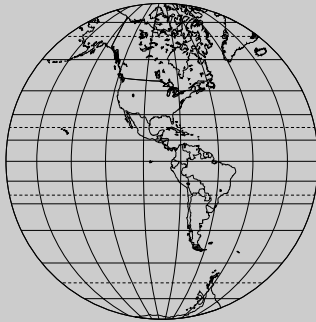


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Evaluating the Impact of Agricultural Exports on the Louisiana Economy

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TABLE OF CONTENTS

Introduction	3
Input-Output Models and Agricultural Exports	5
Estimating New Levels of Louisiana Agricultural Exports	6
Margins	10
Comparison of Estimated and Original Louisiana Agricultural Exports	12
Impact of Agricultural Exports on the Louisiana Economy	14
Impact of Exports of Agricultural Products Produced Outside of Louisiana	22
Impact of Projected Growth in Louisiana Agricultural Exports	24
Summary and Conclusions	29
Policy Implications	30
Bibliography	33
Appendix I: Effect of Export Estimates on Other Model Estimates	36
Endnotes	38

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EVALUATING THE IMPACT OF AGRICULTURAL EXPORTS ON THE LOUISIANA ECONOMY

David W. Hughes and Roman I. Bairak¹

INTRODUCTION

International trade is important to the economic well-being of a nation. Trade benefits countries with increases in utility that arise from comparative advantage. According to this principle, a country will trade with other countries even if it is highly efficient in the production of all goods. Each country will export those goods that it produces at least cost and import those goods that it produces at a higher cost (Samuelson and Nordhaus, 1989).

The United States plays a major part in international trade. In 1991, the U.S. was the world's largest individual trading nation, accounting for 14% of world imports and 12% of world exports. While the European Community, Canada, and Japan remain the major trading partners of the United States, exports to a number of developing countries, particularly in Asia and Latin America, have increased considerably in recent years (Trade Policy Review, 1992).

Further increases in U.S. exports are projected due to signing of the General Agreement on Tariffs and Trade (GATT) and the North American Free Trade Agreement (NAFTA). The former will eventually lower trade barriers on a worldwide basis while the latter will eventually eliminate most trade barriers between the U.S., Canada, and Mexico. Canada has been the U.S.'s largest trading partner for a number of years.

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NAFTA is expected to make these ties stronger. U.S. exports to Mexico were a record \$40.6 billion in 1987. In the 1990s, the United States is experiencing a boom in trade with Latin America in general and Mexico in particular (U.S. Department of Agriculture, 1994).

The United States became an active participant in the world market for agricultural products in the 1970s. Agricultural products accounted for 10% of total U.S. exports in 1990 (U.S. Department of Agriculture, 1994). The United States is the world's leading exporter of a number of agricultural products, including feed grains, wheat, livestock products, soybeans and soybean meal, horticultural products, and rice (Trade Policy Review). However, U.S. agricultural exports are concentrated in low value, often unprocessed, agricultural commodities (Burfisher and Missiaen, 1990).

Louisiana ports are major points of departure for U.S. agricultural commodities. Louisiana ports exported \$16.5 billion of goods in 1992, making the state the sixth-largest port of exit in the nation. Between 55% and 60% of all commodities shipped through Louisiana ports were agricultural products (U.S. Department of Commerce, 1994a) .

Louisiana also produces a number of agricultural commodities that depend heavily on foreign markets, such as cotton, rice, and soybeans. Certain processed food products, such as Louisiana poultry products, are also shipped overseas. Louisiana has a strategic location relative to markets in Latin America and elsewhere. Given these advantages, the state may receive a disproportional benefit from the new trade environment. This benefit will be enhanced if increases in state agricultural exports are concentrated in higher valued, processed agricultural commodities.

No current estimates exist of either the current contribution or the future contribution of the export of Louisiana agricultural products to the state economy. This deficiency is remedied here. Also examined is the contribution to the Louisiana economy of agricultural commodities produced elsewhere, but shipped through Louisiana to foreign markets. An Input-Output (I-O) model of the Louisiana economy, constructed with the IMPLAN model building procedure, is used as the basic tool of analysis. I-O models constructed with programs such as IMPLAN may be of questionable accuracy because model coefficients are not based on survey data concerning the local economy. The I-O model has been verified and refined with information from a number of outside sources resulting in a so-called hybrid I-O model. A combination of survey and U.S. export data was used in estimating new levels of foreign exports of Louisiana agricultural products. Besides indicating the contribution of foreign agricultural markets, model results are also used to indicate to policy makers the potential of processed agricultural exports in enhancing state economic growth.



INPUT-OUTPUT MODELS AND AGRICULTURAL EXPORTS

A number of Louisiana agricultural sectors sell to foreign markets. These industries are linked to many other sectors of the state economy. Because of these interindustry linkages and because of their expected growth, agricultural exports should be an important source of future economic growth in Louisiana.

Input-output (I-O) analysis was selected as the principal analytical framework for this study because of its ability to analyze the interdependencies among industries in an economy (Miller and Blair, 1985). This property makes I-O models well suited for evaluating the effect of agricultural exports on the Louisiana economy.

The basic building block of the I-O model is the A matrix. This matrix shows purchases by specified industries from all other industries on a per dollar of output basis for the purchasing industry. The A matrix forms the basis for calculating the Leontief Inverse. This inverse subsumes the direct and indirect effects of a given direct change in economic activity, or the multiplier effect of that change.

Another major component of any I-O model is final demand. Final demand shows the sales by each sector in the economy to final markets, such as personal consumption purchases, purchases by various levels of government, and both domestic and foreign exports (Miller and Blair).¹ When a change in final demand for any sector of the economy is multiplied by the Leontief Inverse, estimates of direct and indirect changes in the output of all sectors in the regional economy are obtained.

Impact analysis shows the effect of a particular change in a component of final demand, such as exports, for a given set of industries, such as agricultural industries, on total economic activity in the economy being modeled. Hence, the contribution of exports can be estimated with a regional I-O model through the use of impact analysis.

An Input-Output model of the 1985 Louisiana economy is the starting point for this study. The IMPLAN (IMPact PLANning) model building system forms the basis of this I-O model (Alward et al., 1989). The model was improved by applying secondary employment and production-specific data resulting in a hybrid model (Hughes, 1995).

The hybrid model for the Louisiana economy was expected to provide more accurate estimates than the original (ready-made) IMPLAN model.² However, previous modeling efforts were concentrated on

accurately estimating levels of sales between industries, on levels of industry production, and on properly estimating industry payments to factors of production. That is, the emphasis was on building an accurate A matrix. Estimates of foreign exports contained in the model were not critically evaluated. The accuracy of projected changes in Louisiana economic activity due to export of agricultural products depends on both. Hence, a major focus in this study was utilizing outside information to more accurately estimate levels of sales to foreign markets by Louisiana agricultural producers.

The IMPLAN model-building procedure is widely used to estimate the regional impact of industries and of policy changes. Little analysis has been done, however, concerning the accuracy of IMPLAN-based estimates of exports. Further, because estimated foreign exports are subtracted from regional supply in models constructed with IMPLAN, such estimates could also influence analysis unrelated to exports. Comparing and contrasting model results under original and adjusted levels of foreign exports should help indicate the degree of concern that model users should have about the accuracy of unverified foreign export estimates used in IMPLAN models.

Estimating New Levels of Louisiana Agricultural Exports

The original hybrid IMPLAN I-O models for Louisiana in 1985 provided initial estimates of the effect of international exports on the state economy. These estimates of exports for 20 agricultural industries in the original hybrid IMPLAN I-O model were then supplemented by secondary and primary data. These survey-based estimates provided information on agriculturally based products classified as production agriculture (Standard Industrial Classification (SIC) sectors 01 and 02; manufactured food products (SIC 20); lumber, wood, and forest products (SIC 24); and pulp, paper, and allied products (SIC 26)).

Assume that the level of agricultural products shipped through Louisiana is known. Also assume that all foreign agricultural exports produced in Louisiana are shipped through Louisiana ports. Louisiana agricultural exports could then be estimated by determining the proportion of agricultural commodities shipped through Louisiana that are produced in Louisiana.

Export data for the New Orleans U.S. Customs District provided an estimate of agricultural products shipped through Louisiana. The District includes 17 ports located in Louisiana and on the Mississippi River and its tributaries in Mississippi, Tennessee, and Arkansas. However, only certain Louisiana ports in the District are capable of handling ocean going vessels (U.S. Army Corps of Engineers, 1989). These are

the Port of New Orleans, the Port of Baton Rouge, the Port of Lake Charles, and the ports of Destrehan, Gramercy, Avondale, St. Rose, and Good Hope. The latter set of ports, located on the Mississippi River between Baton Rouge and New Orleans, have combined to form the paper port of South Louisiana. All export data for the New Orleans U.S. Customs District were compiled at one of these Louisiana ports of exit.

The value of all agricultural commodities shipped through the New Orleans Customs District for 1989 through 1992 was extracted from *U.S. Exports and Imports of Merchandise on CD-ROM* (machine readable data files) (U.S. Department of Commerce, 1994a). To be consistent with the 1985 IMPLAN model, these values were deflated to 1985 dollars using the appropriate Producer Price Index.

The total estimated average annual value, from 1989 through 1992, of agricultural exports shipped through Louisiana ports was 10.952 billion in 1985 dollars (Table 1). As expected, Food Grains, Oil Bearing Crops, and Feed Grains were the three IMPLAN industries with the largest share of the value of agricultural exports shipped through Louisiana ports. These three industries included wheat, rough rice, corn, sorghum, and soybeans, which contributed more than 75% or \$8.212 billion in total annual agricultural exports shipped through Louisiana over the period 1989 through 1992.

A telephone survey of major agricultural exporters in Louisiana was conducted to obtain the percentage of agricultural exports going through Louisiana ports that originated in Louisiana. A list of 100 trading companies that exported agricultural products was drawn from the "Louisiana Agricultural Export Directory" (Louisiana Department of Agriculture and Forestry, 1994). A stratified random sample, based on the four-digit Standard Industrial Classification (SIC) code, was used to insure coverage of all agricultural products. This was done by assigning companies to industry categories, and randomly choosing from each category. Sixty-three of the 100 firms surveyed were willing to estimate, for all agricultural products that they handled, the percentage produced in Louisiana of the total amount shipped through Louisiana ports.³

The estimated value of agricultural exports originating in Louisiana, the percentages obtained from the survey, and the levels of agricultural exports moving through Louisiana are provided in Table 2. Louisiana ports provided an export channel for \$10.952 billion of agricultural and agriculture-related products. Because Louisiana itself produced \$962.632 million worth of these exports, the remaining \$9.989 billion were assumed to be produced in other states.

Louisiana Paper Products had the largest level of agricultural exports with \$268.781 million or 27.9% of all estimated agricultural exports originating in the state (Table 2). Rice Milling was also a major contributor to state agricultural exports with exports of \$135.047 million or

Table 1. Annual average of agricultural exports shipped through Louisiana Ports from 1989 through 1992 in constant 1985 dollars

IMPLAN Industry	Average Annual Exports	
	Level (millions of 1985 \$)	Percent of Total
10 Cotton	185.651	1.7
11 Food Grains	1,254.951	11.5
12 Feed Grains	3,843.721	35.3
21 Oil Bearing Crops	3,112.971	28.6
82 Meat Packing	13.153	0.1
84 Poultry and Egg Processing	10.593	0.1
87 Dairy Products	45.232	0.4
91 Processed Fish and Seafood	8.928	0.1
92 Other Canned and Frozen Products	17.784	0.2
93 Canned Fruits and Vegetables	3.280	less than 0.1
99 Bread Products	66.516	0.6
103 Other Processed Fats, Feeds	300.302	2.8
104 Rice Milling	337.617	3.1
109 Sugar Processing	106.441	1.0
112 Beverages	31.653	0.3
118 Cottonseed Oil Mills	1.738	less than 0.1
119 Soybean Oil Mills	994.559	9.1
124 Miscellaneous Food Processing	43.284	0.4
160 Lumber	125.533	1.2
187 Paper Products	447.969	4.1
Total	10,951.876	100.0

Source: Bureau of the Census, Washington D.C., 1994. The U.S. Exports and Imports of Merchandise on CD-ROM (machine readable data files).

Table 2. Estimates of agricultural exports shipped through and originating in Louisiana as an annual average from 1989 through 1992 in 1985 dollars

IMPLAN Industry	Exports through Ports of Louisiana (millions 1985 \$)	Survey-Based Coefficient (millions 1985 \$)	Exports Originating in Louisiana	
			Level (millions 1985 \$)	Percentage
10 Cotton	185.65	0.3	55.695	5.8
11 Food Grains	1,254.95	0.02	25.099	2.6
12 Feed Grains	3,843.72	0.01	38.437	4.0
21 Oil Bearing Crops	3,112.971	0.025	77.824	8.1
82 Meat Packing	13.153	0.9	11.838	1.2
84 Poultry and Egg Processing	10.593	0.9	9.534	1.0
87 Dairy Products	45.232	0.9	40.709	4.2
91 Processed Fish and Seafood	8.928	1	8.928	0.9
92 Other Canned and Frozen Products	17.784	0.6	10.670	1.1
93 Canned Fruits and Vegetables	3.28	0.6	1.968	0.2
99 Bread Products	66.516	0.6	39.910	4.1
103 Other Processed Fats, Feeds	300.302	0.1	30.030	3.1
104 Rice Milling	337.617	0.4	135.047	14.0
109 Sugar Processing	106.441	0.8	85.153	8.8
112 Beverages	31.653	0.7	22.157	2.3
118 Cottonseed Oil Mills	1.738	0.5	0.869	0.1
119 Soybean Oil Mills	994.559	0.01	9.946	1.0
124 Miscellaneous Food Processing	43.284	0.05	2.164	0.2
160 Lumber	125.533	0.7	87.873	9.1
187 Paper Products	447.969	0.6	268.781	27.9
Total	10,951.876	0.08	962.632	100

14% of total agricultural exports. Lumber, Sugar Processing and Oil Bearing Crops were other industries with large levels of agricultural exports. These five industries were together responsible for 67.9% of agricultural exports produced in Louisiana.

Other studies were used to evaluate the assumption that all Louisiana agricultural goods were exported through state ports. Researchers have estimated that 3.7% of Louisiana soybean and 5% of Louisiana wheat exports go through ports outside of Louisiana (Larson et al. 1990; Reed and Hill 1990). Other studies for feed grains (oats, sorghum, and corn) show that these Louisiana crops were only exported through Louisiana ports (Baldwin et al. 1990; Hill et al. 1990; Fruin et al. 1990).

Based on these percentages, exports of Louisiana Oil Bearing Crops were increased by 3.7% from \$77.824 million to \$80.772 million (an increase of \$2.948 million). Exports of Louisiana Food Grains were increased by 5.2% from \$25.099 million to \$26.420 million (an increase of \$1.321 million).

Results from these studies imply that the assumption of Louisiana agricultural exports moving through Louisiana ports was generally acceptable. The three Louisiana IMPLAN industries covered in these studies, Oil Bearing Crops, Feed Grains, and Food Grains, had a total of \$141.360 million in exports based on the assumption that Louisiana exports only moved through Louisiana ports. When this assumption was relaxed, total exports for the three industries increase by 2.9% to \$145.629 million. Hence, while this assumption may mean that exports were underestimated, the available evidence indicated that this underestimation was slight.⁴

Margins

Various industries in the Louisiana economy are involved in agricultural exports. Sectors especially affected by agricultural exports are trade, transportation, and ports. These sectors are involved in the process of moving a product from the point where it is grown or manufactured to the port of export for shipment overseas. The exported commodity leads to economic activity through the use of transportation facilities in the movement to the port and in trade and port activity at the port itself.

The port sector is the final seller of agricultural products in international markets. However, the port sector's contribution is only a part of the added value, or the margin, which is a portion of the final port price. For example, assume that one ton of wheat is produced for export by a Louisiana farmer with a free-on-board price of \$160.00. Assume that the farm level value of the wheat is \$128.00. Further assume that the wheat is transported to the port for a charge of \$16.00 per ton and loaded on the

ship for an additional charge of \$16.00 per ton. Hence, the export of the one ton of wheat can be treated as three sales with \$128.00 allocated to the agricultural sector, \$16.00 allocated to the transportation sector, and \$16.00 allocated to the port and trade sector.

Because estimates of exports of agricultural products originating in Louisiana were at the port of exit, transportation, wholesale trade, and port margins were included. To accurately estimate sales by agricultural industries, these margins were allocated for each of the agricultural industries to the appropriate trade and transportation sectors. The wholesale trade margin for all agricultural exports was allocated to the IMPLAN industry Other Wholesale Trade. Such treatment of trade margins is standard in input-output models. Estimated trade margins for all exported agricultural commodities were based on the IMPLAN table wholesale margins for household consumption by commodity (Alward et al.). An estimated wholesale margin of \$44.769 million (4.7% of the total value of Louisiana agricultural exports) was allocated to Other Wholesale Trade.

The transportation margin was allocated to the IMPLAN Motor Freight and Warehousing Industry, to the Water Transportation Industry, or to a combination of the two industries. This allocation was based on assumptions concerning how Louisiana agricultural products move to ports. Products were assumed to move to port by truck, by barge, or by a combination of the two based on information obtained from Eckstein Marine Co., a water transportation firm; SAIA, a truck transportation firm; and Union Pacific, a railroad company. Transportation charges obtained from these firms were used in calculating total transportation costs.

Distances from point of production to export port also had to be calculated to obtain total transportation costs. Unpublished state employment data were used to distribute exports of food processing, paper, and wood products between the nine state agricultural production districts. That is, if a production district had an estimated 20% of poultry and egg processing employment, then that district was assumed to have 20% of state poultry and egg exports. The center of each district was then used to estimate the distances between point of production and port of export. Unprocessed agricultural products were treated in the same manner. However, production levels by agricultural production district obtained from Zapata and Frank (1993) were used instead of employment data to calculate the distribution of exports between production districts.

Port service charges were obtained from "Lake Charles Harbor and Terminal District: A Project Feasibility Evaluation" (National Ports and Waterways Institute, 1992) and deflated to 1985 dollars. For every ton of agriculturally related products exported from Louisiana, a total of

\$4.75 in 1985 dollars was injected into the economy through port services. For each IMPLAN industry, the estimated weight of total exports by industry was used along with the per metric ton charge to estimate a total port charge. The margin for port activity for all agricultural exports was allocated to the Water Transportation sector based on the approach used in Yochum and Agarwal (1987) and Robinson and Hickman (1992).

The total transportation cost of exporting agricultural products produced in Louisiana was estimated to be \$27.973 million in 1985 dollars. Total port charges were estimated at \$11.146 million for all Louisiana agricultural products. Together, port and transportation charges were responsible for \$39.119 million (4.1%) of the value of Louisiana agricultural exports. Of this total, \$25.297 million was allocated to the Motor Freight Transportation and Warehousing sector and \$12.787 was allocated to the Water Transportation industry.⁵

Comparison of Estimated and Original Louisiana Agricultural Exports

Agricultural exports for most Louisiana industries were larger than the estimates of Louisiana agricultural exports in the original 1985 IMPLAN hybrid I-O model. The total estimate of agricultural exports for Louisiana industries was \$880.816 million. This value is \$286.866 million or 48.3% larger than the same total estimates in the original model as shown in Table 3.

Estimates of foreign exports were larger in the original hybrid model for seven of the 20 agricultural industries (Table 3). New export estimates were slightly smaller than original estimates for Food Grains, Canned Fruits and Vegetables, and Other Processed Fats, Feeds. New estimates were markedly less than original estimates for Cotton, Processed Fish and Seafood, and Rice Milling.

Export estimates for 13 of the 20 industries increased in the revised hybrid IMPLAN model (Table 3). Industries with considerable increases in current versus original estimates of exports included Feed Grains, Dairy Products, and Bread Products. Other industries, such as Oil Bearing Crops and Other Processed Fats, Feeds, had very small changes as compared to the original export estimates.

The difference in export estimates for certain industries may partly be explained by differences in the year of estimation. Exports in the original model were estimated for 1985, while export estimates in this study were an annual average from 1989 through 1992. The difference may be especially pronounced as the declining value of the dollar in the late 1980s led to a general increase in U.S. exports. The use of more recent data should more accurately reflect current and future trends in

Table 3. Original versus new export estimates by Louisiana agricultural industries in the 1985 hybrid IMPLAN I-O model

IMPLAN Industry New Exports as Percentage	Estimated Levels of Agricultural Exports			Change of Original (Percent)
		Original	New	
	(millions of 1985 \$)			
10 Cotton	64.468	49.733	-14.735	77.1
11 Food Grains	22.862	19.154	-3.708	83.8
12 Feed Grains	1.635	30.684	29.049	1,876.7
21 Oil Bearing Crops	68.754	70.103	1.349	102.0
82 Meat Packing	4.117	10.036	5.919	243.8
84 Poultry and Egg Processing	3.480	8.341	4.861	239.7
87 Dairy Products	2.148	35.830	33.682	1,668.1
91 Processed Fish and Seafood	26.171	7.541	-18.630	28.8
92 Other Canned and Frozen Products	1.357	8.488	7.131	625.5
93 Canned Fruits and Vegetables	1.897	1.843	-0.054	97.2
99 Bread Products	2.926	35.550	32.624	1,215.0
103 Other Processed Fats, Feeds	29.487	28.384	-1.103	96.3
104 Rice Milling	149.512	127.760	-21.752	85.5
109 Sugar Processing	19.772	77.330	57.558	391.1
112 Beverages	2.559	16.740	14.181	654.2
118 Cottonseed Oil Mills	6.659	1.161	-5.498	17.4
119 Soybean Oil Mills	7.192	9.670	2.478	134.5
124 Miscellaneous Food Processing	0.972	2.136	1.164	219.8
160 Lumber	67.794	79.585	11.791	117.4
187 Paper Products	110.188	260.747	150.559	236.6
Total	593.950	880.816	286.866	148.3

export markets for Louisiana agricultural products.

The use of an annualized average of export data over four years, as opposed to a single year, should also improve accuracy of estimates and may explain some of the observed differences. Agricultural exports in a given year could deviate from long-term trends because of short-term factors, such as droughts. Using four years of data instead of one year of data should reduce the effect of short-term effects on the estimates of exports of Louisiana agricultural products.

Finally, differences between the original estimates and those calculated in this study may be explained by the way in which exports are estimated in the IMPLAN modeling system. For a given industry, Louisiana's proportion of national commodity output was used in the original IMPLAN estimates to calculate Louisiana's share of national exports in that commodity. This approach is standard procedure for models constructed in IMPLAN. However, it may yield inaccurate results because of differences in commodity mixes at the regional and national level. Further, such an approach does not account for the locational advantage (for a state such as Louisiana) or disadvantage (for a given interior state) for a region in moving commodities to port of export. A large difference (plus 48.3%) existed between the calculations of exports found in this study and the calculations contained in the original IMPLAN export estimates. This difference implies that IMPLAN users should be cautious in using unverified estimates in evaluating the impacts of foreign exports on regional economies.⁶

Impact of Agricultural Exports on the Louisiana Economy

The impact analysis for Louisiana agricultural exports had two basic components. The first component was the direct effect of current levels of Louisiana agricultural exports in 20 agriculturally related industries. The second component was the direct effect in the trade and transportation sectors of Motor Freight Transportation and Warehousing, Other Wholesale Trade, and Water Transportation. This direct effect occurred because Louisiana agricultural products were moved to and shipped through Louisiana ports. The impact analysis simulated the total effect of exports for agricultural products, including the three margin industries. Hence, model results showed the maximum level of economic impact attributable to exports of agricultural products originating in Louisiana.

Model results are discussed in terms of total industry output (TIO), total income, value added, and employment. TIO is the value of gross industry sales or the total value of production for a given industry. For any given industry, value added is the difference between the cost of

intermediate purchases and TIO. Value added includes employee compensation, proprietors' income, other property income, and indirect business taxes (Alward et al.). Hence, value added is returns to the factors of production plus indirect business taxes. Value added also provides a measure of Gross State Product. Total income is employee compensation plus income of sole proprietors (two important components of value added). In both the original and revised hybrid IMPLAN models, employment represents the number of full and part-time jobs for the sector in question.⁷

For comparison purposes, the impact of exports of agricultural products, as estimated in the original hybrid IMPLAN model, were evaluated in the model through impact analysis. The original estimates of agricultural exports (\$593.950 million) resulted in a total impact on TIO of \$1.510 billion or 1.1% of estimated TIO in the entire Louisiana economy in 1985. According to model estimates, the total effect of agricultural exports on total income was \$585.972 million or 0.9% of total income in the Louisiana economy in 1985. The total effect on value added was \$667.532 million or 1.1% of state value added. The total direct change in TIO due to agricultural exports was estimated to be \$593.950 million, while the indirect and induced effects were \$915.993 million. An estimated 25,818 jobs were generated in the Louisiana economy due to the export of Louisiana agricultural products.

The same procedure was then repeated, but the newly estimated levels of agricultural exports of Louisiana agricultural products were used. A comparison of impact analysis with the two estimates of Louisiana agricultural exports implied that the original export estimates may have substantially underestimated the importance of such markets to the overall Louisiana economy. The total effect in terms of TIO from the exports of Louisiana agricultural products was \$2.197 billion, a \$686.867 million (45.5%) increase from the original hybrid model estimate (Table 4). The export of agricultural products to foreign markets was estimated to be responsible for \$854.886 million of total income, an increase of \$268.914 over the original estimate. Louisiana exports were estimated to be responsible for \$979.411 million in total value added in the Louisiana economy, an increase of \$311.878 million over the original estimate.

The number of jobs generated in the Louisiana economy by agricultural exports was also larger than in the original hybrid model of the 1985 Louisiana economy. According to model estimates, export of Louisiana agricultural products generated 35,241 jobs in the state economy or 9,423 (36.5%) more jobs than in the original hybrid model estimates. The 35,241 jobs were 1.8% of the total work force of 1,984,043 in 1985. This percentage value was 0.5% greater (1.8% versus 1.3%) than the same estimate calculated with results from the original hybrid model.

Table 4. Total effect of updated Louisiana agricultural exports on selected industries as estimated with the hybrid Louisiana IMPLAN model

IMPLAN Industry	Total Industry Output	Total Income	Value Added	Employment
	_____	_____	_____	_____
		millions	1985 \$	
1 Dairy Farm Products	8.621	4.234	4.281	503.9
2 Poultry and Eggs	8.409	1.824	1.847	179.2
3 Cattle	7.668	1.217	1.263	113.7
10 Cotton	52.368	17.294	18.328	1,379.0
11 Food Grains	85.770	42.055	43.231	3,043.3
12 Feed Grains	33.230	7.128	7.526	680.4
19 Sugar Crops	15.572	8.235	8.527	1,042.0
21 Oil Bearing Crops	81.532	36.747	39.360	1,675.1
22 Forestry	8.230	4.010	4.182	87.0
26 Agricultural Services	12.163	6.720	6.813	568.6
41 Oil and Gas Extraction	59.151	37.217	43.981	254.5
73 Construction	13.980	6.184	6.552	432.7
82 Meat Packing and Preparation	13.103	1.930	2.090	101.5
84 Poultry and Egg Processing	9.696	1.355	1.473	90.7
87 Milk and Other Dairy Processing	39.786	9.039	9.558	231.8
91 Processed Fish and Seafood	8.288	1.441	1.527	89.9
92 Other Canned, Frozen Products	9.011	1.903	2.075	67.6
99 Bread and Related Products	36.775	14.265	14.912	497.2
103 Other Processed Fats, Feeds	37.499	6.502	6.966	152.0
104 Rice Milling	128.773	19.312	20.668	669.6
109 Sugar Processing	103.130	16.460	18.939	565.3
112 Beverages	17.697	3.917	4.999	133.6
119 Soybean Oil Mills	13.024	0.550	0.643	10.9
122 Roasted Coffee	10.724	1.469	1.535	18.7
151 Apparels	5.078	1.723	1.770	150.9
160 Lumber	127.542	42.031	43.516	1,683.4

187	Paper Products	268.960	92.889	96.007	1,988.3
200	Printing and Publishing	7.275	3.352	3.776	108.6
215	Chemical Products	45.300	13.475	13.915	191.5
235	Petroleum Refining	64.387	5.797	10.520	37.8
401	Motor Vehicles	4.829	1.066	1.211	16.4
446	Railroads,	11.859	6.981	7.212	188.6
448	Motor Transportation, Warehousing	45.916	28.725	29.663	982.8
449	Water Transportation	31.241	8.180	8.663	305.3
450	Air Transportation	5.611	2.332	2.629	62.5
454	Communication	19.548	12.178	13.492	238.8
456	Electric, Gas, Sanitary Services	79.878	32.339	36.661	474.2
460	Wholesale Trade	104.018	55.444	75.504	1,910.1
462	Retail Trade Not Restaurants	110.077	58.181	69.472	4,018.9
464	Other Finance and Insurance	43.083	19.809	22.649	986.2
469	Real Estate	121.335	59.922	98.004	280.0
471	Hotels and Lodging Places	8.743	4.704	5.590	437.5
472	Personal Services	20.059	15.725	16.136	895.0
478	Repair Services	24.228	11.600	12.543	462.7
479	Business Services	36.689	26.334	27.711	1,323.1
488	Legal Services	14.662	11.314	11.338	259.8
489	Miscellaneous Services	8.352	5.357	5.387	171.8
491	Eating and Drinking Places	42.096	12.814	21.862	1,344.9
495	Amusement Services	5.672	2.586	2.910	218.7
503	Health Services	68.974	41.704	41.850	2,194.5
507	Educational Services	6.653	4.714	4.714	291.9
510	Membership Organizations	6.473	3.562	3.571	99.6
514	Social Services	6.873	4.165	4.166	608.0
516	Government, Special Industry	5.124	4.076	4.099	205.5
	Total	2,196.8	854.886	979.411	35,241.4

Note: Industries with output impacts under \$4.829 million not reported. Total includes all industries.

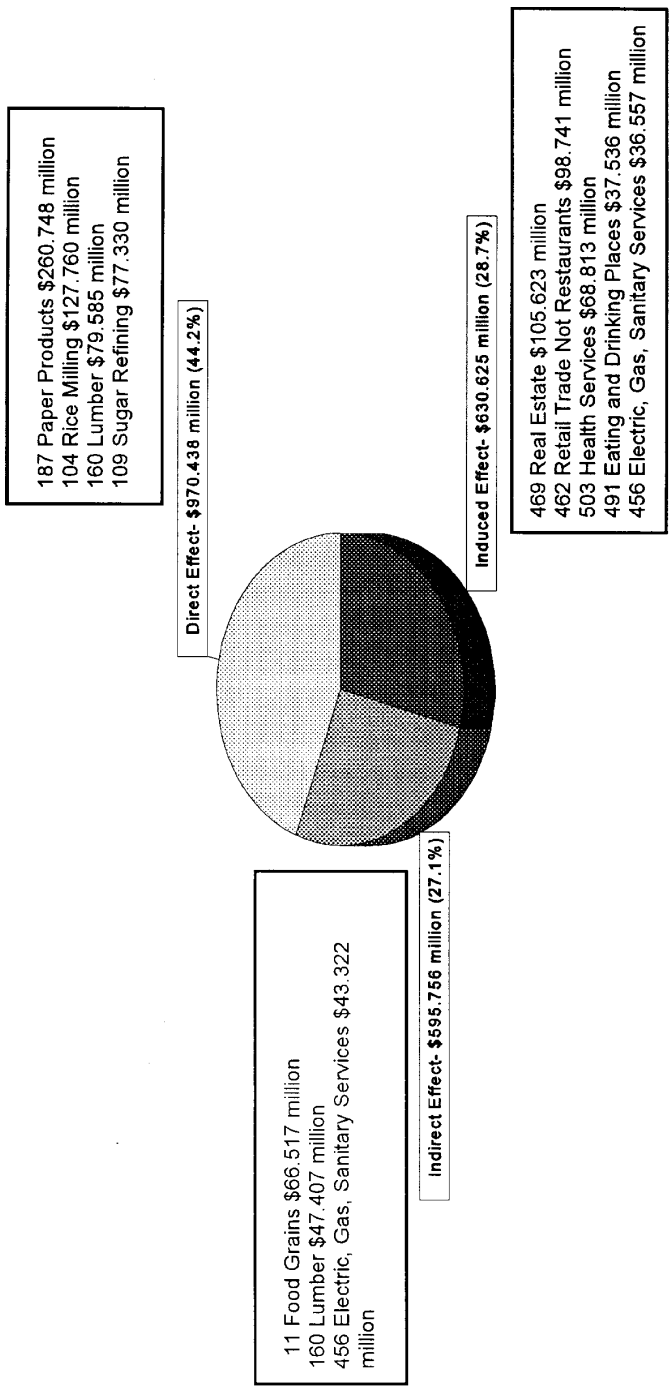


Figure 1. Direct, indirect, and induced effects of agricultural exports on Louisiana TIO estimated with the Louisiana IMPLAN model with updated levels of agricultural exports.

Model results in terms of employment also demonstrated the relative importance of export markets in the total employment generated by Louisiana agriculture. The previously cited study of the Louisiana economy, based on the original hybrid I-O model of the state economy in 1985, estimated that agriculture generated 227,825 state jobs through its spinoff effects (Hughes, 1995). Based on results from this study, 15.5% (35,241 jobs out of 227,825 jobs) of all employment generated by Louisiana agriculture could be traced to the impact of export markets for agricultural products.

The direct effect is the actual change in final demand (the level of foreign sales of agricultural products in this case). The indirect effect from a demand shock measures the impact of changes on other industries excluding the effect of payments to households and resulting household consumption (Miller and Blair, 1985). The induced effect measures the impact of changes in payments to regional households and their resulting purchases of regional commodities on regional economic activity.

The total effect of Louisiana agricultural exports on TIO in terms of direct, indirect, and induced effects, as shown in Figure 1, provided an indication of the nature and composition of export impacts. Out of a total impact of \$2.197 billion on Louisiana TIO, \$970.438 million (44.2%) was in the direct effect, \$595.756 million (27.1%) was in the indirect effect, and 630.625 million (28.7%) of the impact was in the induced effect. The industry with the largest effect in terms of TIO was Paper Products with a \$268.960 million impact (Table 4).

Among the five industries of the Louisiana economy with the largest indirect effect in terms of TIO due to agricultural exports, Food Grains ranked first with a \$66.517 million indirect effect while Lumber ranked second with a \$47.407 million indirect effect (Figure 1). Both of these indirect impacts were explained by the size of the two industries and their strong ties to further processing in the Louisiana. For example, the Food Grains industry required additional processing for its products because rice accounted for most of Food Grains. Rice was generally milled before being shipped overseas. This caused large direct impacts in the rice milling industry, which was reflected as an indirect effect for Food Grains. Petroleum Refining and Chemical Products also had significant indirect TIO impacts due to agricultural exports. Petroleum Refining provided fuel to agricultural machinery and also the export transportation sectors of Motor Freight Transportation and Warehouses and Water Transportation. The Chemical Products industry is a major producer of fertilizers and agricultural chemicals, such as pesticides and herbicides.

The induced effect occurred as a result of household spending attributable to agricultural exports. Real Estate, with a \$121.335 million effect on TIO, had the largest impact from agricultural exports among

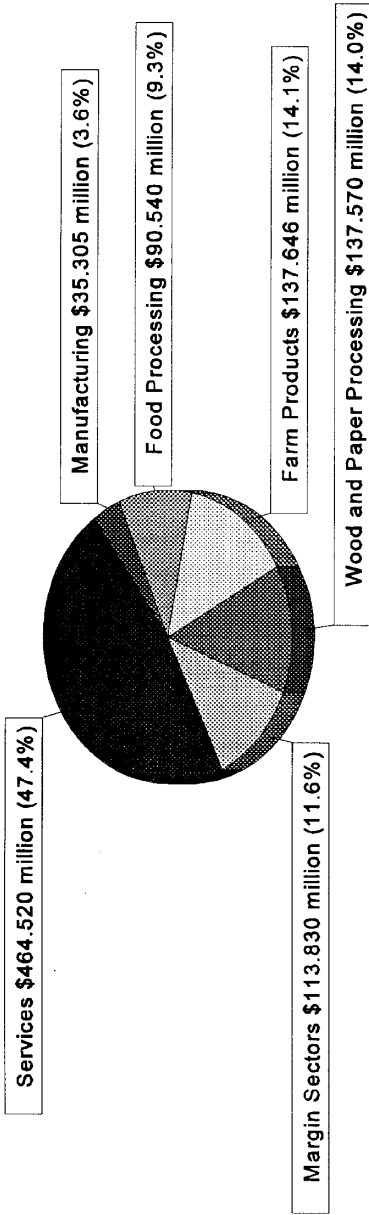


Figure 2. Total value added due to agricultural exports by major category of the Louisiana economy estimated with the Louisiana IMPLAN model with updated levels of agricultural exports.

Note: Farm Products category includes all unprocessed agricultural commodities and Logging Camps IMPLAN sector (160).

Food Processing category includes all food processing products.

Wood and Paper Processing category includes paper products and all lumber products except Logging Camps sector (160).

Margin Sectors category includes Motor Freight Transportation and Warehousing (448), Water Transportation (449), and Wholesale Trade (460).

Manufacturing category includes all non-agricultural manufacturing, that is, all manufacturing except industries belonging to the agricultural processing and wood and paper processing categories, and Logging Camps IMPLAN sector (160).

Services category includes consumer, business, and governmental services except the margin sectors and agricultural services.

nonagricultural industries. For Real Estate, the induced effect was estimated to be \$105.623 million or 87.1% of the total effect on sectoral TIO due to agricultural exports (Figure 1). The induced effect was \$98.741 million or 89.7% of the total effect on TIO due to agricultural exports for Retail Trade Not Restaurants. Both of these industries had households as primary markets. Hence, household spending due to agricultural exports would be expected to have affected both sectors.

General categories of the Louisiana economy were also used in analyzing the composition of the effect of agricultural exports. This approach enabled a comparison of the contributions to the Louisiana economy of unprocessed and processed agricultural products. Such a distinction is important, because local processing of locally produced raw agricultural products increases jobs and income by adding another layer of value to existing activity generated by the commodity in question (Schluter and Edmondson, 1994).

On a per unit basis, such as a bushel of wheat, for example, transforming and exporting the wheat as bread would generate much greater levels of economic activity than directly exporting the bushel of wheat. However, it is possible that exports could be more heavily weighted toward unprocessed rather than processed products. In such a case, the actual value of exported unprocessed agricultural products could be greater than the actual value of exported processed agricultural products. For example, 99 bushels of exported wheat would be expected to be greater in value than the total amount of bread that could be baked from one bushel of wheat. In this case, replacing the export of products in an unprocessed form with processed products (increasing bread exports while decreasing raw wheat exports) could enhance regional economic activity. Therefore, the entire Louisiana economy was separated into six categories: Farm Products, Food Processing, Wood and Paper Processing, Margin Sectors, Manufacturing, and Services.

The contribution of each category as a result of agricultural exports was analyzed in terms of value added. The \$90.540 million in food processing value added was considerably less than the \$137.646 million in farm product value added (Figure 2). Further, 22.9% of the food processing impact was concentrated in Rice Milling. While Rice Milling is an important part of the Louisiana economy, it is not considered a high value food product. Other food processing sectors with a greater potential for generating state economic activity, such as Poultry and Egg Processing, had a smaller share of the food processing value added impact. Hence, the potential appears to exist for “leveraging” the impact of Louisiana farm products by increasing sales of Louisiana processed food products to foreign markets.

Impact of Exports of Agricultural Products Produced Outside of Louisiana

As previously discussed, the estimated average annual value from 1989 through 1992 of agricultural exports moving through Louisiana ports was \$10.952 billion. It was estimated that \$968.623 million of the \$10.952 billion (or 8.8%) of agricultural exports moving through Louisiana ports originated in Louisiana. The \$968.623 million was used in estimating the impact of exports of Louisiana produced agricultural products on the Louisiana economy.⁸ However, agricultural products moving through Louisiana to foreign markets but originating in other states can also have had considerable influence on state economic activity. This activity was estimated at \$9.982 billion or the difference between the estimated value of agricultural export activity at Louisiana ports and the value of agricultural commodities produced in Louisiana for export markets.

A scenario was developed to estimate the impact of exports of agricultural products produced outside of Louisiana on the state economy. To avoid overestimating impacts, the port sector of the Louisiana economy, which was a part of Water Transportation in the Louisiana revised hybrid I-O model, was assumed to be the only industry directly affected by agricultural exports from other parts of the U.S.

The direct shock for agricultural exports moving through Louisiana but produced elsewhere was derived by first estimating the tonnage of agricultural products moving through Louisiana ports to overseas markets. Using information provided by the U.S. Corps of Engineers (1989), it was estimated that 70,938,214 metric tons of agricultural products were shipped through Louisiana ports annually. The estimated quantity of agricultural exports originating in Louisiana was estimated as 2,346,691 metric tons, which was subtracted from the total tonnage of agricultural exports shipped through Louisiana ports. The resulting net quantity of 68,591,523 metric tons was the estimate of agricultural exports originating in other states that were shipped through Louisiana ports. To calculate the impact of such agricultural exports, the 68,591,523 metric tons figure was multiplied by the port service charge of \$4.75 per ton in 1985 dollars. The resulting value of \$325.810 million was estimated to be the direct impact on the Louisiana Water Transportation sector attributable to the movement through Louisiana ports of agricultural exports produced outside of Louisiana.

The total effect of non-Louisiana agricultural exports moving through Louisiana ports on state TIO was \$771.948 million (Table 5). The impact of non-Louisiana exports on state total income was estimated to be \$264.854 million. The total effect on Louisiana value added was estimated at \$301.467 million.

Table 5. Effect of exported agricultural products from other states shipped through Louisiana ports on selected industries in the Louisiana economy as estimated with the hybrid IMPLAN model

IMPLAN Industry	Total Industry Output (millions 1985 \$)	Total Income (millions 1985 \$)	Total Value Added (millions 1985 \$)	Employment
41 Oil and Gas Extraction	20.085	12.637	14.934	86.4
73 Repare, Maintenance Construction	6.139	2.715	2.877	190.0
200 Printing and Publishing	2.067	0.952	1.073	30.9
215 Chemical Products	2.600	0.774	0.799	11.0
235 Petroleum Refining	28.854	2.598	4.714	17.0
448 Motor Transportation, Warehousing	5.420	3.391	3.501	116.0
449 Water Transportation	487.873	127.751	135.293	4768.3
454 Communication	7.518	4.684	5.189	91.9
456 Electric, Gas, and Sanitary Services	16.155	6.540	7.415	95.9
460 Wholesale Trade	11.035	5.882	8.010	202.6
462 Retail Trade				
Not Restaurants	29.504	15.594	18.620	1077.2
464 Other Finance and Insurance	13.228	6.082	6.954	302.8
469 Real Estate	39.093	19.306	31.576	90.2
471 Hotels and Lodging Places	2.480	1.334	1.586	124.1
472 Personal Services	5.767	4.521	4.639	257.5
478 Repare Services	10.466	5.011	5.419	199.9
479 Business Services	15.586	11.187	11.772	562.1
488 Legal Services	5.177	3.995	4.003	91.7
491 Eating and Drinking Places	12.154	3.700	6.312	388.3
503 Health Services	19.725	11.927	11.968	627.6
Total	771.948	264.854	301.467	10,096.4

Note: Industries with TIO impacts of under \$2 million not reported. Total includes unreported industries.

The industries with the largest TIO impacts included the directly affected sector of Water Transportation with a total TIO impact of \$487.873 million (Table 5). Other sectors with large impacts tended to be service industries, such as Real Estate.

A total of 10,096 jobs were generated in Louisiana due to port related services provided for exporting agricultural products produced in other states (Table 5). Forty-seven percent or 4,768 of these jobs were in the directly effected Water Transportation sector. Service industries had the largest non-direct impact in terms of employment. Retail Trade Not Restaurants had an employment impact of 1,077 jobs. Health Services and Business Services also had larger than average employment impacts.

Results from the demand shock for agricultural exports originating in Louisiana and the demand shock for agricultural exports shipped out of Louisiana but produced elsewhere were summed. The combination provided information on the total impact of agricultural exports shipped through Louisiana regardless of origin. Louisiana agricultural exports were estimated to be responsible for \$2.969 billion or 2.1% of state TIO. According to model estimates, the contribution of agricultural exports to total income was \$1.120 billion or 1.8% of total income in the Louisiana economy. The contribution to state value added was \$1.281 billion or 1.7% of total state value added. Agricultural exports generated 45,338 jobs in all sectors of the Louisiana economy, or 2.3% of the total 1,984,043 jobs in the state economy at that time. While 45,338 jobs may seem insignificant when compared with almost two million jobs, the Louisiana economy generated an annual average of 31,242 net jobs from 1988 through 1992 (U.S. Department of Commerce, 1994b.). Hence, total Louisiana employment tied to agricultural exports was approximately equal to the number of jobs generated by the economy over a year and a half.

Impact of Projected Growth in Louisiana Agricultural Exports

Projections of future levels of agricultural exports from Louisiana were used to estimate their future contribution to the Louisiana economy. This task was accomplished by combining estimates of current agricultural exports originating in Louisiana with projected increases in the same.

The institutional structure that governs international trade is changing. The North American Free Trade Agreement (NAFTA) will eliminate most trade barriers between Canada, Mexico, and the U.S. by the year 2000. Lower trade barriers with Mexico could be expected to eventually have an important impact on the Louisiana economy. Successful negotiation of the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) should also lead to increased agricultural exports. The

GATT is a general agreement, signed by 103 countries, to lower trade barriers worldwide.

An effort was made to translate projected changes in U.S. agricultural exports under both NAFTA and GATT into projected changes in Louisiana agricultural exports. All available projections of U.S. exports under NAFTA were based on the assumption that the growth rate of the Mexican economy in the early 1990s would be maintained. But more recent projections for the 1996 Mexico economy indicate negative growth due to the recent dramatic devaluation of the peso. The changes in projected growth in the Mexico economy lead to a need to reevaluate available estimates of projected increases in U.S. exports under NAFTA. Given this uncertainty, the potential impacts of NAFTA on future Louisiana agricultural exports were not accounted for. Rather, a publication by Sumner (1994), which evaluated the impact of GATT on U.S. agricultural exports, was the source for projected levels of Louisiana agricultural exports.

Based on GATT, Sumner provided current levels (1993) and a range of projected levels of U.S. agricultural exports in the year 2000 for five major categories of processed and unprocessed products. The categories were Grains and Feed, Cotton, Animal Products, Horticultural Products, and Oilseeds and Products. The midpoint of these projections was assumed to be the best estimate of increases in Louisiana exports for each category by 2000. The projected increase was calculated as a percentage of the current level of exports. The percentages were then matched with the appropriate IMPLAN industry.

Multiplication of estimated current levels of agricultural exports by the percentage growth rates based on Sumner provided projected exports by agricultural industry for the year 2000. Total agricultural exports for 14 agricultural sectors were projected to increase by \$41.007 million or a total of 8.9%. Because these projections were made for Louisiana agricultural exports based on their port value, appropriate trade and transportation margins were calculated and subtracted from the estimate of sectoral exports. This process yielded direct shocks for the 14 agricultural industries and for Wholesale Trade, Motor Freight Transportation and Warehouses, and Water Transportation as shown in Table 6.

The impact of the projected increases in Louisiana agricultural exports on selected industries in the Louisiana economy in the year 2000 are provided in Table 7. According to scenario estimates, the projected increase in agricultural exports would be expected to increase TIO in the Louisiana economy by \$103.366 million. The increase in agricultural exports by the year 2000 was estimated to be directly and indirectly responsible for an additional \$39.541 million in total income and \$45.606 million in value added in the Louisiana economy. Projected

Table 6. Projected increases in net export levels and margins in the year 2000 for Louisiana agricultural industries in the Louisiana IMPLAN I-O model

IMPLAN Industry	Projected Increase in Export Levels in the Year 2000 (millions 1985 \$)	Projected Wholesale Margin (millions 1985 \$)	Projected Motor Freight Margin (millions 1985 \$)	Projected Water Transportation Margin (millions 1985 \$)	Projected Increase in Net Export Levels (millions 1985 \$)
10 Cotton	6.182	0.402	0.161	0.105	5.514
11 Food Grains	2.272	0.098	0.157	0.100	1.917
12 Feed Grains	3.306	0.149	0.317	0.202	2.638
21 Oil Bearing Crops	3.958	0.170	0.139	0.087	3.562
82 Meat Packing and Preparations	1.764	0.127	0.053	0.025	1.559
84 Poultry and Egg Processing	1.421	0.121	0.043	0.020	1.237
87 Milk and Other Dairy Products	6.066	0.534	0.200	0.085	5.247
91 Processed Fish and Seafood	1.330	0.158	0.043	0.019	1.110
92 Other Canned and Frozen Products	0.352	0.024	0.011	0.005	0.312
93 Canned Fruits and Vegetables	0.065	0.006	0.002	0.001	0.056
103 Other Processed Fats, Feeds	2.583	0.075	0.083	0.036	2.389
104 Rice Milling	11.614	0.174	0.232	0.105	11.103
118 Cottonseed Oil Mills	0.043	0.001	0.001	0.001	0.040
119 Soybean Oil Mills	0.487	0.010	0.007	0.003	0.467
Total	41.443	2.049	1.449	0.794	37.151

Source: Sumner, D. "The Uruguay Round Agreement on Agriculture: An Evaluation". Chapter 4 in "Bringing Agriculture into the GATT." The International Trade Research Consortium, Commissioned Paper Number 9. July 1994. Survey of Louisiana Agricultural Trading Firms, Baton Rouge, 1995.

Table 7. Effect of Projected Louisiana agricultural exports in the year 2000 on selected industries as estimated with the hybrid IMPLAN model of the Louisiana economy

IMPLAN Industry	Total Industry Output	Total Income	Total Value Added	Employment
	Millions 1985 \$			
10 Cotton	5.696	1.881	1.994	150.0
11 Food Grains	7.630	3.741	3.846	270.7
12 Feed Grains	2.884	0.619	0.653	59.1
21 Oil Bearing Crops	4.183	1.885	2.019	85.9
41 Oil and Gas Extraction	2.483	1.562	1.846	10.7
82 Meat Packing and Preparation	1.765	0.260	0.282	13.7
84 Poultry and Egg Processing	1.316	0.184	0.200	12.3
87 Milk and Other Dairy Processing	5.764	1.310	1.385	33.6
91 Processed Fish and Seafood	1.151	0.200	0.212	12.5
103 Other Processed Fats, Feeds	3.193	0.554	0.593	13.0
104 Rice Milling	11.193	1.679	1.796	58.2
215 Chemical Products	2.422	0.720	0.744	10.2
235 Petroleum Refining	2.983	0.269	0.487	1.8
448 Motor Transportation, Warehousing	2.233	1.397	1.442	47.8
449 Water Transportation	2.004	0.525	0.556	19.6
456 Electric, Gas, Sanitary Services	2.984	1.208	1.370	17.7
460 Wholesale Trade	4.774	2.545	3.465	87.7
462 Retail Trade Not Restaurants	5.983	3.163	3.776	218.5
464 Other Finance and Insurance	2.326	1.069	1.223	53.2
469 Real Estate	6.543	3.232	5.285	15.1
478 Repare Services	1.232	0.590	0.638	23.5
479 Business Services	2.007	1.441	1.516	72.4
491 Eating and Drinking Places	2.159	0.657	1.121	69.0
503 Health Services	3.671	2.220	2.228	116.8
Total	103.366	39.541	45.606	1,871.6

Note: Industries with output impacts of under \$1.232 million not reported. Total includes unreported industries.

increases in Louisiana agricultural exports by the year 2000 were estimated to generate an additional 1,872 jobs.

Industries with the largest increases in TIO, total income, value added, and jobs were directly affected sectors, such as Rice Milling and Food Grains, the latter with a \$3.741 million increase in total income and an employment gain of 271 jobs (Table 7). Sectors with large indirect and induced effects from the projected increase in Louisiana agricultural exports by the year 2000 included Real Estate, Wholesale Trade, Retail Trade Not Restaurants, Health Services, and Business Services.

The total impact on the Louisiana economy in the year 2000 was obtained by adding the effect of the projected increase in Louisiana agricultural exports to the effect of the current levels of Louisiana agricultural exports. The impact of Louisiana agricultural exports in 2000 on state TIO was projected to be \$2.300 billion. The projected effect on total income in Louisiana was \$894.427 million. The projected effect on value added was \$1.025 billion. The projected employment level due to future Louisiana agricultural exports was 37,113 jobs, or 1.8% of projected employment for Louisiana (2,033,400 jobs) in 2000 (U.S. Department of Commerce, 1994 b).

The impact of projected levels of agricultural exports originating in other states and moving through the ports of Louisiana was not estimated. These export levels would be expected to increase, however. Adding the current contribution of exported agricultural products moved through Louisiana to the projected contribution of agricultural products originating in Louisiana provided an indication of the future contribution of all agricultural exports shipped through state ports. According to model estimates, all agricultural exports shipped through Louisiana regardless of origin were projected to account for \$3.072 billion in state TIO. The impact on total income was projected to be \$1.159 billion, while the effect on value added was estimated at \$1.326 billion. The contribution of agricultural exports originating in Louisiana and elsewhere to employment was projected to increase to 47,210 jobs. Based on 2,033,400 projected jobs for the year 2000, agricultural exports originating in or merely shipped through Louisiana were projected to account for 2.3% of all state employment at that time.



SUMMARY AND CONCLUSIONS

A revised hybrid IMPLAN model of the Louisiana economy, based on its structure in 1985, was used to estimate the impact of agricultural exports on the state economy. Results of the model should be useful to state policy makers and others concerned about the ability of foreign markets to generate economic activity in Louisiana.

Model results should also be of interest to IMPLAN users in general. Provided here is a case study concerning the accuracy of the procedure used in calculating foreign exports in IMPLAN models. Study results indicated that this procedure may have underestimated foreign exports of Louisiana agricultural products. Total agricultural exports by Louisiana industries was estimated as \$880.816 million in this study based on primary and secondary data. This value was \$286.866 million (48.3%) larger than the same estimate in the original hybrid model. Large differences were observed in the total effect of foreign agricultural markets. The total effect in terms of total industry output (TIO) from the export of Louisiana agricultural products was \$2.197 billion, which was a \$686.867 million (45.5%) increase from the original hybrid model estimates. Exports of Louisiana agricultural products were estimated to have generated 35,241 state jobs, or 9,423 (36.5%) more jobs than in the original hybrid model estimates. Based on these results, IMPLAN users are urged to verify IMPLAN-based estimates of foreign exports with outside information for studies directly concerned with the impacts of foreign exports.



POLICY IMPLICATIONS

Any regional economic policy decision should be based on its anticipated net benefit to the regional economy. While different factors will drive policy decision in different regions, a key factor is the advantage possessed by the region relative to other regions. Specific examples include the region's infrastructure and location.

A case in point is the notion of expanding Louisiana agricultural exports as a policy priority for state government. Louisiana has a network of efficient transportation and storage facilities for agricultural commodities and a favorable geographical location at the mouth of Mississippi River. Louisiana is well situated with regard to markets in Latin America. Given the distinct possibility of the expansion of NAFTA to include Latin American countries other than Mexico, the state has an opportunity for further expansion of agricultural exports. These major advantages indicate the potential for benefits from policy efforts by state and local government aimed at enhancing the growth of Louisiana agricultural exports.

Another factor that should influence policy decisions by a regional government is the desirability of the changes that will arise from the policy. For example, the benefits from a policy should be widespread and not accrue to just one industry. Estimates based on the I-O technique indicated that the effect of agricultural exports was felt throughout the Louisiana economy. Out of a total impact of \$2.197 billion on Louisiana TIO, \$970.438 million (44.2%) was in directly affected sectors, such as rice milling, \$595.756 million (27.1%) was in indirectly affected industries, such as fertilizer producers, and \$630.625 million (28.7%) of the impact was in sectors affected by worker spending, such as health services. Because different sectors of the Louisiana economy are well integrated, sectors other than farmers and agriculture processing firms would benefit from an expansion of agricultural exports. Various firms providing inputs to farmers and agricultural processors could also expect output growth. Expanding exports would also increase consumer income and spending, thus benefiting businesses that sell consumer goods. Tax revenue should also increase as a result of increase in foreign agricultural exports. This widespread impact provides an additional justification for state efforts aimed at the expansion of agricultural exports.

The expansion of Louisiana agricultural exports appears to be feasible and desirable. However, the question remains concerning which type of agricultural products should be emphasized in state-sponsored export promotion efforts. Comparing raw and processed agricultural products, the impact of agricultural exports of raw farm products on state value added and employment was much larger than the impact of exported processed food products. The impact of Louisiana agricultural exports on agricultural processing was 9.3% (\$90.540 million) of the total value added impact. This amount was considerably less than the \$137.646 million impact in value added for farm products. In terms of generating jobs and value added, the export of processed food provided fewer benefits than exports of raw farm products. But for a given agricultural commodity on a per unit basis, export in a processed rather than unprocessed form has greater regional impacts. Processing adds another layer of economic activity to the impact of goods and services produced at the farm gate. For example, a ton of exported refined sugar (the processed form of a commodity) would provide more jobs and income than a ton of exported raw sugar (a less processed form). Therefore, in addition to increasing the levels of agricultural exports from Louisiana, state government should critically evaluate a policy of emphasizing the export of processed agricultural products.

The policy recommendations made here are based on impact analysis concerning Louisiana agricultural exports. The promotion of agricultural exports requires further research, however, before the implementation of any changes in state policy. An emphasis on promoting processed Louisiana agricultural products requires an assessment of their competitiveness in foreign markets. The effect of institutional barriers in Latin America and elsewhere on the export of Louisiana agricultural products should be examined, for example.

A major premise of this study is that the export of Louisiana agricultural products can be expected to increase. Agricultural exports for 14 agricultural sectors were projected to increase by a total of \$41.007 million or 8.9%. As a result, the projected level of employment due to Louisiana agricultural exports in the year 2000 was estimated at 37,113 jobs or 1.8% of total projected state employment. A policy by state government aimed at increasing agricultural exports could further enhance such an increase. The transportation and trade infrastructure in Louisiana appears to be adequate for foreseeable increases in agricultural exports produced in Louisiana and elsewhere. However, future improvements in infrastructure may be necessary, especially if an emphasis is placed on the export of processed agricultural products. Hence, a careful analysis of the state's infrastructure and its potential response to the implementation of any new policy should be conducted.

Louisiana appears poised to benefit from the enhancement of agricultural exports. State government may be able to enhance the export of agricultural exports through beneficial policy changes. However, an extensive study of the potential for increasing agricultural exports, especially in the area of processed agricultural commodities, is required before making any policy decisions.



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APPENDIX I: EFFECT OF EXPORT ESTIMATES ON OTHER MODEL ESTIMATES

Estimates of regional exports to foreign markets may affect general use of IMPLAN models. The Supply Demand Pool (SDP) coefficient is the maximum amount of regional supply available to meet regional demand. Or, it is the ratio of regionally produced commodity supply, **net of foreign exports**, to gross regional commodity demand. A SDP of one means that regional supply at least equals regional demand for the commodity in question. A SDP of less than one implies that the commodity will have to be imported even if none of the regional supply is a domestic export (Alward, et al.).

The Regional Purchase Coefficient (RPC) is the actual amount of local demand that is satisfied by local production. For a given commodity, it represents the ratio between regional purchases of regional output and the total net regional supply. A RPC of .9 means that 10% of the commodity is imported. The smaller the RPC, the less the local commodity is used by regional firms and the smaller the estimates of the regional impacts of a given change in final demand. RPCs for IMPLAN nonservice commodities (1-445) are estimated through an econometrically based procedure. RPC estimates for IMPLAN service commodities (446-528) are calculated based on observed 1977 state supply, exports, and imports. Because the SDP is the maximum amount of regional supply available to meet regional demand, it is an upper bound for the RPC values in IMPLAN models (Alward, et al.).

A commodity's SDP is calculated by first subtracting estimates of foreign exports from gross commodity supply. Hence, foreign exports always influence the coefficient. Foreign exports estimates affect the RPC coefficient for commodities where the SDP coefficient equals the RPC (i.e., the independently estimated RPC is at its SDP upper bound). To illustrate, assume that the actual level of foreign exports is \$10 million, gross regional supply is \$100 million, and gross regional demand is \$100 million. Further, assume that the SDP determines the RPC for a particular commodity. The proper RPC would be 0.9. But also assume that incorrect estimates of foreign exports of \$50 million results in an RPC of 0.5 (a 40% difference). The error in the RPC calculations would in turn lower input coefficients in the regional I-O. Such a model

could yield results that would underestimate the regional effects of a given policy.

A comparison of SDP and RPC estimates in the original hybrid model versus the revised hybrid model showed that under the new estimates of foreign exports, the SDP increased for 18 commodities and decreased for 29 commodities. Similarly, the RPC increased for 9 commodities and decrease for 13 commodities. While most of these changes were small, a few commodities had large changes, such as the difference of 0.4087 for condensed and evaporated milk (IMPLAN commodity 88).

To compare the potential effect of changes in RPCs on model estimates, the impact of a \$10 million dollar change in final demand for each of the 20 agricultural industries listed in Table 3 was calculated for the state model with original versus new estimates of foreign exports. Differences in RPCs due to differences in foreign export estimates had little impact on model results. For example, estimates of the employment impacts under the two models differed by only 0.3% (7487 versus 7511). Substantially different estimates of foreign exports of agricultural products had little impact on model results. One can conclude that IMPLAN model users should not be too concerned with estimates of foreign exports when the variable is not of direct concern.



ENDNOTES

1. In IMPLAN, regional exports are divided into foreign exports and domestic exports. To avoid confusion, this terminology is retained only in Appendix I. Throughout the rest of the text, the term exports refers to foreign exports.

2. Regional input-output models constructed with a computer-based system, such as IMPLAN, that have not been changed are called ready-made models. Hybrid models are ready-made models that have been calibrated and verified with outside information. The term hybrid stems from the fact that such models are a mixture of survey-based data and models that are completely based on secondary data. The process of constructing the initial hybrid model used in this study is explained in detail in Hughes.

3. Firms contacted reflected the prevalence and hence the importance of particular Louisiana agricultural industries. For the 20 industry groups, survey responses ranged from 33.3% to a 100% response rate by industry. In terms of number of firms covered, responses ranged from one respondent to seven respondents. Because responses were obtained for each sector and industries with a greater emphasis on exports were more heavily surveyed, survey results were assumed to be a reasonable accurate picture of Louisiana agricultural exports. For more detail, see Bairak.

4. Estimates of Louisiana foreign exports for agricultural crops were also compared with estimates derived from these sources for unprocessed agricultural crops and to U. S. Commerce Department survey-based estimates for processed agricultural products (food processing, paper, and timber products) for 1987 through 1989. In all cases, estimates of foreign exports used in this study were closer to estimates obtained from these other sources than were the original IMPLAN estimates. For more details, see Bairak.

5. Of the \$39.119 million, \$0.035 million was the margin for Louisiana exports through out of state ports. This amount was not assigned to any Louisiana trade and transportation sector. The estimate of the total trade and transportation margin (8.9%) was compared with national estimates of margins for processed agricultural products found in the Census data. As expected, the estimates used here were less than the national values because of lower transportation cost charges. For more details, see Bairak.

6. A discussion of the effect of the changes in estimates of foreign exports on other uses of the IMPLAN model are contained in Appendix I.

7. In the original 1985 version (but not later versions) of original IMPLAN models, employment is given in terms of full-time equivalent jobs (Alward et al., 1989).

8. The direct shock differed slightly from the survey based estimates because IMPLAN sector 122, Roasted Coffee, was not included in the survey data. The original estimate of foreign exports (\$5.991 million) for the sector was assumed to be accurate.

Evaluating the Impact of Agricultural Exports on the Louisiana Economy



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