Estimation of Economic Impact Multipliers for the Texas Coastal Bend Cotton Industry

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Abstract

Cotton production in the Texas Coastal Bend has decreased since 2006 due to extreme drought, sharp increases in input prices, increases in the price of feed grains, and relatively weak cotton prices. Stakeholders in the Texas Coastal Bend area, both producers and service providers to the cotton industry, are concerned that reduced cotton production will have a significant, negative economic impact on the area. This study develops estimates of economic impact multipliers for Texas Coastal Bend, based on regional industry data and compares those estimates to IMPLAN default values to help local stakeholders more accurately interpret the economic consequences of reduced cotton production in the region. Four types of impacts were calculated from the Type Social Accounting Matrices (SAM) model: output (gross sales), value-added, labor income, and employment. The total economic output contribution of cotton production and processing in the region for 2005 was estimated to be $620 million. Of that total, $451 million was attributable to cotton farming, $92 million to ginning, $52 million to oil milling and whole seed sales, and $25 million to the compress. This compares with IMPLAN default values of a total economic output contribution of cotton production of $425 million, resulting in a total cotton industry contribution of $594 million.

Introduction

Cotton production in the Texas Coastal Bend has decreased since 2006 due to extreme drought, sharp increases in input prices, increases in the price of feed grains and relatively weak cotton prices. Stakeholders in the Texas Coastal Bend area, both producers and service providers to the cotton industry, are concerned that reduced cotton production will have a significant, negative economic impact on the area. This study develops estimates of economic impact multipliers for Texas Coastal Bend, based on regional industry data and compares those estimates to IMPLAN default values to help local stakeholders more accurately interpret the economic consequences of reduced cotton production in the region. Four types of impacts were calculated from the Type Social Accounting Matrices (SAM) model: output (gross sales), value-added, labor income, and employment.

Materials and Methods

The source of employment, cost and return information for the cotton farming sector were enterprise budgets developed by Texas AgriLife Extension Service personnel based on input from area producers, input suppliers and related service providers (Falconer). The data related to employment, costs, and returns for the ginning sector were provided by area ginners (TCGA). Detailed employment, production costs, and returns information for the cottonseed milling sector was provided by area cooperatives (Sullivan). In addition, local warehouse facilities provided in-depth information on costs, returns, and employment (Weatherford).

The regional income and cost data provided in the industry budgets and surveys were calculated in terms of costs per dollar of income. Thus, costs and profits could be interpreted as shares of income. Each cost category provided by survey respondents was matched to an industry sector in the IMPLAN input-output model (Minnesota IMPLAN Group, 2004). For example, farmers' gas and diesel costs were matched to the petroleum refining sector of IMPLAN, and compress telephone costs were matched to IMPLAN's telecommunications sector. In some cases, expenditures in multiple budget categories were grouped to fit IMPLAN's broader sector classification system. Similarly, value added components (e.g., employee compensation, proprietor's income, other property income, and indirect business taxes) were grouped into sectors recognized by IMPLAN. For example, profits were considered proprietor's income in IMPLAN, which was deemed appropriate based on the ownership structure of Texas Coastal Bend cotton farms.

The cost shares for each phase of cotton production and processing were entered into IMPLAN to determine the economic contribution of the cotton industry to the South Texas region. Input-output models use a direct effect, such

as industry sales, to estimate indirect and induced effects based on purchasing relationships between industries and households. The direct effect on the economy is the initial change in final demand, or sale to final users. The direct effect results in two types of secondary effects. The indirect effect results from the purchase of inputs among local industries. The induced effect results from the expenditure of institutions such as households and governments benefitting from increased the activity among local businesses.

IMPLAN estimates backward linkages through the economy. For example, the inputs to cottonseed oil mills include the products of cotton farming and ginning. However, IMPLAN's industry aggregation groups cotton ginning with other agricultural support activities such as aerial chemical application, and this aggregation of industries distorts the relationship between ginning alone and its suppliers. Similarly, cottonseed oil mills are lumped with soybean mills, and compresses are part of the much broader warehousing sector. Thus, it is more accurate to calculate each step of the cotton industry separately.

In calculating the forward linkages, care must be taken to avoid double counting the contributions of earlier stages of production. Cotton sales including government payments are entered for the cotton farming sector. The costs of cotton production must then be excluded from the processing contribution calculations. Therefore, each processing sector (ginning, oil milling, and compress) is modeled by excluding payments to previous stages of production.

IMPLAN has default "production functions" for each of its sectors with output as a function of input costs rather than input levels. The default cost function for cotton farming was adjusted to reflect costs in Texas AgriLife Extension Service Coastal Bend (District 11), which is representative of the majority of dryland cotton production in South Texas. In this case, District 11 farmers spent a higher share of income in the agriculture support industry than suggested by IMPLAN default values. District 11 farmers also reported lower levels of value-added, and thus they had a higher share of production costs attributable to inputs. Income for cotton farms was divided into two components: actual sales and counter-cyclical payments (CCP) were added together and considered cotton sales in order to generate positive profits while direct payments (DCP) were divided 75/25 between farmers and landlords. Farmers' DCP payments were entered as direct payments to household income groups making $50-75 thousand; landlords' payments were made in the other property income sector.

Cost functions for the ginning, oil milling/whole seed sales, and compress stages of cotton processing were also adjusted to reflect survey responses from businesses in District 11. However, these industries were part of larger sectors within IMPLAN so specific industry entries were created in the model to avoid changing the purchasing patterns of the broader sector. This maintained the relationship of the non-gin agricultural support businesses and various warehouse facilities to the regional economy. Building industry-specific cost functions also allowed purchases from earlier stages of production to be excluded from the model without violating the relationship between input purchases and value-added costs.

Results and Discussion

Four types of impacts were calculated from the Type SAM model: output (gross sales), value-added, labor income, and employment. Output or sales multipliers measure the effect of external spending on overall economic activity in the region. The output multiplier provides the largest economic impact value and therefore is reported in many studies; however, the output multiplier says nothing about how the event affects the welfare of households or the profitability of businesses.

The value-added multiplier measures an industry's contribution to regional gross domestic product (GDP). Value-added includes labor income, proprietor's income, other property income, and indirect business taxes. The labor income or personal income multiplier is a key component of the value-added multiplier that is often reported alone. The labor income multiplier measures the effect of final demand spending on the incomes of households in the region and is appropriate for discerning the benefit of an event to a region's residents. The employment multiplier measures the effect of final demand expenditures on regional employment. Calculation of the employment multiplier assumes that existing employees are fully occupied and does not distinguish between full-time and part-time workers.

Results of the input-output model are shown in Table 1. The total economic output contribution of cotton production and processing in District 11 was $620 million. Of that total, $451 million was attributable to cotton farming, $92

million to ginning, $52 million to oil milling and whole seed sales, and $25 million to the compress. In the cases of the processing industries, costs attributable to previous sectors in the value chain were excluded. For example, compress sales were $18 million, but only 63 percent of those sales generated economic contributions above those already accounted for by production and previous processing. Of the $620 million in industry output, the cotton industry contributed $237 million to the 18-county region's GDP (Table 2), including $121 million in labor income (Table 3) and 5,000 jobs (Table 4).

Table 1. Total Output Estimates for the Texas Coastal Bend Cotton Industry.

	Production	Ginning	Oil Milling	Compress	Total Cotton Sector
Direct*	290,871,034	61,819,380	42,444,831	18,328,986	413,464,231
Indirect*	115,805,333	20,101,909	3,135,043	1,349,957	140,392,242
Induced*	43,958,869	10,346,154	6,159,331	5,387,982	65,852,336
Total*	450,635,229	92,267,443	51,739,205	25,066,925	619,708,802

The effects of manipulating the cost function to reflect costs of District 11 farmers are evident in the production industry outcomes. Industry stakeholders had a priori expectations that their regional multiplier was larger than the default IMPLAN multiplier. The output multiplier is the most widely reported multiplier across publications, and the farmers' hypothesis was correct for the output multiplier because farmers in the region purchased more inputs and made fewer payments to value-added. The higher share of purchases from other industries raised the indirect contribution in District 11 relative to the contribution expected based on default values. In turn, greater business activity generated greater induced effects. This was true even though the balance of local and non-local purchases by farmers (as well as the forward linked industries) were left unchanged using IMPLAN's regional purchase coefficients.

Table 2. Value Added Estimates for the Texas Coastal Bend Cotton Industry.

	Production	Ginning	Oil Milling	Compress	Total Cotton Sector
Direct*	89,031,391	13,162,902	9,874,008	9,407,179	121,475,480
Indirect*	67,750,437	9,266,108	1,609,535	746,574	79,372,654
Induced*	24,282,462	5,632,112	3,337,258	2,917,019	36,168,851
Total*	181,064,286	28,061,122	14,820,801	13,070,772	237,016,981

The input mix identified by local cotton farms actually resulted in a reduction of the economic output contribution than would be expected from the default IMPLAN production function by $22.6 million. A smaller share of inputs was purchased locally because the inputs more heavily used by District 11 farmers were not produced in the area. For example, local farmers used more pesticide than assumed by IMPLAN, and only a small fraction of pesticides are produced in the region. On the other hand, a great deal of petroleum refining takes place on the Texas coast, but farmers in the region use less petroleum than assumed by IMPLAN. As a result, the indirect contribution of District 11 cotton farming was reduced.

Table 3. Labor Income Estimates for the Texas Coastal Bend Cotton Industry.

	Production	Ginning	Oil Milling	Compress	Total Cotton Sector
Direct*	27,953,199	9,896,708	1,717,205	3,190,722	42,757,834
Indirect*	51,204,480	5,810,828	956,931	488,910	58,461,149
Induced*	13,104,634	3,038,963	1,800,564	1,573,864	19,518,025
Total*	92,262,312	18,746,499	4,474,700	5,253,496	120,737,007

Despite lower indirect contributions, the regional input mix resulted in higher induced contributions than the IMPLAN default, an increase of $5.4 million. The sectors from which District 11 cotton farmers purchased heavily tend to spend more on labor income and proprietor's income, of which a large share is spent locally. At the same time, those sectors important to cotton production spent less on other property income and indirect businesses taxes, both of which have high leakages. Regardless, the increased contribution from higher overall input purchases

relative to value-added was larger than the decreased contribution resulting from input mix. The District 11 contribution was therefore larger than expected from default IMPLAN functions. The reader should note that the table and forward-linked economic contributions include the combined effects of higher inputs relative to value-added and the disadvantageous input mix.

Output multipliers are widely reported, but the value-added multiplier is a more appropriate measure of regional welfare. The value-added multiplier measures the value added to the regional economy (contribution to regional GDP) or the return to local resources used in the production of the industry's products or services. Value-added was a smaller component of District 11 costs (Table 2), and therefore the value-added contribution was lower for District 11 farms than for the IMPLAN default by $34.1 million. However, accounting for the region's industry mix countered the loss of direct value added in local cotton production (although not fully). This effect was similar to that of the induced output contribution discussed previously.

Furthermore, the employee compensation effect that stimulated induced sales also resulted in a higher labor income contribution than suggested by the IMPLAN default. Adjusting the model to reflect regional conditions also resulted in an additional 800 jobs in District 11, which again accounts for increased labor and induced output contributions.

Table 4. Employment Estimates for the Texas Coastal Bend Cotton Industry.

	Production	Ginning	Oil Milling	Compress	Total Cotton Sector
Direct*	1,870	388	45	70	2,373
Indirect*	1,855	123	19	12	2,009
Induced*	426	99	58	51	634
Total*	4,150	610	122	133	5,016

The ginning, oil milling, and compress industries are so different from their parent sectors in IMPLAN that the type of comparison provided for cotton production is meaningless. The purpose of quantifying the contributions of these industries was to model the full contribution of the cotton value chain.

Summary

The total economic output contribution of cotton production and processing in the region was $620 million. Of that total, $451 million was attributable to cotton farming, $92 million to ginning, $52 million to oil milling and whole seed sales, and $25 million to the compress. This compares with IMPLAN default values of a total economic output contribution of cotton production of $425 million, resulting in a total cotton industry contribution of $594 million.

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