older firms in the South were less likely to choose the landscaper over the re-wholesaler channel. Furthermore, firms located in this region using four or more computer functions in their activities were more likely to use the landscaper over the reference channel than those firms with less computerization level. The variable trade shows had an expected negative value for firms in the West. Therefore, firms located in this region with more trade shows attendance had greater likelihood of selling to the re-wholesaler channel and lower likelihood of selling to the landscaper channel.

Table 21 – Estimated coefficients from multinomial logit models, by region and by marketing channel

Variable	Mass Merchandiser / Re-wholesaler			Garden Center / Re-wholesaler			Landscaper / Re-wholesaler		
	South	West	Midwest/ Northeast	South	West	Midwest/ Northeast	South	West	Midwest/ Northeast
Firm size	0.3178	-0.4817	-0.9816	0.4510	1.4337[b]	-0.4610	0.1035	0.5817	0.1830
	(0.4579)	(0.8289)	(1.4322)	(0.3546)	(0.6264)	(0.4534)	(0.2750)	(0.5315)	(0.3895)
Firm age	-0.0016	-0.0057	-0.0232	-0.0067	-0.0052	-0.0009	-0.0106[a]	-0.0086	-0.0041
	(0.0107)	(0.0135)	(0.0183)	(0.0079)	(0.0113)	(0.0067)	(0.0062)	(0.0119)	(0.0058)
Computer use in mgt.	0.0952	0.3652	-0.0829	-0.1507	-0.0325	0.2128	0.4448[b]	-0.3441	0.0997
	(0.4293)	(0.6195)	(0.8014)	(0.2949)	(0.5160)	(0.3488)	(0.2221)	(0.4643)	(0.3113)
Channel diversity	1.1682[b]	1.7662[b]	0.3421	0.3942	1.5604[b]	-0.2956	0.0535	1.0027[b]	-0.7780[b]
	(0.4015)	(0.6170)	(0.8342)	(0.2963)	(0.5008)	(0.3537)	(0.2306)	(0.4689)	(0.3103)
Plant group 1	-0.0100	-0.1524[a]	-0.2507	0.0349[a]	-0.0309	0.0387[b]	0.0437[b]	0.0165	0.0327[a]
	(0.0250)	(0.0839)	(0.1766)	(0.0208)	(0.0286)	(0.0190)	(0.0178)	(0.0172)	(0.0178)
Plant group 2	0.0217	0.1217[a]	0.1276	0.0545[b]	0.0647	0.0534	0.0286	-0.3464	0.0289
	(0.0173)	(0.0710)	(0.1518)	(0.0253)	(0.0597)	(0.0563)	(0.0186)	(0.2215)	(0.0518)
Plant group 3	0.0994[a]	0.0581	0.0975	0.1619[b]	0.1281	0.1436[b]	0.1019[b]	0.1145[b]	0.1069[b]
	(0.0535)	(0.1017)	(0.1182)	(0.0579)	(0.0887)	(0.0542)	(0.0493)	(0.0556)	(0.0517)
Plant group 4	0.0124	0.0278	0.5192	-0.2298[b]	-0.0223	0.9276	-0.1338[b]	-0.2726	-0.0097
	(0.0298)	(0.1163)	(1.2249)	(0.1010)	(0.1072)	(0.6713)	(0.0499)	(0.3473)	(0.7429)
Plant group 5	-0.0462[b]	-0.2829	-0.4893[b]	-0.0329	-0.2175	0.0087	0.0047	-0.0059	0.0030
	(0.0235)	(0.1928)	(0.2263)	(0.0222)	(0.1398)	(0.0277)	(0.0107)	(0.0430)	(0.0205)
Trade shows attended	-0.0100	-0.5972[b]	-0.7268[a]	0.0285	-0.1654[a]	-0.0379	0.0189	-0.3066[b]	-0.0768
	(0.0762)	(0.2317)	(0.4408)	(0.0709)	(0.0994)	(0.0772)	(0.0566)	(0.1041)	(0.0638)
Prop. of negotiated sales	0.0490[b]	0.1622[b]	0.0236	0.0284	-0.2530[b]	-0.1965[b]	-0.0005	-0.0200	-0.0293
	(0.0214)	(0.0825)	(0.1085)	(0.0186)	(0.1041)	(0.1004)	(0.0120)	(0.0195)	(0.0555)

(Table continued)

(Table continued)

Variable	Mass Merchandiser / Re-wholesaler			Garden Center / Re-wholesaler			Landscaper / Re-wholesaler		
	South	West	Midwest/ Northeast	South	West	Midwest/ Northeast	South	West	Midwest/ Northeast
Contract production (dollars)	-0.0154 (0.0193)	-0.1239 (0.1470)	0.3661[b] (0.1803)	-0.1751[b] (0.0743)	-0.1273 (0.0925)	-0.1384 (0.0849)	-0.0660[b] (0.0321)	-0.0001 (0.0228)	-0.0631 (0.0398)
Contract, other producers	-1.2033[b] (0.4558)	-1.2292[a] (0.6872)	-3.0599[b] (1.1522)	-2.6881[b] (0.4386)	-1.3175[b] (0.5462)	-2.3342[b] (0.5099)	-1.4311[b] (0.2540)	-1.4767[b] (0.5101)	-1.5271[b] (0.3872)
Contract, garden center	-0.0508 (0.5571)	0.2457 (0.6706)	1.8237[b] (0.8551)	2.9808[b] (0.4274)	0.4996 (0.5284)	2.2675[b] (0.4815)	0.7945[b] (0.3811)	-0.6010 (0.6222)	0.8858 (0.4572)
Contract, mass merch.	2.2016[b] (0.4698)	1.6382[a] (0.9436)	4.7381[b] (1.2560)	-2.1374[b] (0.7282)	0.9759 (0.9612)	1.7859 (1.0107)	-1.7984[b] (0.5876)	-0.5922 (1.2858)	0.4368 (1.0128)
Product uniqueness	-0.4094 (0.3691)	-1.0295[a] (0.5674)	-0.3174 (0.8071)	-0.0663 (0.2857)	-0.4139 (0.4780)	-0.6844[b] (0.3372)	-0.0236 (0.2171)	-0.8595[b] (0.4154)	-0.4090 (0.2957)
Website adv. Share	-0.1154 (0.1252)	-0.8855[b] (0.4217)	0.0082 (0.8202)	0.0329 (0.0904)	-0.3244[a] (0.1777)	-0.0707 (0.0871)	0.0481 (0.0845)	-0.2488 (0.1836)	-0.0337 (0.0756)
Trade show adv. Share	0.0019 (0.0137)	0.2011[a] (0.1091)	0.2475 (0.1654)	-0.0802[b] (0.0306)	0.0642 (0.0393)	-0.0914[a] (0.0482)	-0.0424[b] (0.0187)	-0.0153 (0.0277)	-0.0541 (0.0348)
Constant	-2.1701[b] (0.5160)	-0.4800 (0.7027)	-1.1161 (0.8976)	-0.5186 (0.3443)	-0.3613 (0.6000)	0.7078[a] (0.3881)	0.5073[a] (0.2660)	0.9311[a] (0.5030)	1.4354[b] (0.3388)

Source: Multi-state Regional Project S-1021 survey, 2004

Note: Re-wholesaler is the reference group and standard errors are in parenthesis. The superscript "a" represents significance at the 0.10 level and "b" at the 0.05 level.

<u>Regional Nurseries Model Marginal Effects</u>

Re-wholesaler Channel - The marginal effects calculated from this model are shown in Table 22. We can observe in this table that channel diversification was negative and positive for nurseries located in the West and Midwest/Northeast, respectively. These relationships implied that firms in the West were less likely to sell ornamental products through re-wholesalers and firms located in the Midwest/Northeast had greater probability of using this channel. In the South, firms with diversified production of plants (groups 1, 2 and 3) were associated with lower probability of using the re-wholesaler channel. Furthermore, firms located in the Midwest/Northeast with higher percentage of sales of plants within groups 1 and 3 were less likely to use this channel. Firms growing plants of group 3 in the United States were less likely to choose re-wholesalers to allocate products. Only firms in the South and West selling plants of groups 1 and 5 had greater probability of using the re-wholesaler channel, respectively. The variable trade shows had positive sign for growers in the West. Therefore, producers attending trade shows in this region were more likely to choose this channel. The contract production variable was significant for firms in the South and Midwest/Northeast. Firms using production contracts in these regions favored the sales toward the re-wholesaler channel. Similar choices were observed for firms in all regions that used contract production with other producers. However, in the South and the Midwest/Northeast, nursery firms were less likely to sell ornamental products through re-wholesalers if they sign production contracts with garden centers. The use of contracts with mass merchandisers was associated with lower probability of selling products to the re-wholesaler channel if firms were located in the Northeast/Midwest region. The price determination based on product uniqueness in the West and Midwest/Northeast was associated with greater probability of using this channel. Firms in the West would tend to sell to this channel if they had higher website advertising expenditure. On the other hand, this channel would be more likely to be used by firms with more trade shows advertising expenditure located in the South and the Midwest/Northeast.

Table 22 – Marginal effects from multinomial logit model, by region and by marketing channel

Variable	Re-wholesaler			Mass Merchandiser			Garden Center			Landscaper		
	South	West	Midwest /Northeast	South	West	Midwest/ Northeast	South	West	Midwest/ Northeast	South	West	Midwest/ Northeast
Firm size	-0.04310	-0.12361	-0.00243	0.01373	-0.03423	-0.00330	0.04008	0.10930[a]	-0.09257	-0.01071	0.04855	0.09830
	(0.05728)	(0.09789)	(0.06550)	(0.02914)	(0.04588)	(0.00603)	(0.03309)	(0.05982)	(0.05646)	(0.05820)	(0.05732)	(0.07275)
Firm age	0.00201	0.00130	0.00059	0.00030	-0.00021	-0.00007	-0.00010	-0.00028	0.00035	-0.00222[a]	-0.00082	-0.00087
	(0.00130)	(0.00178)	(0.00097)	(0.00068)	(0.00066)	(0.00012)	(0.00073)	(0.00079)	(0.00084)	(0.00134)	(0.00131)	(0.00111)
Computer use in mgt.	-0.06615	0.02043	-0.02269	-0.00674	0.01980	-0.00066	-0.04228	-0.00040	0.02307	0.11516[b]	-0.03984	0.00028
	(0.04747)	(0.07737)	(0.05262)	(0.02755)	(0.02962)	(0.00295)	(0.02937)	(0.03583)	(0.04319)	(0.04719)	(0.05413)	(0.05966)
Channel diversity	-0.05493	-0.26473[b]	0.11448[b]	0.07688[b]	0.08544	0.00320	0.02792	0.10421	0.04001	-0.04987	0.07508	-0.15768[b]
	(0.04720)	(0.09294)	(0.05552)	(0.02855)	(0.06837)	(0.00519)	(0.02739)	(0.06602)	(0.04773)	(0.04924)	(0.06160)	(0.06077)
Plant group 1	-0.00818[b]	0.00652	-0.00577[a]	-0.00239	-0.00774[b]	-0.00098	0.00133	-0.00177	0.00271[a]	0.00924[b]	0.00299	0.00404
	(0.00400)	(0.00400)	(0.00300)	(0.00200)	(0.00400)	(0.00100)	(0.00100)	(0.00200)	(0.00200)	(0.00300)	(0.00300)	(0.00300)
Plant group 2	-0.00736[a]	0.02194	-0.00628	0.00002	0.00814	0.00036	0.00399[a]	0.00753	0.00528	0.00335	-0.03762[b]	0.00064
	(0.00400)	(0.01400)	(0.00900)	(0.00100)	(0.00700)	(0.00100)	(0.00200)	(0.00600)	(0.00600)	(0.00400)	(0.01000)	(0.00800)
Plant group 3	-0.02541[b]	-0.02016[a]	-0.02041[b]	0.00181	0.00168	0.00003	0.01061[b]	0.00809	0.01097[b]	0.01300	0.01039	0.00941
	(0.01000)	(0.01100)	(0.00800)	(0.00300)	(0.00500)	(0.00000)	(0.00500)	(0.00700)	(0.00400)	(0.00900)	(0.00800)	(0.00700)
Plant group 4	0.03061[b]	0.02438	-0.04233	0.00719[b]	0.00326	0.00118	-0.01697[a]	0.00083	0.15223[b]	-0.02083[a]	-0.02847	-0.11108
	(0.01000)	(0.03400)	(0.12000)	(0.00300)	(0.00600)	(0.00400)	(0.01000)	(0.00800)	(0.07400)	(0.01200)	(0.03600)	(0.13200)
Plant group 5	0.00173	0.02493[a]	-0.00039	-0.00292[i]	-0.01345	-0.00175	-0.00335	-0.01474	0.00144	0.00454[a]	0.00325	0.00070
	(0.00200)	(0.01400)	(0.00400)	(0.00200)	(0.01000)	(0.00200)	(0.00200)	(0.01100)	(0.00400)	(0.00300)	(0.00500)	(0.00400)
Trade shows attended	-0.00396	0.06114[b]	0.01217	-0.00153	-0.02777	-0.00240	0.00205	-0.00669	0.00326	0.00344	-0.02667	-0.01303
	(0.01191)	(0.02216)	(0.01064)	(0.00460)	(0.01927)	(0.00332)	(0.00610)	(0.00839)	(0.01036)	(0.01152)	(0.01833)	(0.01301)
Prop. of negotiated sales	-0.00229	0.01038	0.01287	0.00300[b]	0.00949[b]	0.00029	0.00261	-0.01914[b]	-0.02871[b]	-0.00332	-0.00073	0.01555
	(0.00300)	(0.00700)	(0.01100)	(0.00100)	(0.00500)	(0.00100)	(0.00200)	(0.00700)	(0.01300)	(0.00300)	(0.00200)	(0.01300)

(Table continued)

(Table continued)

Variable	Re-wholesaler			Mass Merchandiser			Garden Center			Landscaper		
	South	West	Midwest / Northeast	South	West	Midwest/ Northeast	South	West	Midwest / Northeast	South	West	Midwest / Northeast
Contract production (dollars)	0.01818[b]	0.01262	0.01421[a]	0.00266	-0.00577	0.00153	-0.01474[b]	-0.00884	-0.01554	-0.00610	0.00199	-0.00019
	(0.00700)	(0.00900)	(0.00800)	(0.00200)	(0.00700)	(0.00200)	(0.00700)	(0.00700)	(0.01200)	(0.00800)	(0.00300)	(0.01000)
Contract, other producers	0.37207[b]	0.21537[b]	0.36596[b]	-0.02024	-0.04090	-0.00408	-0.14053[b]	-0.06542	-0.16998[b]	-0.21130[b]	-0.10905	-0.19190[b]
	(0.05164)	(0.08263)	(0.08420)	(0.02353)	(0.03786)	(0.00556)	(0.02785)	(0.04608)	(0.04999)	(0.05196)	(0.07539)	(0.08850)
Contract, garden center	-0.25915[b]	-0.00080	-0.18854[b]	-0.05511[l]	0.01417	0.00282	0.44800[b]	0.04670	0.31600[b]	-0.13374[b]	-0.06006	-0.13029[a]
	(0.04622)	(0.09376)	(0.05092)	(0.01841)	(0.03802)	(0.00572)	(0.06961)	(0.05482)	(0.07272)	(0.06593)	(0.05905)	(0.07887)
Contract, mass merch.	0.04133	-0.15569	-0.14378[a]	0.48215[b]	0.14468	0.11871	-0.11632[b]	0.08173	0.25210	-0.40716[b]	-0.07072	-0.22703
	(0.09041)	(0.20641)	(0.07944)	(0.09479)	(0.14028)	(0.16097)	(0.02425)	(0.10904)	(0.19945)	(0.05510)	(0.08012)	(0.19257)
Product uniqueness	0.01701	0.15110[a]	0.08129[a]	-0.02723	-0.05012	0.00022	-0.00197	-0.01650	-0.06530	0.01219	-0.08448	-0.01621
	(0.04498)	(0.08342)	(0.04616)	(0.02613)	(0.04783)	(0.00266)	(0.02626)	(0.03617)	(0.04455)	(0.04648)	(0.06615)	(0.05593)
Website adv. Share	-0.00623	0.07713[b]	0.00759	-0.00947	-0.04216[b]	0.00015	0.00178	-0.01770	-0.00764	0.01392	-0.01727	-0.00010
	(0.01800)	(0.02700)	(0.01300)	(0.00800)	(0.02100)	(0.00300)	(0.00600)	(0.01600)	(0.00900)	(0.01600)	(0.02100)	(0.01200)
Trade show adv. Share	0.01005[b]	-0.01058	0.01097[a]	0.00221[b]	0.01008[a]	0.00105	-0.00615[b]	0.00401	-0.00883	-0.00611	-0.00350	-0.00320
	(0.00400)	(0.00700)	(0.00600)	(0.00100)	(0.00600)	(0.00100)	(0.00300)	(0.00300)	(0.00600)	(0.00400)	(0.00400)	(0.00700)

Source: Multi-state Regional Project S-1021 survey, 2004

Note: Re-wholesaler is the reference group and standard errors are in parenthesis. The superscript "a" represents significance at the 0.10 level and "b" at the 0.05 level.

Mass Merchandiser Channel - Firms in the South using three or more marketing channel were more likely to have business relationship with mass merchandisers (Table 22). In this region, the sales of plants of group 4 and 5 were associated with greater and lower probability of using this channel. Firms with higher percentage of negotiated sales and trade shows advertising expenditure in both regions, South and West, were more likely to use the mass merchandiser channel.

Garden Center Channel – Since the variable size was significant and positive, large firms in the West tended to establish more business relationship with garden centers compared with small firms in the same region (Table 22). Producers growing plants of groups 1, 3 and 4 in the Midwest/Northeast region were associated with greater probability of choosing to this channel. Moreover, the use of contracts with other producers makes firms in the South and Midwest/Northeast less likely to sell to the garden center channel. The opposite was observed for firms signing contracts with garden centers.

Landscaper Channel - The marginal effect of age had a negative and significant value for firms located in the South (Table22). Statistically, older firms in this region were less likely to sell to landscapers. In this region, firms with high level of computer functions adoption were more likely to use the landscaper channel. For these firms, the production of plants of groups 1 and 5 was associated with greater probability of using this channel.

Impacts of Business Characteristics on Sales to Marketing Channels - Two-Limit Tobit Model

The proportion of sales through each marketing channel was estimated by size firm (large and small) using the two-limit tobit model. Two models were run for each of the channels. It was expected to demonstrate how firms' characteristics affect the sales of ornamental products through each channel.

Size Nursery Models

Table 23 shows the goodness of fit and overall model significance measurements of the small and large models. The p-value for all models was lower than 0.05 level of significance, indicating the models were statistically significant. The lowest pseudo-R^2 was obtained from the landscaper small nursery model

with a value of 9.4%, meaning that very little of the variation from the mean percentage of sales to this channel was accounted for by this model. The opposite was observed in the large nurseries model for garden centers which had the highest value of 40%.

Table 23 – Measurements of goodness of fit from two limit tobit model, by size

	Mass Merchandiser		Garden Center		Landscaper		Re-wholesaler	
	Large nursery	Small nursery	Large nursery	Small nursery	Large nursery	Small nursery	Large nursery	Small nursery
Log likelihood	-242.10	-244.27	-147.95	-534.87	-337.33	-647.72	-309.31	-633.04
Number of observations	560	755	560	755	560	755	560	755
LR chi-squared (20)	264.37	155.14	202.18	219.03	151.59	134.79	103.39	195.3
Probability > chi-squared	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pseudo R-squared	0.353	0.241	0.405	0.17	0.183	0.094	0.143	0.133

Source: Multi-state Regional Project S-1021 survey, 2004

<u>Large and Small Nurseries Model Estimated Coefficients</u>

The estimated coefficients of the two-limit tobit model are presented in Table 24. This table includes the results of eight equations per channel and firm size. Results and interpretation were focused in the significant parameters. For the interpretation of sales–weighted coefficients, the term unit refers to $100,000.

Re-wholesaler Channel - The variable Northeast was significant and negative, as expected. This result indicated that the percentage of sales sold through this channel was influenced negatively by firms located in the Northeast compared with small firms in the South. These results showed a significant positive relationship between large firms located in the West and the proportion of sales to the re-wholesaler channel. Small firms that sell to three or more marketing channels had a positive impact on the proportion of sales through this channel. For small and large firms, the variables groups of plants 1, 2 and 3 had negative sign. Thus, the proportion of sales allocated to re-wholesalers was negatively influenced by the categories of plants in groups 1, 2 and 3 grown by most of large and small producers. Moreover, large and small firms with higher percentage of sales on contract were more likely to increase the proportion of sales toward this channel.

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Table 24 – Estimated coefficients from two-limit tobit models, by size and by marketing channel

Variable	Re-wholesaler		Mass Merchandiser		Garden Center		Landscaper	
	Large nursery	Small nursery	Large nursery	Small nursery	Large nursery	Small nursery	Large nursery	Small nursery
Region Northeast	-0.01138	-0.23279 [b]	-0.11300	-0.09142	0.13864 [b]	0.14275 [b]	-0.08774 [a]	0.03711
	(0.04714)	(0.07193)	(0.07061)	(0.15924)	(0.03566)	(0.05986)	(0.05233)	(0.06379)
Region Midwest	-0.07046	-0.19847 [b]	-0.24820 [b]	0.09814	-0.06671 [a]	0.03278	0.20697 [b]	0.11535 [a]
	(0.05172)	(0.07364)	(0.08796)	(0.17760)	(0.04001)	(0.06450)	(0.05602)	(0.06549)
Region West	0.09300 [b]	0.07905	0.06583	0.61608 [b]	0.03896	-0.06445	-0.20612 [b]	-0.21475 [b]
	(0.04437)	(0.07002)	(0.06132)	(0.14042)	(0.03418)	(0.06489)	(0.05018)	(0.06736)
Firm age	0.00079	0.00092	0.00005	-0.00218	0.00032	0.00092	-0.00090	-0.00077
	(0.00072)	(0.00149)	(0.00113)	(0.00317)	(0.00056)	(0.00129)	(0.00080)	(0.00136)
Computer use in mgt.	-0.00622	-0.00836	0.06967	-0.12246	-0.02227	-0.02990	-0.00832	0.04755
	(0.04511)	(0.05098)	(0.07045)	(0.11412)	(0.03498)	(0.04557)	(0.04991)	(0.04684)
Channel diversity	-0.05111	0.12098 [b]	0.29578 [b]	0.48703 [b]	0.23960 [b]	0.32096 [b]	0.03247	0.03392
	(0.03582)	(0.05595)	(0.06057)	(0.12287)	(0.02930)	(0.05021)	(0.03989)	(0.05149)
Plant group 1	-0.00151 [b]	-0.03305	-0.00113	-0.41072 [b]	0.00034	-0.03921	0.00113 [a]	0.12632 [b]
	(0.00061)	(0.02749)	(0.00087)	(0.09716)	(0.00045)	(0.02498)	(0.00067)	(0.02534)
Plant group 2	-0.00348 [b]	-0.14693 [b]	0.00210 [a]	0.16274 [a]	0.00033	0.13755 [b]	0.00079	-0.09409 [b]
	(0.00099)	(0.05066)	(0.00113)	(0.08826)	(0.00071)	(0.03899)	(0.00105)	(0.04409)
Plant group 3	-0.00221 [b]	-0.21683 [b]	0.00151	0.09637	0.00201 [b]	0.07486	-0.00046	0.09577 [a]
	(0.00096)	(0.05869)	(0.00112)	(0.09904)	(0.00066)	(0.04792)	(0.00099)	(0.05054)
Plant group 4	0.00356	0.09785 [a]	0.00930 [b]	0.01050	-0.00150	-0.02483	-0.02045 [b]	-0.11458 [b]
	(0.00226)	(0.05207)	(0.00270)	(0.10502)	(0.00173)	(0.04989)	(0.00449)	(0.05310)
Plant group 5	0.00140 [a]	0.07288 [b]	-0.00157	-0.02188	-0.00126	-0.09459 [b]	0.00094	0.02140
	(0.00085)	(0.03449)	(0.00133)	(0.06858)	(0.00077)	(0.03278)	(0.00096)	(0.03210)
Trade shows attended	0.00568	0.02988	0.00492	0.03534	0.00157	-0.00224	-0.00229	-0.02025
	(0.00503)	(0.02026)	(0.00710)	(0.04292)	(0.00388)	(0.01859)	(0.00557)	(0.01898)
Prop. of negotiated sales	-0.00105	0.05109	0.00242 [b]	-0.04847	-0.00026	-0.07378 [b]	-0.00112	-0.00625
	(0.00071)	(0.03750)	(0.00090)	(0.10097)	(0.00055)	(0.03630)	(0.00082)	(0.03528)
Contract production (dollars)	0.00183 [a]	0.10834 [b]	0.00098	-0.38714 [b]	-0.00193 [b]	-0.06515	-0.00127	0.01089
	(0.00096)	(0.05484)	(0.00114)	(0.14940)	(0.00072)	(0.05349)	(0.00117)	(0.05166)
Contract, other producers	0.26648 [b]	0.53266 [b]	-0.05746	0.07274	-0.09940 [b]	-0.27997 [b]	-0.14580 [b]	-0.25813 [b]
	(0.04082)	(0.06539)	(0.05869)	(0.13772)	(0.03191)	(0.06056)	(0.04617)	(0.06164)
Contract, garden center	-0.15630 [b]	-0.38138 [b]	-0.03640	0.08437	0.31238 [b]	0.46721 [b]	-0.11545 [b]	-0.14050 [b]
	(0.04736)	(0.06910)	(0.06707)	(0.13011)	(0.03536)	(0.05673)	(0.05308)	(0.06123)
Contract, mass merch.	-0.09460 [a]	-0.03598	0.64937 [b]	1.07730 [b]	-0.16380 [b]	-0.32878 [b]	-0.27241 [b]	-0.28443 [b]
	(0.05415)	(0.12270)	(0.06681)	(0.19910)	(0.04138)	(0.11324)	(0.06318)	(0.12177)
Product uniqueness	-0.03898	0.11419 [b]	-0.02848	-0.12415	0.02929	-0.02273	0.00944	-0.07927 [a]
	(0.03380)	(0.05167)	(0.04871)	(0.10878)	(0.02623)	(0.04591)	(0.03736)	(0.04720)
Website adv. share	0.00059	-0.07076	-0.00250	0.30822 [b]	0.00290	0.08802	-0.00350	-0.04730
	(0.00413)	(0.07678)	(0.00504)	(0.14081)	(0.00305)	(0.06609)	(0.00480)	(0.07060)
Trade show adv. share	0.00264 [b]	0.03284	-0.00082	0.18804 [a]	-0.00020	0.00512	-0.00043	-0.06246
	(0.00087)	(0.04540)	(0.00111)	(0.11242)	(0.00068)	(0.04310)	(0.00097)	(0.04459)
Constant	0.28199 [b]	0.06955	-0.53515 [b]	-0.98183 [b]	-0.02685	-0.01223	0.44666 [b]	0.32647 [b]
	(0.05535)	(0.07057)	(0.09700)	(0.18399)	(0.04414)	(0.06332)	(0.06134)	(0.06369)

Source: Multi-state Regional Project S-1021 survey, 2004
Note: Re-wholesaler is the reference group and standard errors are in parenthesis. The superscript "a" represents significance at the 0.10 level and "b" at the 0.05 level.

Contract production with other producers and garden centers positively and negatively impacts the proportion of sales of large and small nurseries to the re-wholesaler channel, respectively. For large nurseries, the proportion of sales of products through re-wholesalers was positively influenced by the percentage of advertising expenditure allocated in trade shows.

Mass Merchandiser Channel - The variable diversification channel was positive and significant for large and small nurseries. This result implies that there was a significantly positive relationship between firms using three or more channels and the proportion of sales to mass merchandisers as opposed to firms using only one or two channels. The proportion of sales allocated to re-wholesalers was influenced positively by the categories of plants in group 2 grown by large and small producers. Moreover, small firms with higher trade shows advertising expenditures were less likely to increase the proportion of sales toward this channel.

Garden Center Channel - Firms located in the Northeast were more likely to have a higher percentage of sales through this channel compared to firms in the South. Unlike the proportion of sales to the garden center channel was negatively influenced by large firms located in the Midwest as opposed to firms in the South. The variable negotiated sales was negative for small firms. Therefore, there was a significantly negative relationship between proportion of sales made toward the garden center channel and the percentage of negotiated sales.

Landscaper Channel - In the West, small and large firms were less likely to have a higher proportion of sales through the landscaper channel compared with firms in the South. On the other hand firms in the Midwest had higher probability of selling to this channel than firms in the South. Small firms growing and selling plants of group 1 and 3 positively affected the proportion of sales to this channel, while firms selling plants of groups 2 and 4 negatively affected the sales toward landscapers. The percentage of sales made through this channel was influenced negatively by large and small firms using contracts with other producers, garden centers or mass merchandisers as compared to firms in the South.

<u>Large and Small Nurseries Model Marginal Effects</u>

Marginal effects are very important because they give more convenient understanding of how a unit change in a dependent variable would affect the independent variable. Furthermore, the interpretation of the estimates obtained from the two-limit tobit model is complicated because of the censoring of the dependent variable. Therefore, three different marginal effects were calculated for large and small firms and organized by market channel. Tables 25, 26 and 27 show the marginal effects for the unconditional expected value of the dependent variable, for the expected value of the dependent variable conditional upon being between 0 and 1, and for the probability of the dependent variables of being uncensored.

The marginal effects were estimated at the mean value of each independent variable and the interpretation of the results is organized by marketing channel.

Re-wholesaler Channel - The regional Midwest marginal effect had a negative and significant value. Therefore, an average small producer located in the Midwest would have a fall of about 10% in the proportion of wholesale sales made through the re-wholesaler channel as compared to a similar firm located in the South (Table 25). However, if these nurseries were already selling a portion of their wholesale sales to this channel, the proportion of sales to this channel would decrease by only 3.97% (Table 26). Furthermore, a typical small firm located in the Midwest compared with nurseries in the South had 8.57% lower probability of having a portion of the wholesale sales allocated toward the re-wholesaler channel (Table 27).

The marginal effects for the variable contract sales were significant for small firms with a positive impact on the dependent variable. That is, if small and large producers with mean business characteristics increased in one unit the amount of sales on contract, the expected proportion of sales to re-wholesalers would increase by 5.74% and 0.13%, respectively (Table 25).

Table 25 – Marginal effects from two-limit tobit models, by size and by marketing channel: unconditional expected value

Variable	Re-wholesaler		Mass Merchandiser		Garden Center		Landscaper	
	Large nursery	Small nursery	Large nursery	Small nursery	Large nursery	Small nursery	Large nursery	Small nursery
Region Northeast	-0.00851	-0.11582 [b]	-0.02961 [a]	-0.00567	0.10793 [b]	0.07472 [b]	-0.06189 [a]	0.02178
	(0.03511)	(0.03308)	(0.01654)	(0.00922)	(0.02927)	(0.03285)	(0.03586)	(0.03767)
Region Midwest	-0.05150	-0.09935 [b]	-0.05554 [b]	0.00704	-0.04664 [a]	0.01650	0.15693 [b]	0.06858 [a]
	(0.03675)	(0.03440)	(0.01445)	(0.01374)	(0.02672)	(0.03290)	(0.04366)	(0.03953)
Region West	0.07141 [b]	0.04265 [b]	0.02030	0.06712 [b]	0.02898	-0.03109	-0.13984 [b]	-0.11899 [b]
	(0.03479)	(0.03840)	(0.01997)	(0.02147)	(0.02590)	(0.03036)	(0.03143)	(0.03496)
Firm age	0.00060	0.00049	0.00002	-0.00014	0.00024	0.00046	-0.00065	-0.00045
	(0.00054)	(0.00079)	(0.00033)	(0.00021)	(0.00041)	(0.00064)	(0.00058)	(0.00079)
Computer use in mgt.	-0.00468	-0.00443	0.01903	-0.00803	-0.01644	-0.01482	-0.00604	0.02776
	(0.03397)	(0.02700)	(0.01799)	(0.00737)	(0.02612)	(0.02254)	(0.03631)	(0.02737)
Channel diversity	-0.03859	0.06517 [b]	0.07695 [b]	0.04207 [b]	0.16289 [b]	0.17130 [b]	0.02342	0.01986
	(0.02728)	(0.03029)	(0.01338)	(0.01267)	(0.01778)	(0.02724)	(0.02858)	(0.03020)
Plant group 1	-0.00113 [b]	-0.01751	-0.00033	-0.02723 [b]	0.00025	-0.01946	0.00082 [a]	0.07367 [b]
	(0.00045)	(0.01457)	(0.00025)	(0.00563)	(0.00033)	(0.01241)	(0.00049)	(0.01477)
Plant group 2	-0.00261 [b]	-0.07784 [b]	0.00061 [a]	0.01079 [a]	0.00024	0.06827 [b]	0.00057	-0.05488 [b]
	(0.00074)	(0.02672)	(0.00033)	(0.00601)	(0.00052)	(0.01932)	(0.00076)	(0.02568)
Plant group 3	-0.00166 [b]	-0.11487 [b]	0.00044	0.00639	0.00147 [b]	0.03715	-0.00033	0.05586 [a]
	(0.00072)	(0.03098)	(0.00033)	(0.00666)	(0.00049)	(0.02377)	(0.00072)	(0.02943)
Plant group 4	0.00267 [b]	0.05184 [b]	0.00271 [b]	0.00070	-0.00110	-0.01232	-0.01481 [b]	-0.06683 [b]
	(0.00169)	(0.02759)	(0.00080)	(0.00697)	(0.00126)	(0.02476)	(0.00323)	(0.03094)
Plant group 5	0.00105 [a]	0.03861 [b]	-0.00046	-0.00145	-0.00092	-0.04695 [b]	0.00068	0.01248
	(0.00064)	(0.01824)	(0.00039)	(0.00454)	(0.00056)	(0.01621)	(0.00070)	(0.01873)
Trade shows attended	0.00426	0.01583	0.00143	0.00234	0.00115	-0.00111	-0.00166	-0.01181
	(0.00377)	(0.01073)	(0.00206)	(0.00284)	(0.00283)	(0.00923)	(0.00403)	(0.01108)
Prop. of negotiated sales	-0.00079	0.02706	0.00070 [b]	-0.00321	-0.00019	-0.03662 [b]	-0.00081	-0.00365
	(0.00053)	(0.01986)	(0.00026)	(0.00665)	(0.00040)	(0.01794)	(0.00059)	(0.02058)
Contract production (dollars)	0.00137 [a]	0.05740 [b]	0.00028	-0.02566 [b]	-0.00141 [b]	-0.03234	-0.00092	0.00635
	(0.00072)	(0.02907)	(0.00033)	(0.01008)	(0.00053)	(0.02653)	(0.00085)	(0.03013)
Contract, other producers	0.20872 [b]	0.30082 [b]	-0.01604	0.00508	-0.06926 [b]	-0.12313 [b]	-0.10175 [b]	-0.14213 [b]
	(0.03261)	(0.03668)	(0.01570)	(0.01010)	(0.02113)	(0.02319)	(0.03085)	(0.03148)
Contract, garden center	-0.11078 [b]	-0.18159 [b]	-0.01024	0.00594	0.25691 [b]	0.26496 [b]	-0.08064 [b]	-0.07968 [b]
	(0.03137)	(0.02861)	(0.01825)	(0.00974)	(0.03101)	(0.03423)	(0.03558)	(0.03361)
Contract, mass merch.	-0.06853 [a]	-0.01883	0.32092 [b]	0.19806 [b]	-0.10688 [b]	-0.13107 [b]	-0.17715 [b]	-0.15035 [b]
	(0.03770)	(0.06342)	(0.04340)	(0.06118)	(0.02367)	(0.03412)	(0.03567)	(0.05637)
Product uniqueness	-0.02940	0.05964 [b]	-0.00840	-0.00863	0.02121	-0.01133	0.00683	-0.04653 [a]
	(0.02562)	(0.02655)	(0.01455)	(0.00792)	(0.01884)	(0.02299)	(0.02699)	(0.02783)
Website adv. Share	0.00044	-0.03749	-0.00073	0.02043 [b]	0.00212	0.04369	-0.00253	-0.02759
	(0.00310)	(0.04069)	(0.00147)	(0.00923)	(0.00222)	(0.03279)	(0.00347)	(0.04117)
Trade show adv. Share	0.00198 [b]	0.01740	-0.00024	0.01247 [a]	-0.00015	0.00254	-0.00031	-0.03643
	(0.00065)	(0.02405)	(0.00032)	(0.00739)	(0.00050)	(0.02139)	(0.00070)	(0.02599)

Source: Multi-state Regional Project S-1021 survey, 2004
Note: Re-wholesaler is the reference group and standard errors are in parenthesis. The superscript "a" represents significance at the 0.10 level and "b" at the 0.05 level.

Nevertheless, the proportion of sales to re-wholesalers would decrease by 2.20% and 0.082% for those small and large firms who were partially using this channel and increased in one unit the sales of products committed before being planted (Table 26). Moreover, a typical small and large firm using contracts sales had respectively 4.11% and 0.12% higher probability of having a portion of the wholesale sales to this channel (Table 27). Variable group of plants 2 had a negative sign for both size firms. The results indicated that a unit increase in sales of plants of group 2 from an average large firm would lead to reduce the proportion of wholesale sales to this channel by 0.26%. On the other hand, a one-unit increase from the mean sales of plants of group 2 led to decline the proportion of wholesale sales of small firms to the re-wholesaler channel by 7.78%. The effects on the proportion of wholesale sales to the channels were lower for large and small firms who already were selling to this channel. Thus, a one unit increase in sales of plants of this group would reduce the proportion of sales to the re-wholesaler channel by 0.15% and 2.99% for large and small producers, respectively. Furthermore, large and small firms growing plants within this group had a reduction in the probability of selling a portion of wholesale sales to the re-wholesale channel of 0.23% and 5.58%.

If small firms determined price based on product uniqueness, the proportion of sales to this channel would increase by 5.96% compared to firms with other price determination method. However if this size firms already sold less than 100% of wholesale sales to re-wholesalers and determined prices based on product uniqueness would have an increase of 2.31% in the proportion of sales to the re-wholesaler channel. The probability that small firms will sell a portion of the wholesale sales to re-wholesalers would increase by 4.50%.

Mass Merchandiser Channel - The variable negotiated sales had positive marginal effects. These results suggested that for large firms a marginal increase in sales using negotiation led to a 0.07% increase in the proportion of sales made through mass merchandisers.

Table 26 – Marginal effects from two-limit tobit models, by size and by marketing channel: conditional of being uncensored

Variable	Re-wholesaler		Mass Merchandiser		Garden Center		Landscaper	
	Large nursery	Small nursery	Large nursery	Small nursery	Large nursery	Small nursery	Large nursery	Small nursery
Region Northeast	-0.00507	-0.04658 [b]	-0.02590 [a]	-0.00830	0.07568 [b]	0.03524 [b]	-0.03452 [a]	0.00851
	(0.02096)	(0.01417)	(0.01543)	(0.01429)	(0.02090)	(0.01511)	(0.02026)	(0.01466)
Region Midwest	-0.03086	-0.03978 [b]	-0.05334 [b]	0.00908	-0.03222 [a]	0.00798	0.08560 [b]	0.02658 [a]
	(0.02217)	(0.01453)	(0.01661)	(0.01656)	(0.01846)	(0.01578)	(0.02390)	(0.01520)
Region West	0.04239 [b]	0.01619	0.01616	0.05990 [b]	0.02011	-0.01544	-0.07905 [b]	-0.04835 [b]
	(0.02066)	(0.01443)	(0.01539)	(0.01377)	(0.01803)	(0.01538)	(0.01851)	(0.01498)
Firm age	0.00035	0.00019	0.00001	-0.00020	0.00016	0.00022	-0.00036	-0.00018
	(0.00032)	(0.00030)	(0.00027)	(0.00029)	(0.00028)	(0.00031)	(0.00032)	(0.00031)
Computer use in mgt.	-0.00279	-0.00170	0.01625	-0.01119	-0.01140	-0.00724	-0.00334	0.01089
	(0.02023)	(0.01039)	(0.01596)	(0.01031)	(0.01813)	(0.01102)	(0.02006)	(0.01075)
Channel diversity	-0.02297	0.02477 [b]	0.06742 [b]	0.04597 [b]	0.11352 [b]	0.07978 [b]	0.01297	0.00778
	(0.01628)	(0.01138)	(0.01230)	(0.01108)	(0.01259)	(0.01241)	(0.01582)	(0.01178)
Plant group 1	-0.00067 [b]	-0.00673	-0.00027	-0.03761 [b]	0.00017	-0.00950	0.00045 [a]	0.02892 [b]
	(0.00027)	(0.00562)	(0.00021)	(0.00835)	(0.00023)	(0.00607)	(0.00027)	(0.00598)
Plant group 2	-0.00155 [b]	-0.02994 [b]	0.00050 [a]	0.01490 [a]	0.00017	0.03331 [b]	0.00032	-0.02154 [b]
	(0.00045)	(0.01037)	(0.00027)	(0.00799)	(0.00036)	(0.00949)	(0.00042)	(0.01013)
Plant group 3	-0.00099 [b]	-0.04418 [b]	0.00036	0.00882	0.00101 [b]	0.01813	-0.00018	0.02193 [a]
	(0.00043)	(0.01210)	(0.00027)	(0.00904)	(0.00034)	(0.01162)	(0.00040)	(0.01159)
Plant group 4	0.00159	0.01994 [a]	0.00223 [b]	0.00096	-0.00076	-0.00601	-0.00819 [b]	-0.02624 [b]
	(0.00101)	(0.01066)	(0.00065)	(0.00961)	(0.00087)	(0.01208)	(0.00181)	(0.01221)
Plant group 5	0.00063 [a]	0.01485 [b]	-0.00038	-0.00200	-0.00064	-0.02291 [b]	0.00038	0.00490
	(0.00038)	(0.00704)	(0.00032)	(0.00628)	(0.00039)	(0.00796)	(0.00039)	(0.00736)
Trade shows attended	0.00254	0.00609	0.00118	0.00324	(0.00079	-0.00054	-0.00092	-0.00464
	(0.00225)	(0.00414)	(0.00170)	(0.00390)	(0.00196)	(0.00450)	(0.00223)	(0.00435)
Prop. of negotiated sales	-0.00047	0.01041	0.00058 [b]	-0.00444	-0.00013	-0.01787 [b]	-0.00045	-0.00143
	(0.00032)	(0.00766)	(0.00022)	(0.00922)	(0.00028)	(0.00877)	(0.00033)	(0.00808)
Contract production (dollars)	0.00082 [a]	0.02208 [b]	0.00023	-0.03545 [b]	-0.00097 [b]	-0.01577	-0.00051	0.00249
	(0.00043)	(0.01123)	(0.00027)	(0.01340)	(0.00037)	(0.01296)	(0.00047)	(0.01183)
Contract, other producers	0.12355 [b]	0.11054 [b]	-0.01352	0.00671	-0.04788 [b]	-0.06485 [b]	-0.05697 [b]	-0.05799 [b]
	(0.01976)	(0.01457)	(0.01356)	(0.01275)	(0.01465)	(0.01352)	(0.01765)	(0.01371)
Contract, garden center	-0.06684 [b]	-0.07533 [b]	-0.00860	0.00778	0.18430 [b]	0.11878 [b]	-0.04513 [b]	-0.03188 [b]
	(0.01930)	(0.01347)	(0.01563)	(0.01210)	(0.02339)	(0.01553)	(0.02027)	(0.01382)
Contract, mass merch.	-0.04113 [a]	-0.00731	0.19914 [b]	0.11203 [b]	-0.07416 [b]	-0.07354 [b]	-0.10167 [b]	-0.06306 [b]
	(0.02286)	(0.02483)	(0.02472)	(0.02242)	(0.01672)	(0.02311)	(0.02183)	(0.02598)
Product uniqueness	-0.01750	0.02317 [b]	-0.00686	-0.01144	0.01468	-0.00551	0.00378	-0.01819 [a]
	(0.01525)	(0.01048)	(0.01178)	(0.01004)	(0.01303)	(0.01115)	(0.01494)	(0.01087)
Website adv. share	0.00026	-0.01442	-0.00060	0.02822 [b]	0.00147)	0.02131	-0.00140	-0.01083
	(0.00185)	(0.01567)	(0.00121)	(0.01264)	(0.00154)	(0.01602)	(0.00192)	(0.01617)
Trade show adv. share	0.00118 [b]	0.00669	-0.00020	0.01722 [a]	-0.00010	0.00124	-0.00017	-0.01430
	(0.00039)	(0.00926)	(0.00027)	(0.01023)	(0.00035)	(0.01044)	(0.00039)	(0.01022)

Source: Multi-state Regional Project S-1021 survey, 2004

Note: Re-wholesaler is the reference group and standard errors are in parenthesis. The superscript "a" represents significance at the 0.10 level and "b" at the 0.05 level.

However, if these firms had less than 100% of sales to this channel, a one-unit increase in the sales after negotiation led only to a 0.05% increase in the proportion of sales toward this channel. For large and small firms, the use of production contract with mass merchandisers had a positive and significant impact of the dependent variable. Thus, an average large and small firm contracting production with this channel compared with firms without signing this type of contracts had an increase of 32.09% and 19.80% in the proportion of sales to the mass merchandiser channel, respectively (Table 25). On the other hand, these firms using production contracts with mass merchandisers and selling a portion of wholesale sales through mass merchandisers would increase their proportion of sales to this channel by 19.91% and 11.20%, respectively (Table 26). Finally, large and small nurseries using contract production with mass merchandisers had respectively 51.41% and 28.46% higher probability of having a portion of the wholesale sales to this channel (Table 27).

Garden Center Channel - In the Midwest, small firms had inverse relationship with the proportion of sales to garden centers. Thus, if a small firm was located in this region, compared with a similar firm in the South, the proportion of wholesale sales to the garden center channel would have a decrease of 4.66%. However, small nurseries located in the Midwest selling less than 100% of their wholesale sales to garden centers would have a smaller increase (3.22%) in the proportion of sales to this channel, respectively. The probability of selling a portion of the wholesale sales to garden centers compared to small firms in the South was not significant.

Moreover, the results indicated that a unit-increase in sales of plants of group 3 from an average large firm would lead to increase the proportion of sales to this channel by 0.14% (Table 25). However, if this firm had a portion of sales to this channel, a one unit increase in the amount of sales of plants of this group lead to a 0.10% increase in the proportion of sales sold through garden centers (Table 26). Moreover, a typical large firm selling vines and groundcovers, roses and herbaceous perennials had a 0.23% higher probability of having a portion of wholesale sales to garden centers (Table 27).

Table 27 – Marginal effects from two-limit tobit models, by size and by marketing channel: probability of being uncensored.

Variable	Re-wholesaler		Mass Merchandiser		Garden Center		Landscaper	
	Large nursery	Small nursery)	Large nursery	Small nursery	Large nursery	Small nursery	Large nursery	Small nursery
Region Northeast	-0.00789	-0.10119 [b]	-0.08782 [a]	-0.01330	0.14412 [b]	0.08386 [b]	-0.05758	0.01160
	(0.03312)	(0.03483)	(0.05164)	(0.02195)	(0.03194)	(0.03297)	(0.03760)	(0.01900)
Region Midwest	-0.05258	-0.08571 [b]	-0.17539 [b]	0.01590	-0.08356	0.02017	0.08262 [b]	0.03184 [b]
	(0.04173)	(0.03525)	(0.05075)	(0.03035)	(0.05250)	(0.03920)	(0.01435)	(0.01498)
Region West	0.05640 [b]	0.02800	0.05518	0.12967 [b]	0.04487	-0.04086	-0.14777 [b]	-0.08708 [b]
	(0.02370)	(0.02302)	(0.05242)	(0.03547)	(0.03813)	(0.04178)	(0.04185)	(0.03243)
Firm age	0.00054	0.00035	0.00004	-0.00033	0.00038	0.00057	-0.00053	-0.00025
	(0.00050)	(0.00057)	(0.00093)	(0.00049)	(0.00067)	(0.00081)	(0.00048)	(0.00045)
Computer use in mgt.	-0.00422	-0.00318	0.05535	-0.01857	-0.02597	-0.01863	-0.00490	0.01542
	(0.03038)	(0.01941)	(0.05410)	(0.01694)	(0.04005)	(0.02843)	(0.02906)	(0.01514)
Channel diversity	-0.03392	0.04289 [b]	0.22469 [b]	0.08861 [b]	0.29926 [b]	0.17825 [b]	0.01966	0.01079
	(0.02310)	(0.01863)	(0.03905)	(0.02385)	(0.03761)	(0.02463)	(0.02461)	(0.01595)
Plant group 1	-0.00103 [b]	-0.01255	-0.00092	-0.06284 [b]	0.00041	-0.02441	0.00067 [a]	0.04134 [b]
	(0.00042)	(0.01050)	(0.00071)	(0.01305)	(0.00053)	(0.01561)	(0.00040)	(0.00928)
Plant group 2	-0.00238 [b]	-0.05582 [b]	0.00172 [a]	0.02490 [a]	0.00039	0.08561 [b]	0.00047	-0.03079 [b]
	(0.00070)	(0.01974)	(0.00093)	(0.01362)	(0.00084)	(0.02455)	(0.00062)	(0.01477)
Plant group 3	-0.00151 [b]	-0.08237 [b]	0.00124	0.01475	0.00239 [b]	0.04659	-0.00027	0.03134 [a]
	(0.00067)	(0.02322)	(0.00091)	(0.01525)	(0.00079)	(0.02991)	(0.00059)	(0.01684)
Plant group 4	0.00244	0.03717 [a]	0.00762 [b]	0.00161	-0.00179	-0.01545	-0.01216 [b]	-0.03750 [b]
	(0.00155)	(0.02002)	(0.00225)	(0.01608)	(0.00205)	(0.03107)	(0.00290)	(0.01777)
Plant group 5	0.00096	0.02769 [b]	-0.00129	-0.00335	-0.00149	-0.05887 [b]	0.00056	0.00700
	(0.00058)	(0.01323)	(0.00110)	(0.01049)	(0.00092)	(0.02058)	(0.00057)	(0.01053)
Trade shows attended	0.00388	0.01135	0.00403	0.00541	0.00187	-0.00139	-0.00136	-0.00663
	(0.00345)	(0.00775)	(0.00580)	(0.00652)	(0.00461)	(0.01157)	(0.00331)	(0.00624)
Prop. of negotiated sales	-0.00072	0.01941	0.00198 [b]	-0.00742	-0.00031	-0.04592 [b]	-0.00066	-0.00205
	(0.00049)	(0.01436)	(0.00074)	(0.01536)	(0.00066)	(0.02265)	(0.00049)	(0.01155)
Contract production (dollars)	0.00125 [b]	0.04116 [a]	0.00080 [b]	-0.05923 [b]	-0.00229 [b]	-0.04055	-0.00076	0.00356
	(0.00066)	(0.02105)	(0.00094)	(0.02280)	(0.00086)	(0.03338)	(0.00070)	(0.01691)
Contract, other producers	0.12786 [b]	0.10127 [b]	-0.04613	0.01156	-0.12458 [b]	-0.18107 [b]	-0.09808 [b]	-0.10574 [b]
	(0.01635)	(0.01537)	(0.04613)	(0.02265)	(0.04195)	(0.03980)	(0.03480)	(0.03027)
Contract, garden center	-0.12496 [b]	-0.17278 [b]	-0.02935	0.01349	0.25718 [b]	0.21732 [b]	-0.07795 [a]	-0.05278 [b]
	(0.04285)	(0.03547)	(0.05333)	(0.02174)	(0.02063)	(0.02059)	(0.03999)	(0.02603)
Contract, mass merch.	-0.07226	-0.01418	0.51415 [b]	0.28469 [b]	-0.21576 [b]	-0.21425 [b]	-0.20932 [b]	-0.12931 [a]
	(0.04553)	(0.05007)	(0.03920)	(0.05978)	(0.05826)	(0.07106)	(0.05694)	(0.06721)
Product uniqueness	-0.02602	0.04505 [b]	-0.02346	-0.01965	0.03517	-0.01410	0.00565	-0.02467 [a]
	(0.02205)	(0.02127)	(0.04027)	(0.01774)	(0.03185)	(0.02837)	(0.02247)	(0.01414)
Website adv. share	0.00040	-0.02688	-0.00205	0.04716 [b]	0.00345	0.05479	-0.00208	-0.01548
	(0.00283)	(0.02925)	(0.00414)	(0.02108)	(0.00362)	(0.04122)	(0.00286)	(0.02315)
Trade show adv. share	0.00180 [b]	0.01247	-0.00067	0.02877 [a]	-0.00024	0.00319	-0.00026	-0.02044
	(0.00061)	(0.01728)	(0.00091)	(0.01705)	(0.00081)	(0.02682)	(0.00058)	(0.01474)

Source: Multi-state Regional Project S-1021 survey, 2004

Note: Re-wholesaler is the reference group and standard errors are in parenthesis. The superscript "a" represents significance at the 0.10 level and "b" at the 0.05 level.

For small nurseries a unit-increase in sales of categories of plants of group 2 would lead to an increment of 6.82% in the proportion of sales to this channel. Meanwhile, for small firms an increment of one unit in sales of plants of group 2 increased the proportion of sales to this channel by 3.33%. Finally, small firms growing plants of group 2 had 8.56% greater probability of selling a proportion of wholesale sales to the garden center channel.

Landscaper Channel - The variable uniqueness was negative for small firms. That is, if price determination based on product uniqueness was important or very important for an average small nursery, the proportion of sales to the landscaper would decline by 4.65% compared to firms that place less importance in this factor to determine price (Table 25). However, the use of price uniqueness to determine price by small firms, who were partially users of this channel, would decline the proportion of sales to the landscaper channel only by 1.81% (Table 26). Moreover, small firms using this factor had a 2.46% higher probability of having a portion of the wholesale sales to landscapers (Table 27).

The results indicated that production of plants of group 2 had negative marginal effects for small firms. Thus, for these size firms a unit increase in sales of this group would lead to reduce the proportion of sales to this channel by 5.48%. However, if these nurseries were already selling a portion of their wholesale sales to this channel, there would be a 2.15% decrease in the proportion of sales to the landscaper channel. Finally, a typical small firm selling these plants had 3.07% lower probability of having a portion of the wholesale sales allocated toward this channel.

CHAPTER 5 - CONCLUSIONS

Nursery Industry Description

We present first a summary of descriptive information reported in Chapter 3. The difference between sales of large and small nurseries was substantial - large nurseries had 20 times more dollars of sales than small firms. Regional differences indicated that small and large firms in the South and West had highest sales of ornamental products in dollar value. Large firms on average were older than small nurseries by about 10 years. As expected, large firms had more permanent and temporary employees than small firms, and large firms in the West had the most permanent employees. Firms in the Midwest and Northeast hired more temporary than permanent employees, possibly a function of climate (the shorter production season) in those regions.

In terms of percentage of sales of ornamental products through alternative market channels, most were made through the landscaper channel, followed by the re-wholesaler and the garden center channels. Regional differences in channel use indicated that large and small firms in the West had more than one third of total sales through the re-wholesaler channel. These considerations can be important to producers as they define marketing strategies.

In total, small and large firms typically focused on sales of trees and shrubs. Furthermore, the types of plants sold by small firms were similar to those sold by large nurseries. Foliage was the category of plants with fewest sales in all regions for both size nurseries.

The ornamental industry is not an exception to the expanding use of internet in business activities. Communication through e-mail was the computer function most implemented by nurseries in all regions. For many reasons including cost and communication/management assistance needs, use might be different depending the size of the firm. Large firms had greater use of this computer function compared with small nurseries. The inventory of products was highly computerized by both firms but was most used by large firms mainly because the larger amount of products they handle and the requirements stipulated

by their customers. The use of bar coding system was by far higher for large producers compared with small firms in all the regions. These firms might use this type of software to fulfill the requirements of mass merchandisers. Landscape-designing software was a function evenly implemented by small and large producers. The highest and lowest implementation of this software was observed for firms located in the Midwest and the West, respectively.

The use of catalogs was preferred for most small and large firms to advertise the company and their products; however, for most of the firms located in the South and West the advertising through trade shows was more important. Overall, gardening publications were least used among the advertising alternatives. Interestingly, small firms in all the regions invested a larger percentage of their total sales in advertising than large producers. This situation could be explained because large producers have already a strong relationship with more loyal, reliable and big customers; meanwhile, small firms constantly search for new customers. Firms in the Midwest allocated the highest percentage of sales to advertisement of ornamental products. In most regions, small nurseries advertised more through yellow pages than large firms.

Impacts of Business Characteristics on Sales and Marketing Channel Use, by Size and by Region

Accomplishing the stated objective of this research has been approached by assuming that nurserymen first would chose the channel(s) to be used, while the portion of production sold through each channel would be a second decision. Variables that explained these choices were the same. In the paragraphs below, we summarize the results from chapter 4 into a series of general points; first for the multinomial logit results that explain the choice, then for the two-limit tobit results that explain the portion of output sold through each channel.

The reader should recall that the general expectation was that the garden center and landscaper channels, since they may be less price sensitive, would be the channels used first. The mass merchandiser and the re-wholesaler channels were expected to be more price sensitive, so the expected margins from

these channels would not be of the same level. These channels, however, would provide outlets for significant sales quantities.

Use of Channels by Firm Size (Logit Coefficients) – What Factors Affected the Decision?

The channel use question – to which channel did nurseries sell the largest share of output - was addressed with the multinomial logit model. An overview of the results suggested that characteristics of nurseries had differing impacts on the use of marketing channels, as measured by logit results which used the re-wholesaler channel as the base and compared the other channels to that base.

Overall Impacts of Size

When looking at results of the channel choice question from an overall point of view, two groups of variables appeared most important. These groups were the plant groups and contract production/kind of contractor.

Looking at the plant group results as a whole, higher sales of the trees/shrubs group was associated with lower likelihood for the mass merchandiser channel and higher likelihood for the garden center and landscaper channels. Higher sales of the bedding plants group suggested that the re-wholesaler channel had lower likelihood of use compared to the other channels. The most consistent relationship was in the vines group, where the other three channels were more likely to be used than the re-wholesaler channel. For foliage group, the garden center and landscaper channels were less likely to be used compared to the re-wholesaler channel. Additionally, these plant groups appeared to be more consistently associated with the garden center and the landscaper channels than with the mass merchandiser.

For contract production and contracts with specific customers, we see that the level of contracting and contracting with other producers had negative sign when significant, indicating all the other channels were less likely to be used than the re-wholesaler channel. In contrast, when contracts were with garden centers or mass merchandisers, the positive signs of the significant coefficients indicated that almost all channels were more likely to be used than the re-wholesaler channel.

Other variables provided less consistent results, through the regional variables mostly were not significant. With more channel diversity, the mass merchandiser channel was more likely to be used. Product uniqueness favored the re-wholesaler channel for small firms. Higher trade show advertising expenditure meant that use of the mass merchandiser channel was more likely and garden center and landscaper channels were less likely to be used compared to the re-wholesaler channel. Both the uniqueness and the trade show advertising results were unexpected.

Use of Channels (Logit Coefficients) – What Factors Differed between Small and Large Firms?

Based on coefficient signs and statistical significance, there appeared to be modest impact when data were sorted into large and small firms. By region, differing behavior was suggested between firm sizes as small firms in the Northeast used the garden center channel over the re-wholesaler channel, while large firms in the Midwest favored the use of the re-wholesaler channel.

The type of plants sold affected choices of small and large firms as indicated by differences by size. First, there were instances where both firm sizes had significant coefficients with the same sign. However, for the tree/shrub group for the mass merchandiser channel, higher sales tended to favor re-wholesaler channel sales for small firms, while the coefficient for large firms was not significant. Again for mass merchandiser channel for the bedding plants group, the signs were positive but only the large firm coefficient was positive.

The use of production contracts and contracts with specific kinds of customers might be a common strategy used by re-wholesalers compared with the other channels. For the garden center channel, large and small firms had similar behavior for three of these variables. On the other hand, we see significantly different behavior by large and small firms in the mass merchandiser (small firms are different, large are not) and the landscaper (large firms tended to be different) channels.

In the variables where we found less significance variables, there were some size differences. Examples include channel diversity in the garden center comparison, in the portion of negotiated sales for

small firms, and in product uniqueness for small firms for all channels. The trade show advertising variable had unexpected size differences across channel comparisons, with garden center and landscaper channels less likely to be used by large firms, and mass merchandiser channel more likely to be used by small firms.

Use of Channels by Region (Logit Coefficients) – What Factors Affected the Decision?

Again using the multinomial logit model results where alternative channels are compared to the re-wholesaler channel base, an overview suggested that characteristics of nurseries had differing impacts by region. Results are discussed from an overview standpoint, and in term of differences between the geographic regions.

Overall Impacts of Region

Differences in the use of the channels were expected since producers face longer or shorter production seasons and therefore production practices will change. An overview of the results suggested that the variables channel diversity, plants groups and contract with specific kinds of buyers seemed most important. In general terms, more diversification of the marketing strategy was associated with higher likelihood for the mass merchandiser and garden center channel.

Considering the plants groups, results suggested that sales of the trees and shrubs group negatively affected the use of the mass merchandiser channel but was positive for the garden center and landscaper channels. Higher sales of vines and ground covers suggested a strong and consistent association with the likelihood of choosing the other three channels when they were compared to the re-wholesaler channel. The sales of bedding and flowering plants, and foliage plants, had less impact on channel use compared to the other plant groups. The plant groups also appeared to have most impact on channel use in the south region for the garden center and re-wholesaler channels.

The other group of variables that had strong regional impacts was the contracts by kind of buyer. The most consistent relationship was in contracts with other producers, where the mass merchandiser, garden

center and landscaper channels were less likely to be used at expense of the re-wholesaler channel. When producers reported either contracts with garden centers or contracts with mass merchandisers, the likelihood of choosing these channels across regions was higher than the likelihood of using the re-wholesaler channel. However, contracts with these two kinds of buyers had relatively little impact on sales to other channels, though there was some consistent impact in the South region.

The other variables in the model had fewer significant results across channels. For firm size, the garden center channel was more likely to be used for the West. This was different for firm age where the landscaper channel was less likely to be used and for computer use in management activities where this channel had lower likelihood to be chosen for the South region. Comparing to the other three channels, trade show attendance favored the use of the re-wholesaler channel, mainly in the West. Higher negotiation of sales meant that use of the mass merchandiser channel was more likely and garden center channel was less likely to be used compared to the re-wholesaler channel. Product uniqueness as a pricing factor, web site and trade show advertising expenditure provided unexpected negative results, meaning that the re-wholesaler channel was more likely to be used when firms reported these characteristics.

Use of Channels (Logit Coefficients) – What Factors Differed between Geographic Regions?

The signs and significance of the estimated coefficients suggested many regional differences in marketing channel use. A channel diversification marketing strategy in the West favored all the three channels compared to the re-wholesaler, while in the Midwest/Northeast the likelihood of using the re-wholesaler was higher only for the landscaper channel comparison. The plant groups had many consistent results when producers used specific channels. In general, plants groups seemed to have little impact in the mass merchandiser channel, except for trees/shrubs, and bedding/flowering plants in the West. For the garden center and the landscaper channels, the most consistent relationship for the plant groups was observed in the South, to a lesser extent in the Midwest/Northeast, and almost never in the West. The signs of the significant coefficients were consistent between the garden center and landscaper channel.

We see a clear relationship between results in the West between more trade show attendance and the higher use of the re-wholesaler channel compared to other channels, and across regions.

For the three regions, there were consistent results for the mass merchandiser and re-wholesaler channels when using contracts with mass merchandisers and contracts with other producers, respectively. Again, as with plant groups, in the contract with specific buyers we see more significant variables in the South, fewer in the West and somewhere between in the Midwest/Northeast. There is similarity between the results for the garden center and landscaper channels, some support for argument that these may be less responsive to price.

The other variables had less significant association with producers' choice; however they show some differences by region. For instance, an increase in the proportion of negotiated sales favored the use of the re-wholesaler channel when was compared to garden center only in the West and Midwest/Northeast and not in the South. The determination of price based on uniqueness as a factor in pricing was not associated with marketing channel choice in the South, while this variable favored the use of re-wholesalers in the West. In the South, higher expenditure in trade shows advertising for the garden center and landscaper channel means fewer sales through these two channels. Finally, consistency in signs between the garden center and landscaper channels generally supports similar regional behavior between these channels.

Use of Channels by Firm Size (Logit and Tobit Marginal Effects) – What Factors Affected the Decision?

In the following section we included the discussion of the marginal effects obtained from the econometric models and reported in Table 19 and 25. The marketing channel choice question was addressed with the multinomial logit model, where the results provided an insight of how a one unit change in the nurseries characteristics affected the marketing channel choice toward a channel but without comparison to a base reference. On the other hand, the marginal effects of the two-limit tobit model provided the change in the proportion of sales allocated through specific marketing channel by a one unit change on business characteristics.

<u>Overall Impacts of Size</u>

The number of significant values generated by the two models suggests that many groups of variables were important in explaining the choice of channel and proportion of sales to each channel. As expected, the significance of the regional variables confirmed that geographic location affected producers' market channel use. Being located in the West was associated with higher use and proportion of sales to the re-wholesaler channel, and lower sales to the landscaper channel compared to the South. For the Midwest, use and proportion of sales increased for the landscaper channels but decreased for the garden center channel. For the Northeast, the garden center channel had an increase in the proportion of sales and was more likely to be used, while the mass merchandiser channel was lower compared to nurseries in the South. Generally, the West region seemed most different from the South.

The categories of plants sold by producers also influenced the choice and the proportion of sales. An increase in bedding and flowering plants increased the use and the proportion of sales in the garden center channel in particular, but was associated with lower proportion of sales to the re-wholesaler channel. When sales of the trees and shrubs group and the vines group increased, the re-wholesaler channel had a decrease in the proportion of sales and was less likely to be used, while the landscaper channel had an increase in the proportion of sales and became more likely to be used. However, we see that these categories of plants had different impact according the channel used. Trees and shrubs only affected the use and proportion of sales toward the mass merchandiser channel in a negative way, while producers selling vines had only a positive impact when the use and proportion of sales were addressed toward the garden center channel. In addition, it appeared that increases in sales of these groups had relatively more impact on the re-wholesaler and landscaper channels. When firms increased sales of foliage by one unit, there was a higher likelihood of using and increasing the proportion of sales toward the re-wholesaler and mass merchandiser channels, but a negative impact on the landscaper channel.

Another important variable was channel diversity, which had mostly positive signs for the significant results, with a diversified marketing strategy favoring the use and increasing the proportion of sales to the mass merchandiser and garden center channels.

Increases in the dependent variables when contract production sales increased were important for the re-wholesaler channel, and for the garden center channel for large firms. When we analyzed contracts with specific buyers, most of these variables were consistently significant across channels. Contracts with other producers increased the choice and the proportion of sales toward re-wholesaler, garden center and landscaper channels, and these results were very similar when results from contracts with mass merchandisers were evaluated. More contracts with garden centers positively affected the choice and increased the proportion of sales toward garden centers, and reduced the values for re-wholesaler and landscapers channels. This appeared to be the group of variables with most consistent impact on use of channels and proportion of sales.

The other variables had little association with the use and the proportion of sales toward the marketing channels, particularly for expected relationships for price determination based on product uniqueness and website advertising expenditures. Higher expenditure on trade show advertising suggested that producers increased the use and proportion of sales to the re-wholesaler and mass merchandiser (small firm only) channels, which were unexpected outcomes.

Use of Channels (Logit and Tobit Marginal Effects) – What Factors Affected Differing Use between Firm Sizes?

Based on the results of the multinomial logit model and two-limit tobit model presented in Chapter 4, differing behavior was suggested between firm sizes. An overview of the signs of significant marginal effects suggested the presence of differences in behavior between large and small firms.

The regional variables showed that large firms in the Northeast tended to sell less to the mass merchandiser channel, while the marginal effects for small firms were not significant.

In the Northeast, small firms favored the use and increased the proportion of sales to the garden center channel, but in the Midwest large firms were less likely to choose or to increase the proportion of sales to this channel.

The categories of plants had some impact when the data was classified into large and small firms. In some cases, both firm sizes had the same sign for the significant results. Furthermore, there were cases where only one firm size had significant marginal effects, while the other size was not significant. For the vines group, large firms were more likely to choose and increased the proportion of sales to the garden center, but for small firms this group did not affect the choice and the proportion of sales. For the mass merchandiser channel for foliage, most of the marginal effects had positive signs but only the large firm results were significant.

A more diversified marketing strategy might be an option similarly used by large and small firms. For the mass merchandiser and the landscaper channel, both firm sizes had similar behavior when they sold to three or more channels.

Contract production might suggest that small and large firm had different behavior when they used the mass merchandiser channel. For small firms, the proportion of sales to this channel decreased when contract production increased, while large firms using contracts sales were more likely to sell to this channel. Furthermore, large firms had positive and significant marginal effects for the garden center, but the contracts did not impact the choice and the proportion of sales of small firms to this channel. The use of contracts with specific kinds of buyers suggested consistent results in the choices of large and small firms. For the re-wholesaler, mass merchandiser and landscaper channels, most of the signs of the significant marginal effects were the same for both firm sizes. However, for the mass merchandiser channel the use of contracts with other producers appeared to affect negatively the choice and the proportion of sales of small firms, while for large firms the use of these contracts was not significant.

This suggests that there is less difference in behavior of small and large firms, and/or that some other sales boundary should be chosen to distinguish between these sizes.

For the product uniqueness and website promotion expenditure variables, there were few significant marginal effects that would indicate differences by firm size. Product uniqueness affected the choice and proportion of sales of small firms in the re-wholesaler model, indicating differences, but it was not expected that this channel would be responsive to uniqueness. For trade show expenditures, we found differences between firms for both measures for the re-wholesaler channel, and other isolated differences for the firm sizes. Generally, these three variables revealed little in firm size differences that had the relationships that were hypothesized at the beginning of the study.

Conclusion of the Study

Few studies examined the choice of sales channels of ornamental producers using multinomial logit and two-limit tobit model. These models provide important econometric information about the characteristics of growers and how they affect the use of outlets and sales in all four marketing channels. This information should aid producers to understand the functioning of the marketing sector and choice of channels in the ornamental industry.

In this study, results from both models suggested similarity of behavior of small and large firms when they use a specific marketing channel. Marginal effects of both models had similar sign between landscaper and garden center channel when compared with either the re-wholesaler or mass merchandiser channel. However, landscaper and garden center channels, considered to be core channels, had opposite signs. This situation was different for the mass merchandiser and re-wholesaler channels, considered to be growth channels, which had similar sign for most of the significant marginal effects. This evidence suggests no large differences between the core and growth channels. In certain situations, depending on the characteristics of producers, these groups might be used similarly by producers.

Some variables included in these models had lower explanatory effects than others. The variables age, computer technology usage and advertising expenditures provided little information about producers' behavior. On the other hand, contracts with specific buyers, diversification of marketing strategy and categories of plants (mainly groups 1 to 4) grown by large and small producers, were important in explaining the marketing situation in the industry. Producers with more diversified marketing strategy were associated with higher use of mass merchandisers and garden centers. Contracts with other producers showed strong positive relationship with sales to the re-wholesaler channel; however, producers with this type of contracts reduced the sales to the other channels. The regional multinomial logit model suggested that firms in the South might be somewhat more similar to producers in the Midwest/Northeast than with nurseries in the West.

The multinomial logit and two-limit tobit models were consistent for large and small firms regarding variable signs. The same impact direction was observed for marginal effects compared in both models; however the interpretation of the marginal effects of the two-limit tobit model gives a more useful insight of the potential effects of variables on the sales to the channels.

In conclusion, although this study has indicated that business characteristics may favor one channel over another; growers faced other economic, institutional and managerial factors that affected their ability to use specific market channels.

Limitations

Missing values and other omissions on the survey instrument reduced the number of observations by almost half of the total respondents, decreasing the final sample size of our study. Even though the number of observations in the analysis appeared to provide an acceptable sample size, a bigger sample might have addressed issues such as non-converging models. More observations in the regional data set might have allowed estimation of models for the four regions, without the need to combine the Northeast and Midwest regions.

Due to incomplete responses regarding the question about the percentage of total sales spent on advertising, the advertising variables were sales-weighted directly to the amount of total sales reported and not of total advertising expenditure.

In the multinomial logit analysis, the preferred channel choice was assumed to be the channel with highest percentage of sales compared to other channels. This could change from year to year depending on market conditions. It would have been preferable for producers to indicate their preferred channel, but that question was not asked directly. The marketing activities studied here are reports only from producers, documenting their interaction with wholesale outlets. A companion analysis of perceptions and activities of wholesalers, and of consumers' preferences at the same point in time, would provide a more comprehensive understanding of marketing practices in the ornamental industry.

Future Research

Since this research includes only information regarding producers' marketing practices, the analysis of the existing relationship between nurseries and marketing channels might be more accurate if information of the other participants in the market is included. Future research with data collected from both producers and wholesale outlets could improve the understanding of the marketing situation in the nursery industry. Furthermore, this information might enhance the estimation of statistical models and therefore the results.

Since the Trade Flows and Marketing Practices survey is collected every four years, the estimation of similar econometric model using more updated information could be useful to contrast with the results of this study. Furthermore, an analysis of more updated and larger sample size might show useful information about the trends of the industry, changes in the marketing activities and the possible factors affecting the efficiency of the market. The determination of these factors and the main issues existing in the industry might be used to establish a package of politics that contributes to incentive a more efficient marketing system considering the great importance of this industry in the agricultural sector of the United States.

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APPENDICES

APPENDIX A: 2003 TRADE FLOWS AND MARKETING PRACTICES QUESTIONNAIRE

<u>GENERAL INFORMATION</u>

1. From what state are you reporting? _____ Your ZIP code
   Does your business operate a nursery in another state?

   _____ yes   _____ no

   If yes, please list the state(s)

2. In what year was your firm established?

3. How many people does your firm employ at this location?

   Permanent employees

   Temporary employees _____ (average number during your peak season)

   Has the number of employees over the last five years?

   Permanent: __ increased, __ stayed the same, __ decreased.

   Temporary: __ increased, __ stayed the same, __ decreased.

   If employment has changed, indicate by what percent?

   Permanent _____ %   Temporary _____ %

4. What functions of your firm are computerized?

Function	Using computer for task now		Planned within next five years
	(please check if yes)		
Word processing			
Accounting / cost analysis			
Inventory			
Financial investments / analysis			
Internet commerce (B2B or B2C)			
CDs for marketing			
Communications - E-mail			
Landscape designing (CAD)			
Production scheduling			
Greenhouse production controls			
Digital imaging for disease diagnosis			
Bar coding			
Other (please list)			

100

PRODUCTION

5. What percentage of your sales are in these plant categories?

_____ % Deciduous shade and flowering trees
_____ % Deciduous shrubs
_____ % Broad-leaved evergreen shrubs (excluding Azaleas)
_____ % Narrow-leaved evergreen shrubs
_____ % Evergreen trees
_____ % Azaleas
_____ % Vines and grounds covers
_____ % Roses
_____ % Herbaceous perennials
_____ % Bedding plants - flowering annuals
_____ % Bedding plants - vegetables, fruits, and herbs
_____ % Flowering potted plants
_____ % Christmas trees (live or cut)
_____ % Tree fruits
_____ % Foliage
_____ % Propagated material (liners, cuttings, plugs, etc.)
_____ % Other
  100 % Total

6. What is your firm's source of irrigation water?

____ % Natural surface
____ % Recaptured
____ % City
____ % Well
 100 % Total

7. Has your use of irrigation water on a per acre basis changed over the past five years?

___ increased, ___ remained the same, ___ decreased.

If irrigation water has changed, indicate by what percent? _____ %

Irrigation methods used? ___ Overhead   ___ Drip

                ___ Subirrigation (Ebb / flood)

                ___ Other

8. Please place a check mark beside each of the following IPM activities that you practice.

yes ✓	Activity	yes ✓	Activity
	Remove infested plants or plant parts		Inspect incoming stock
	Alternate pesticides to avoid chemical resistance		Manage irrigation to reduce pests
	Elevate or space plants for air circulation		Spot treatment with pesticides
	Use cultivation, hand weeding		Ventilate greenhouses
	Disinfect benches/ground cover		Use of beneficial insects
	Use sanitized water foot baths		Keep pest activity records
	Soil solarization/sterilization		Adjust fertilization rates
	Monitor pest populations with tarp or sticky boards		Use screening/barriers to exclude pests
	Adjust pesticide application to protect beneficials		Use biopesticides/lower toxicity
	Use mulches to suppress weeds		Treat retention pond water
	Beneficial insect identification		Use pest resistant varieties

9. Considering all plants sold by your firm, what percentage of your sales are in these forms?

Percent of Sales		Method Used
_____ %		Bare root
_____ %		Balled and potted
_____ %		Balled and burlapped
_____ %		Processed balled
_____ %		Container
_____ %		Field grow bag
_____ %		In-ground containers (pot-in-pot)
_____ %		Other (please list) _____ (For example, cut Christmas trees, budwood, scions, seeds, tissue cultured plants, unrooted cuttings)
100 %		Total

10. What are the top five states (or countries), including your own state, from which you purchase seedlings, liners, whips, grafted material, tissue culture plantlets, cuttings, or plugs?

Top five states or countries:		Percent of Purchases
1) Home state _____		%
2)		%
3)		%
4)		%
5)		%
All other states combined		%
Total =		100 %

SALES CONSIDERATIONS

11. What percent of total sales is from native plants? _____ %
(Native plants are defined as those present
in your state before European settlement)

12. At how many trade shows was your firm represented in 2003?

_____ With an exhibit

_____ Without an exhibit

13. What percentage of your sales are done with repeat customers? _____ %

14. Do you publish discount (price) information for large-volume
purchases? _____ yes _____ no

15. What percent of your sales are negotiated sales?
(Negotiated means there was discussion/debate
over price, quality or other terms of sale.) _____ %

16. What percentage of your sales transactions are made using the following methods

Percent		Method
%		Trade show orders
%		Telephone orders
%		In-person orders
%		Mail orders
%		Internet sales
100 %		Total sales

17. What percent of your 2003 total annual sales are:

_____ % Wholesale

_____ % Retail

100 % Total

18. If you sell wholesale, what percentage of your wholesale sales (from question 17) are to:

_____ % Mass merchandisers (general merchandise stores, supermarkets, etc.)

_____ % Home Centers (home improvement, building supply outlets, hardware, etc.)

_____ % Garden centers (single location)

_____ % Garden Centers (multiple locations)

_____ % Landscape firms (in-house or external)

_____ % Re-wholesalers (brokers, other growers, etc.)

100 % Total

19. Do you export nursery products out of the U.S.?

_____ yes _____ no

If yes, what percentage of total sales are from exports?

_____ %

If you export, please list the countries:

20. What are the top five states (or countries), including your own state, that are destinations for your firm's total sales?

Top five states or countries:		Distribution of Sales
1) Home state _____		_____ %
2)		_____ %
3)		_____ %
4)		_____ %
5)		_____ %
All other out-of-state sales combined		_____ %
Total =		100 %

21. Do you handle/resell items from other growers?

_____ yes _____ no

If yes, what percent of your total sales does this account for?
_____ %

22. What percentage of your total sales are on contract, in other words, sold or committed before being planted/potted?

_____ %

23. What types of buyer(s) are contracting for production with your firm?

_____ Other producers _____ Retail garden centers

_____ Mass merchandisers _____ Cooperatives

_____ Other (please specify)

PRICE DETERMINATION

24. Regarding price determination, please rate the level of importance of each factor by using the 1 to 4 scale, with 1= not important; 2= minor importance; 3= important; and 4= very important.

	1	2	3	4
Cost of production				
Inflation				
Other growers' prices				
Grade of plants				
Market demand				
Product uniqueness				
Inventory levels				
Last year's price				
Other (please specify)				

FACTORS LIMITING EXPANSION

25. Regarding factors that might limit the expansion of the geographic scope of your trading area, please rate the level of importance of each factor by using the 1 to 4 scale, with 1= not important; 2= minor importance; 3= important; and 4= very important.

	1	2	3	4
Debt capital				
Equity capital				
Marketing				
Personnel				
Production				
Transportation				
Plant offering				

26. Please rate each of the factors listed below according to how much they impact your business by using the 1 to 4 scale, with 1= not important; 2= minor importance; 3= important; and 4= very important.

	1	2	3	4
Weather uncertainty				
Land				
Market demand				
Labor				
Water supply				
Debt capital				
Equity capital				
Own managerial expertise				
Competition / Price undercutting				
Environmental regulations				
Other government regulations				
Ability to hire competent management				
Ability to hire competent hourly employees				

ADVERTISING

27. What percentage of total sales did your firm spend on advertising in 2003? _____ %

How do you allocate these advertising dollars?
_____ % Web sites
_____ % Yellow pages
_____ % Radio / TV
_____ % Billboards
_____ % Gardening publications
_____ % Catalogs (print or CD)
_____ % Trade journals
_____ % Newsletters
_____ % Trade shows
_____ % Other, please specify
100 % Total

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28. What was the gross value of product sales from your nursery in 2003, or your most recently completed fiscal year? Please check the appropriate category below, or enter the value here $_____.

_____	Less than $249,999
_____	$ 250,000 - $ 499,999
_____	$ 500,000 - $ 999,999
_____	$ 1,000,000 - $ 1,999,999
_____	$ 2,000.000 - $ 2,999,999
_____	$ 3,000,000 - $ 3,999,999
_____	$ 4,000,000 - $ 4,999,999
_____	$ 5,000,000 - $ 9,999,999
_____	$10,000,000 - $14,999,999
_____	$15,000,000 - $19,999,999
_____	$20,000,000 or above

APPENDIX B: 2003 REGIONAL PERCENT OF SALES BY WHOLESALE OUTLET

Region	Mass merchandisers	Home centers	Garden Centers	Landscapers	Re-wholesalers
Northeast	6.78	15.33	28.99	28.50	20.39
Midwest	3.42	1.49	20.02	52.37	22.71
South	11.29	12.67	19.52	27.94	28.57
West	10.03	15.62	20.48	20.81	33.06
Total	7.88	11.28	22.25	32.41	26.18

Source: Multi-state Regional Project S-1021 survey, 2004

```
DM "output; clear; log; clear";
options pageno=1 nodate;
ods rtf file= "z:US";
proc import datafile= "z:US for SAS.xls"
out=data1 replace;
run;
data New; set data1;
gc=gcs+gcm;
mh=hc+mm;
data US; set New;
if rt=100 then delete;*delete observations*;
if rt>69 then delete;
if wm>100 then delete;
if rt=0 and wm=0 then delete;
if rt+wm<100 then delete;
if rt+wm>100 then delete;
if sales=. then delete;
if sales=0 then delete;
if sales < 10000 then delete;
if wm=. then delete;
if wm=0 then delete;
if rt=. then delete;
if mh=0 and gc=0 and ld=0 and rw=0 then delete;
if mh+gc+ld+rw<99 then delete;
if mh+gc+ld+rw>=101 then delete;
if age = 1725 then age=0;
if age > 2003 then age=0;
if age=0 then delete;
agef= 2004-age;
data Regional; set US;
if state="AR" then REGION= "South";if state="DE" then REGION= "South";
if state="FL" then REGION= "South";if state="GA" then REGION= "South";
if state="KY" then REGION= "South";if state="LA" then REGION= "South";
if state="MS" then REGION= "South";if state="NC" then REGION= "South";
if state="OK" then REGION= "South";if state="SC" then REGION= "South";
if state="TN" then REGION= "South";if state="TX" then REGION= "South";
if state="VA" then REGION= "South";if state="WV" then REGION= "South";
if state="CA" then REGION= "West";if state="CO" then REGION= "West";
if state="HI" then REGION= "West";if state="ID" then REGION= "West";
if state="MT" then REGION= "West";if state="NV" then REGION= "West";
if state="NM" then REGION= "West";if state="OR" then REGION= "West";
if state="UT" then REGION= "West";if state="WA" then REGION= "West";
if state="WY" then REGION= "West";
if state="CT" then REGION= "Northeast";if state="ME" then REGION= "Northeast";
if state="MA" then REGION= "Northeast";if state="NH" then REGION= "Northeast";
if state="NJ" then REGION= "Northeast";if state="NY" then REGION= "Northeast";
if state="PA" then REGION= "Northeast";if state="RI" then REGION= "Northeast";
if state="VT" then REGION= "Northeast";
if state="IN" then REGION= "Midwest";if state="IL" then REGION= "Midwest";
if state="IA" then REGION= "Midwest";if state="MI" then REGION= "Midwest";
if state="MN" then REGION= "Midwest";if state="MO" then REGION= "Midwest";
if state="NE" then REGION= "Midwest";if state="ND" then REGION= "Midwest";
if state="OH" then REGION= "Midwest";if state="SD" then REGION= "Midwest";
data Variables; set Regional;
*'region'*;
```

```
dwest=0;
if region="W" then dwest=1;
dsouth=0;
if region="S" then dsouth=1;
dnortheast=0;
if region="N" then dnortheast=1;
dmidwest=0;
if region="M" then dmidwest=1;
*variable computarization Q4*;
if wrd=1 then wrd=1;
if wrd=2 then wrd=1;
if acc=1 then acc=1;
if acc=2 then acc=1;
if inv=1 then inv=1;
if inv=2 then inv=1;
if fin=1 then fin=1;
if fin=2 then fin=1;
if int=1 then int=1;
if int=2 then int=1;
if cds=1 then cds=1;
if cds=2 then cds=1;
if ema=1 then ema=1;
if ema=2 then ema=1;
if cad=1 then cad=1;
if cad=2 then cad=1;
if sch=1 then sch=1;
if sch=2 then sch=1;
if gren=1 then gren=1;
if gren=2 then gren=1;
if did=1 then did=1;
if did=2 then did=1;
if bar=1 then bar=1;
if bar=2 then bar=1;
if coth=1 then coth=1;
if coth=2 then coth=1;
comp= wrd+acc+inv+fin+int+cds+ema+sch+gren+did+coth+bar+cad;
dcomp=0;
if comp>3 then dcomp=1;
*variable plat categories Q5*;
gr1= dsft+ds+bles+nles+azl+tft+et;
gr2= bpf+bpv+fpp;
gr3= vgc+ros+hep;
gr4= fol;
gr5= xtr+pm+oth;
*variable trade shows Q12*;
trade=TSE+TS;
*variable price determination Q24*;
dpdcp=0;
if pdcp=3 then dpdcp=1;
if pdcp=4 then dpdcp=1;
dpdi=0;
if pdi=3 then dpdi=1;
if pdi=4 then dpdi=1;
dpdog=0;
if pdog=3 then dpdog=1;
if pdog=4 then dpdog=1;
dpdgp=0;
if pdgp=3 then dpdgp=1;
if pdgp=4 then dpdgp=1;
```

```
dpdmd=0;
if pdmd=3 then dpdmd=1;
if pdmd=4 then dpdmd=1;
dpdpu=0;
if pdpu=3 then dpdpu=1;
if pdpu=4 then dpdpu=1;
dpdil=0;
if pdil=3 then dpdil=1;
if pdil=4 then dpdil=1;
dpdly=0;
if pdly=3 then dpdly=1;
if pdly=4 then dpdly=1;
dpdot=0;
if pdot=3 then dpdot=1;
if pdot=4 then dpdot=1;
*sales Q28*;
sales=sales/100000;
data Final; set Variables;
gr1s=(gr1*sales)/100;
gr2s=(gr2*sales)/100;
gr3s=(gr3*sales)/100;
gr4s=(gr4*sales)/100;
gr5s=(gr5*sales)/100;
psns=(psn*sales)/100;
ctcts=(ctct*sales)/100;
pawss=(paws*sales)/100;
patss=(pats*sales)/100;
if sales >= 5 then delete;
dsize=0;
if sales>=5 then dsize=1;
dmm=0;
if mm >0 then dmm=1;
dhc=0;
if hc >0 then dhc=1;
dgc=0;
if gc >0 then dgc=1;
dld=0;
if ld >0 then dld=1;
drw=0;
if rw >0 then drw=1;
dchannel=0;
if dmm+dhc+dgc+dld+drw>2 then dchannel=1;
ods rtf close;
run;
quit;
```

APPENDIX D: STATA PROGRAM FOR THE MULTINOMIAL LOGIT MODEL

```
**multinomial logit model of small firms **
set matsize 800
use "Z:data for stata small firms.dta", clear
set logtype text
log using "Z:results for stata small firms.log", replace
summarize
**Model**
mlogit choice dnortheast dmidwest dwest agef dcomp dchannel gr1s gr2s gr3s gr4s gr5s
trade psns ctcts tcop tcgc tcmm dpdpu pawss patss, basecat(4)
**Marginal effects**
mfx compute, predict (outcome(1))
mfx compute, predict (outcome(2))
mfx compute, predict (outcome(3))
mfx compute, predict (outcome(4))
**IIA assumptions**
mlogtest, iia
```

APPENDIX E: STATA PROGRAM FOR THE TWO-LIMIT TOBIT MODEL

```
** Two-limit tobit model of small firms selling to re-wholesalers **
set matsize 800
use "Z:data for stata small firms tobit.dta", clear
set logtype text
log using "Z:results for stata small firms tobit re-wholesalers.log", replace
summarize
**Model**
tobit rw dnortheast dmidwest dwest agef dcomp dchannel gr1s gr2s gr3s gr4s gr5s trade
psns ctcts tcop tcgc tcmm dpdpu pawss patss, ll(0) ul(1)
**Marginal effects**
mfx compute, predict (ys(0,1))
mfx compute, predict (e(0,1))
mfx compute, predict (p(0,1))
```

APPENDIX F: DESCRIPTIVE STATISTICS FOR 2003 NATIONAL NURSERIES

F.1 – Descriptive statistics for national small nurseries

Variables	Observations	Mean	Std. Dev.	Minimum	Maximum
Contract, other producers	755	0.1907	0.3931	0	1
Contract, garden center	755	0.1934	0.3952	0	1
Contract, mass merch.	755	0.0450	0.2075	0	1
Channel choice	755	2.9576	0.8821	1	4
Firm age	755	20.4715	17.6934	1	152
Region West	755	0.1576	0.3646	0	1
Region Northeast	755	0.1801	0.3846	0	1
Region Midwest	755	0.1550	0.3621	0	1
Computer use in mgt.	755	0.4543	0.4982	0	1
Trade shows attended	755	0.7245	1.3023	0	10
Product uniqueness	755	0.6583	0.4746	0	1
Plant group 1	755	0.8890	1.1237	0	4.50
Plant group 2	755	0.2053	0.6060	0	4.42
Plant group 3	755	0.1462	0.4454	0	3.75
Plant group 4	755	0.0927	0.4623	0	4.35
Plant group 5	755	0.3860	0.7966	0	3.75
Prop. of negotiated sales	755	0.4401	0.6914	0	4.05
Contract production (dollars)	755	0.2155	0.5104	0	3.75
Website adv. share	755	0.0806	0.3156	0	3.50
Trade show adv. share	755	0.1805	0.5648	0	4.05
Firm size	755	0.0000	0.0000	0	0
Channel diversity	755	0.2861	0.4522	0	1
Prop. of sales to landscaper	755	0.3657	0.3744	0	1
Prop. of sales to re-wholesaler	755	0.3248	0.3777	0	1
Prop. of sales to garden center	755	0.2498	0.3335	0	1
Prop. of sales to mass merch.	755	0.0596	0.1984	0	1

F.2 – Descriptive statistics for national large nurseries

Variables	Observations	Mean	Std. Dev.	Minimum	Maximum
Contract, other producers	560	0.2357	0.4248	0	1
Contract, garden center	560	0.1643	0.3709	0	1
Contract, mass merch.	560	0.1375	0.3447	0	1
Channel choice	560	2.8196	1.0051	1	4
Firm age	560	32.0839	23.5632	2	163
Region West	560	0.1893	0.3921	0	1
Region Northeast	560	0.1696	0.3757	0	1
Region Midwest	560	0.1286	0.3350	0	1
Computer use in mgt.	560	0.8268	0.3788	0	1
Trade shows attended	560	3.1446	3.7088	0	27
Product uniqueness	560	0.6607	0.4739	0	1
Plant group 1	560	16.8333	34.3179	0	346.33
Plant group 2	560	6.5888	24.6653	0	230.00
Plant group 3	560	5.2142	19.2059	0	250.00
Plant group 4	560	1.5693	7.0968	0	125.00
Plant group 5	560	5.6010	22.0340	0	250.00
Prop. of negotiated sales	560	11.1742	32.2156	0	250.00
Contract production (dollars)	560	6.3376	22.0685	0	250.00
Website adv. share	560	1.4723	4.2391	0	42.50
Trade show adv. share	560	9.5627	24.8974	0	250.00
Firm size	560	1.0000	0.0000	1	1
Channel diversity	560	0.6500	0.4774	0	1
Prop. of sales to landscaper	560	0.3488	0.3460	0	1
Prop. of sales to re-wholesaler	560	0.3004	0.3185	0	1
Prop. of sales to garden center	560	0.2241	0.2562	0	1
Prop. of sales to mass merch.	560	0.1268	0.2653	0	1

F.3 – Descriptive statistics for nurseries in the South

Variables	Observations	Mean	Std. Dev.	Minimum	Maximum
Contract, other producers	670	0.2164	0.4121	0	1
Contract, garden center	670	0.1522	0.3595	0	1
Contract, mass merch.	670	0.0955	0.2942	0	1
Channel choice	670	2.9194	0.9499	1	4
Firm age	670	22.5910	17.6745	1	163
Region West	670	0.0000	0.0000	0	0
Region Northeast	670	0.0000	0.0000	0	0
Region Midwest	670	0.0000	0.0000	0	0
Computer use in mgt.	670	0.5925	0.4917	0	1
Trade shows attended	670	1.8582	2.7073	0	22
Product uniqueness	670	0.6716	0.4700	0	1
Plant group 1	670	5.7589	16.7084	0	212.50
Plant group 2	670	2.9749	17.4290	0	230.00
Plant group 3	670	1.8270	11.7338	0	250.00
Plant group 4	670	1.0766	4.3249	0	40.50
Plant group 5	670	3.0262	18.3553	0	250.00
Prop. of negotiated sales	670	5.7900	24.0129	0	250.00
Contract production (dollars)	670	2.4684	11.4486	0	148.75
Website adv. share	670	0.5526	2.1599	0	25.00
Trade show adv. share	670	5.0021	19.6042	0	250.00
Firm size	670	0.4284	0.4952	0	1
Channel diversity	670	0.4552	0.4984	0	1
Prop. of sales to landscaper	670	0.3606	0.3531	0	1
Prop. of sales to re-wholesaler	670	0.3394	0.3561	0	1
Prop. of sales to garden center	670	0.2085	0.2829	0	1
Prop. of sales to mass merch.	670	0.0915	0.2337	0	1

F.4 – Descriptive statistics for nurseries in the West

Variables	Observations	Mean	Std. Dev.	Minimum	Maximum
Contract, other producers	225	0.2533	0.4359	0	1
Contract, garden center	225	0.1956	0.3975	0	1
Contract, mass merch.	225	0.0889	0.2852	0	1
Channel choice	225	2.9244	1.0768	1	4
Firm age	225	22.7111	19.0052	1	103
Region West	225	1.0000	0.0000	1	1
Region Northeast	225	0.0000	0.0000	0	0
Region Midwest	225	0.0000	0.0000	0	0
Computer use in mgt.	225	0.6800	0.4675	0	1
Trade shows attended	225	1.7289	3.3875	0	27
Product uniqueness	225	0.6400	0.4811	0	1
Plant group 1	225	11.5006	34.1160	0	346.33
Plant group 2	225	3.6409	17.1685	0	175.00
Plant group 3	225	2.1676	8.7469	0	75.00
Plant group 4	225	0.8428	8.4620	0	125.00
Plant group 5	225	1.9636	7.4916	0	75.00
Prop. of negotiated sales	225	6.3583	22.6627	0	225.00
Contract production (dollars)	225	4.0216	18.7411	0	242.43
Website adv. share	225	0.6706	2.7042	0	25.00
Trade show adv. share	225	3.9298	12.9591	0	131.25
Firm size	225	0.4711	0.5003	0	1
Channel diversity	225	0.4267	0.4957	0	1
Prop. of sales to landscaper	225	0.2418	0.3407	0	1
Prop. of sales to re-wholesaler	225	0.3862	0.3901	0	1
Prop. of sales to garden center	225	0.2254	0.3059	0	1
Prop. of sales to mass merch.	225	0.1466	0.2910	0	1

F.5 – Descriptive statistics for nurseries in the Midwest

Variables	Observations	Mean	Std. Dev.	Minimum	Maximum
Contract, other producers	189	0.1852	0.3895	0	1
Contract, garden center	189	0.1693	0.3760	0	1
Contract, mass merch.	189	0.0317	0.1758	0	1
Channel choice	189	2.9841	0.7254	1	4
Firm age	189	27.9365	23.3823	1	154
Region West	189	0.0000	0.0000	0	0
Region Northeast	189	0.0000	0.0000	0	0
Region Midwest	189	1.0000	0.0000	1	1
Computer use in mgt.	189	0.6296	0.4842	0	1
Trade shows attended	189	1.6243	2.7928	0	23
Product uniqueness	189	0.6402	0.4812	0	1
Plant group 1	189	9.0767	25.8639	0	250.00
Plant group 2	189	0.7912	5.3959	0	68.25
Plant group 3	189	2.5817	10.9002	0	96.25
Plant group 4	189	0.0419	0.2679	0	2.25
Plant group 5	189	2.2218	10.4061	0	100.00
Prop. of negotiated sales	189	2.1556	6.0570	0	56.00
Contract production (dollars)	189	1.2934	4.7155	0	40.00
Website adv. share	189	0.6893	3.2654	0	37.50
Trade show adv. share	189	2.0421	6.3579	0	54.00
Firm size	189	0.3810	0.4869	0	1
Channel diversity	189	0.3651	0.4827	0	1
Prop. of sales to landscaper	189	0.5149	0.3735	0	1
Prop. of sales to re-wholesaler	189	0.2494	0.3324	0	1
Prop. of sales to garden center	189	0.2089	0.2818	0	1
Prop. of sales to mass merch.	189	0.0267	0.1166	0	0.75

F.6 – Descriptive statistics for nurseries in the Northeast

Variables	Observations	Mean	Std. Dev.	Minimum	Maximum
Contract, other producers	231	0.1688	0.3754	0	1
Contract, garden center	231	0.2597	0.4394	0	1
Contract, mass merch.	231	0.0909	0.2881	0	1
Channel choice	231	2.7446	0.9039	1	4
Firm age	231	34.1862	27.2769	2	152
Region West	231	0.0000	0.0000	0	0
Region Northeast	231	1.0000	0.0000	1	1
Region Midwest	231	0.0000	0.0000	0	0
Computer use in mgt.	231	0.5931	0.4923	0	1
Trade shows attended	231	1.5887	2.8696	0	23
Product uniqueness	231	0.6580	0.4754	0	1
Plant group 1	231	8.3820	26.5030	0	204.17
Plant group 2	231	3.8218	18.3655	0	187.50
Plant group 3	231	3.5957	18.9351	0	250.00
Plant group 4	231	0.1294	0.9171	0	12.50
Plant group 5	231	2.3320	9.7872	0	113.75
Prop. of negotiated sales	231	3.7769	21.5842	0	250.00
Contract production (dollars)	231	3.9333	22.1470	0	250.00
Website adv. share	231	1.0127	4.1403	0	42.50
Trade show adv. share	231	3.7656	17.6137	0	212.50
Firm size	231	0.4113	0.4931	0	1
Channel diversity	231	0.4762	0.5005	0	1
Prop. of sales to landscaper	231	0.3382	0.3570	0	1
Prop. of sales to re-wholesaler	231	0.2250	0.2988	0	1
Prop. of sales to garden center	231	0.3645	0.3416	0	1
Prop. of sales to mass merch.	231	0.0723	0.2178	0	1

VITA

Mr. Marco A. Velástegui was born on May, 1980, in Quito, Ecuador. During his childhood, he attended high school at Academia Naval Almirante Nelson private school and finished his studies in August of 1998. In 2003, he received his Bachelor of Science degree in socio-economic development and environment from the Pan-American Agricultural School "El Zamorano" in Honduras. After his graduation, Marco went back to Ecuador to work as a logistic and business manager with an importer of electronic devices. In the summer of 2005, he was accepted to begin an internship program in the Department of Agricultural Economics and Agribusiness, Louisiana State University. After six months of working as a research assistant, he began his master´s program in Spring 2006. He is a candidate for the degree of Master of Science in agricultural economics in August 2008. Marco is considering joining the doctoral program.