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Proving the Economic Importance of the Greenhouse, Nursery and Sod Industry: A New Jersey Case Study¹

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Abstract

The economic contribution of the greenhouse, nursery and sod (GNS) sector to the economy of New Jersey was analyzed using Impact Analysis for Planning (IMPLAN). The results were analyzed in terms of employment, employee compensation, and total industry output, and were disaggregated into direct, indirect and induced effects of GNS activity. The analysis shows that the direct contribution of the GNS sector generated substantial indirect and induced economic effects in the real estate sector. The indirect effects were also great for the wholesale, agricultural services and agricultural chemicals sector, while the general merchandise, and the apparel and accessories sectors experienced major gains from the induced effects of GNS activity.

Index words: IMPLAN, demand driven, input-output, economics.

Significance to the Nursery Industry

In 1990 the greenhouse-nursery-sod (GNS) sector generated over \$600 million in economic activity in New Jersey. Of this total, over \$120 million was indirect activity (additional purchases by backward-linked sectors to produce additional output) and \$265 million from induced effects (changes in regional household spending patterns caused by changes in household income). Households also comprised the greatest final demand sector, followed by exports and government purchases.

Results from this study show that the GNS sector is linked very closely to the real estate sector. In a state which has a high population density and ranks second in terms of per capita income, the high linkage is understandable. The high population density means that there is increased demand for residential units and GNS products, while the significant per capita income provides the capacity to buy GNS products. Important linkages also exist with the wholesale, agricultural services and agricultural chemicals sectors. Because of these important linkages, social or economic policies which have a negative impact on these sectors would adversely affect the contribution that the GNS sector makes to the economy of the state and the economic well-being of the nursery industry.

Introduction

Between 1968 and 1990, agricultural marketing receipts from the GNS sector increased by over 350 percent, second only to the equine industry which increased by approximately 1000 percent. In 1968, despite the growing importance in equine sales, agricultural marketing receipts from the GNS sector was over 18 percent of total agricultural revenues, compared to 2.7 percent for equine. In 1990, the GNS sector was the largest source of agriculture revenues, comprising 35.3 percent of all agricultural sectors. By contrast, agricultural marketing receipts from all vegetables which accounted for 25.7 percent of all commodities sold in 1968, decreased to 17.8 percent in 1990. For the same period, receipts for all

crops as a percentage of all commodities sold, increased from 60.6 percent to 69.9 percent, and decreased from 39.4 percent to 30.1 percent for all livestock and products (10).

Though the determinants of the growth of the GNS sector are not investigated here, the proximity to the 'high traffic' markets of Philadelphia and New York City appear to provide an important stimulus to growth. Moreover, because of the highly urbanized nature of the state, the opportunity for sales of GNS products directly to consumers at farm stands and roadside markets may lead to higher demand and increased farm incomes (11). As farm income and the demand for GNS products increase, the contributions of the GNS sector to the economy of the state becomes more important. These economic contributions often get lost in aggregate analysis of the agricultural sector. Though aggregate analysis is often useful, and in most cases the only analysis that is possible because of data limitations, its utility to policy makers is questionable because it fails to identify the contributions of various sectors, and therefore makes sector-specific policy difficult.

The objective of this study is to disaggregate the agricultural sector in order to identify and quantify the economic linkages between the GNS and other sectors in the economy in terms of employment, employee compensation and industry output. The study goes beyond previous research in identifying not only the indirect effect of GNS activity, but also the induced effects. The economic linkages which the study provides can be used to examine the potential consequences on non-agricultural and agricultural sectors, given fluctuations in demand for products from the GNS sector. This is important not only to policy makers but nursery growers.

Materials and Methods

The concept of economic base and economic base models provide the theoretical framework within which the contributions of the GNS sector is investigated. The components of an economic base are export sectors which infuse outside capital into an economy (8, 4). The central idea behind economic base theory is that there exists a relationship between export-generating or basic employment and residential or non-basic employment and between export-generating employment and population. Exports are any extra-regional

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Table 1. Type I and III multipliers for the greenhouse, nursery, and sod sector, and selected sectors.

Sectors	I			III		
	Output	VA ^a	Employment	Output	VA	Employment
Landscape	1.2384	1.3110	1.1107	2.0206	2.4199	1.6217
Vegetables	1.5909	3.7584	1.7624	2.0270	6.2822	2.3741
Greenhouse	1.5593	1.0139	1.2344	2.7305	1.4146	1.6523

^aVA = value added.

transaction which brings in 'new money' and helps a region to grow; a region may be defined as a municipality, county, state or nation. Hence the sale of goods or services from one county to another, qualify as exports. In that context, any activity which leads or determines a region's growth, is referred to as basic, while non-basic activities are the consequences or spill-over results, from growth. Because regional growth and development patterns change overtime, identification and measurement of a region's economic base should be a continuous process.

Input-output analysis is a useful technique for investigating a region's economic base because it identifies structural linkages in an economy. The technique has undergone major intellectual development (6) and has been used in many empirical applications (7, 2). More recently, the technique has been used to examine the economic linkages of the U.S. greenhouse and nursery products industry (3). The analysis provided estimates of backward and forward linkages, but did not disaggregate backward-linkage effects, an important component for understanding induced household expenditures. These expenditures can be captured by IMPLAN (Impact analysis for PLANning).

IMPLAN uses input-output techniques. It is a demand-driven (backward linkages) program developed by the US Forest Service and the University of Minnesota. The program has been used to estimate impacts in the forest industry (13, 12), recreation and tourism industry (1), and environmental issues (5). The approach requires a transaction (table) matrix which shows the inter-industry purchases and sales. A direct coefficient matrix giving the proportion of each industry's expenditure by sector, and a Leontief inverse showing the sales caused by a dollar change in final demand (demand by the ultimate consumers of the product) are calculated from that matrix.

The 1990 IMPLAN database for New Jersey is used to calculate the economic impacts of GNS sales to final demand. The IMPLAN modelling system provides two types of multipliers for impacts dealing with output, personal income, total income, value-added and employment. Type I multipliers are the Leontief inverse. IMPLAN sums the direct and indirect effects and divides the result by the direct effect. The direct effect which is produced by changes in final demand, generates an indirect effect because of input requirements. Both direct and indirect effects produce employment which induces household spending.

Type III multipliers capture the induced effects and are based on changes in employment and population. The multipliers are obtained by summing the direct, indirect and induced effects and dividing the result by the direct effect. The direct and indirect effects are first converted to each sector's employment-to-output ratio. Employment change is then multiplied by the region's population-to-employment ratio, converting it to population change. Population change

is multiplied by average regional per-capita consumption rates by sector to estimate the regional household consumption generated by the initial final demand changes. This change in household consumption is treated as an additional set of final demand changes and are multiplied by the Leontief Inverse matrix to generate the first round of induced (additional direct and indirect) effects (9).

Although the GNS sector in New Jersey is less than one-tenth of one percent of the economic base of the state in terms of foreign exports, the demand for GNS products generates economic activity in three ways. First, there is a direct impact on the economy as home-owners, real estate operators, and others buy GNS products. Second, as purchases from the GNS sector increases, the GNS sector increases its demand for inputs (seed material from businesses, labor from households) from other industries to meet the increased demand for its products (indirect effect). The multiplier benefits of these indirect effects do not go on indefinitely because some inputs are purchased outside of the region leading to money leaving the regional economy (demand leakages). The third effect results from increased household spending as more labor is hired in response to GNS-led economic activity (induced effect). These impacts or multiplier effects depend on the amount of money that is actually spent in the regional economy.

Results and Discussion

The economic contributions of the GNS sector are analyzed in terms of total industry output, employee compensation and employment. Total industry output represents gross sales from production; employee compensation is the value of wages and salaries paid to employees by industries plus the value of benefits and contributions to social security and pension funds by the employee and employer.

Selected multipliers from IMPLAN analysis are presented in Table 1. Recall that the impact of the multipliers depend on the importance of the economic linkages among the various sectors. Hence, increased interindustry purchases and sales mean greater economic activity and greater multipliers effects. The GNS sector has a Type I output multiplier of 1.5593. This means for every dollar of output produced 0.5593 dollars (1.5593 - 1) worth of indirect output is generated in other local industries. The Type III multiplier of 2.7305 means that 1.7305 dollars (2.7305 - 1) of indirect and induced output is generated in other local industries. In this case the induced output amounts to (2.7305 - 1.5593) 1.1712 dollars, for each dollar of output produced by the GNS sector.

In 1990, the GNS sector in New Jersey generated over \$226 million in sales, paid over \$31 million in employee compensation and provided over 6000 jobs (Table 2). To achieve that much economic activity, the sector utilized in-

Table 2. Total effect of greenhouse, nursery, and sod sector on New Jersey's economy, and selected sectors.

Sectors	Direct	Indirect	Induced	Total
TIO* (\$M)	226.0	126	265	617
Employee comp. (\$M)	31.5	39	74	144
Employment (#)	6155.0	1452	2701	10308

*TIO = total industry output.

Table 3. Indirect effects of greenhouse, nursery, and sod sector on New Jersey's economy, and selected sectors.

Sectors	Employee		
	TIO* (\$M)	Comp. (\$M)	Employment (No.)
Agricultural services	2.25	0.81	85
Agricultural chemicals	2.04	0.31	6
Wholesale	3.65	2.41	64
Real estate	17.10	1.10	100

*TIO = total industry output.

Table 4. Induced effects of greenhouse, nursery, and sod sector on New Jersey's economy, and selected sectors.

Sectors	Employee		
	TIO* (\$M)	Comp. (\$M)	Employment (No.)
Wholesale	3.44	2.26	60
Building	1.76	1.11	51
General merchandise	4.34	2.59	172
Apparel & accessories	2.42	1.08	68
Real estate	20.79	1.34	121
Fruits	0.017	0.0009	1
Vegetables	0.2851	0.0091	3

*TIO = total industry output.

puts from other industries, which generated an additional \$126 million in sales. The direct and indirect industry sales induced households to spend an additional \$265 million. Hence, the economic activity of the GNS sector generated over \$600 million in sales.

Because New Jersey is a very densely populated state (ranks first in the U.S.), it is not surprising that the multiplier effects from GNS activity generated \$17.1 million in sales in the real estate sector; the real estate sector includes real estate operators and homeowners, among others (Table 3). Johnson and Jensen (8) found that sales of U.S. nursery stock were positively related to residential construction, which supports the above observation. Other major beneficiaries of GNS economic activity include the wholesale trade sector, which are establishments engaged in the wholesale distribution of durable and non-durable goods, and the agricultural chemical and agricultural services sectors. These sectors experienced sales of \$3.65, \$2.04, and \$2.25 million, respectively.

The value of the jobs generated by GNS economic activity varied by industry. With 100 jobs generated by the real estate sector and \$1.1 million in total employee compensation, the average value of real estate employment was \$11,000. This compares to approximately \$52,000 for the

agricultural chemical sector, and \$37,000 for the wholesale sector.

The induced effect of household spending benefitted non-agricultural-related industries disproportionately. Because we spend a small fraction of our budget on food (approximately 12%–13%), this result is not surprising. For example, induced real estate sales totalled about \$21 million, and the general merchandise, wholesale and apparel/accessories sectors had sales of over \$4 million, \$3 million and \$2 million, respectively. This compares to induced fruit and vegetable sales of only \$16,500 and \$248,800, respectively (Table 4). Employee compensation of \$2.59 million in the general merchandise sector paid an average of \$15,058.

It is clear from the above analysis that in calculating the impact of any sector on economy the total contribution should be considered. This includes disaggregating backward linkages into direct, indirect and induced impacts. The results show that when all these effects are considered, the GNS sector made a substantial contribution to the economy of the state of New Jersey in 1990. This substantial contribution occurs because of the strong backward linkages between the GNS sector and real estate, and agricultural services sectors. Clearly policies which adversely affect GNS activity would also have a negative impact on backward-linked sectors.

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