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IMPACT OF AGRICULTURAL EXPORT TRADE
ON A STATE'S ECONOMY:
THE CASE OF MISSOURI

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IMPACT OF AGRICULTURAL EXPORT TRADE ON A STATE'S ECONOMY: THE CASE OF MISSOURI

The contribution of agricultural exports to the U.S. balance of trade and the prosperity of American farmers is now well recognized. During 1978, an agricultural trade surplus of \$14.6 billion helped offset part of the deficit in non-agricultural trade. In addition, U.S. farmers have derived significant benefits from an export market that accounts for approximately one-fifth of farm income and the output of one out of every three harvested acres. What is less known and clearly not documented is the substantial impact of farm export sales on domestic economic activity such as production by types of industries, income and the generation of local and state tax revenues. An expanding foreign market for U.S. agricultural products is important not only to farmers, but to labor, industry, and the rest of the American economy.

The benefits from the international marketing of agricultural commodities will differ, of course, among states and geographical areas depending upon an area's or state's production mix and dependence on export activity. If local policy makers are to evaluate and respond to the consequences of changing U.S. export levels and policies on their community's economic vitality, it is necessary for them to achieve a better understanding of how export activity affects their local economies. It is the aim of this study to provide such information for the Missouri economy. Utilizing available state and national input-output

tables, we derive an estimate of the extent of foreign export activity by the state for 1963 and 1972. The input-output model is then used to study the output, income and tax revenue multiplier effects brought about by export sales.

Estimation of Missouri Exports

Exports of a particular state includes two types of products. The products produced in the state and "directly" exported to foreign countries, and those goods produced by local firms and shipped to producers in other states for further processing before they are exported. These latter exports constitute "indirect" exports of the state.

Estimates of the dollar value of Missouri's "direct" exports of agricultural commodities are available by the U.S. Department of Agriculture [7]. The estimated export shares of farm products attributable to individual states are based on each state's share of total national production or sales. These estimates are adjusted to reflect actual shipments on the basis of information from commodity specialists, trade associations, transportation agencies, and exporters.

The value of "direct" exports of manufacturing establishments by states have been estimated by the Bureau of the Census of the U.S. Department of Commerce and are available for several years [8, 9]. These manufacturing export data are based on surveys conducted by the Bureau of the Census at irregular intervals. At times, directly reported exports from the surveyed firms understate the true value of each state's exports. For this reason, an effort is made by the Bureau

to estimate the actual export value by adding to the reported figures those exports made by wholesalers and independent exporters. The adjustments made to compensate for the underreporting of exports are based on data compiled by the Foreign Trade Division of the Bureau of the Census.

The exact estimation of "indirect" Missouri exports requires tracing every sale made by Missouri firms to other states all the way through to the final sale. While estimates are available of the magnitude of sales made by Missouri firms outside the state, no information exists of the destination of such sales. Nonetheless, utilizing information contained in input-output (I-O) tables for the state of Missouri and the United States [1, 2, 6], the approximate magnitude of the state's indirect exports can be ascertained.

The following procedure was utilized to derive estimates of indirect exports of Missouri for the years 1963 and 1972. These years were chosen for our analysis because they are the only years for which complete I-O information for both Missouri and the U.S. are available. Since the Missouri I-O tables contain 54 endogenous industries and the U.S. I-O tables consist of 83 industries, it was necessary to aggregate the U.S. tables into conformity with the Missouri tables. ^{1/} The next step in our procedure involved the estimation of the total amount of sales made by Missouri firms, on an industry basis, to other parts of the U.S. Since the distribution of these sales among various U.S. sectors is not known, it was necessary to assume that the distribution of Missouri's out-of-state sales follows a pattern similar to the industry distribution for the U.S. as a whole. Thus, the dollar allocation of sales by each Missouri industry i to U.S. industry j (MS_{ij}) is defined as:

$$(1) MS_{ij} = a_{ij} MX_i$$

where:

a_{ij} = the percentage of sales of industry i allocated to industry j ,

calculated from the aggregated U.S. I-O table;

MX_i = total sales (less direct exports) made by Missouri firms in industry i to the rest of the U.S., obtained from the Missouri I-O table.

Given the distribution of total Missouri sales to each U.S. industry from (1) above, the next step was to determine how much of these intermediate goods sold to other U.S. industries ultimately become part of exported products. This is accomplished by multiplying the dollar amount of intermediate sales made to each industry by exports as a percentage of output for that industry. Therefore, the value of goods exported by Missouri firms in each industry i through U.S. industry j (INX_{ij}) is given by:

$$(2) INX_{ij} = MS_{ij} \cdot USX_j$$

where:

USX_j = the percentage of total output of industry j exported from the U.S., calculated from the aggregated U.S. I-O table.

Finally, adding across the j industries to which Missouri firms sell, the total amount of indirect exports for each Missouri industry i (INX_i) is determined:

$$(3) INX_i = \sum_{j=1}^n INX_{ij}$$

Table 1 provides the estimated indirect Missouri exports along with the direct exports by industry for the years 1963 and 1972. Nearly \$82

Table 1: Direct and Indirect Missouri Exports, 1963 and 1972.

Industry	1963			1972		
	Direct Exports	Indirect Exports	Total Exports	Direct Exports	Indirect Exports	Total Exports
<u>Million Dollars</u>						
Livestock	21.3	2.9	24.2	33.3	8.3	41.6
Agriculture	143.0	*	143.0	257.8	.4	258.2
Meat Processing	3.7	1.9	5.6	12.1	2.0	14.1
Dairy Products	3.7	.5	4.2	1.7	1.8	3.5
Grain Mill Prod.	34.9	.9	35.8	37.4	1.5	38.9
Other Food Prod.	16.2	1.9	18.1	22.7	5.3	28.0
Textile & Apparel	3.7	2.0	5.7	7.1	3.3	10.4
Lumber & Furniture	2.8	.7	3.5	4.1	3.0	7.1
Paper & Paper Prod.	2.6	2.5	5.1	4.3	4.5	8.8
Printing & Publishing	2.5	.5	3.0	10.5	1.7	12.2
Chemicals	28.9	12.7	41.6	66.7	32.4	99.1
Petroleum Prod.	.5	*	.5	1.8	.3	2.1
Leather, Rubber, Plastics	5.1	3.1	8.2	13.3	9.8	23.1
Stone, Clay, Glass	12.7	1.7	14.4	16.4	4.8	21.2
Primary Metals	2.6	8.2	10.8	17.5	30.7	48.2
Metal Prod.	7.4	7.4	14.8	9.8	18.8	28.6
Industrial Mach.	26.8	7.8	34.6	72.1	22.4	94.5
Household Appliances	2.4	.4	2.8	4.8	.1	4.9
Other Electrical Prod.	8.1	5.4	13.5	29.9	25.0	54.9
Auto & Parts	9.1	16.7	25.8	81.8	48.8	130.3
Airplanes, Aerospace	2.9	1.7	4.6	165.5	3.6	169.1
Other Transportation	1.0	.1	1.1	20.6	.6	21.2
Other Manufacture	27.0	1.9	28.9	30.6	3.0	33.6
Lead & Zinc Mining	*	.1	.1	.8	2.1	2.9
Oil & Gas Mining	*	*	*	*	*	*
Coal Mining	.4	.1	.5	*	*	*
Other Mining	1.3	.6	1.9	1.4	.6	2.0
Totals	370.0	81.7	451.7	924.0	234.5	1158.5

*Indicates a value less than 100,000 dollars.

million worth of Missouri output was indirectly exported in 1963, while close to \$235 million was indirectly exported in 1972. Indirectly exported goods thus amounted to 22 percent of the total dollar value of direct exports in 1963, and about 25 percent by 1972. Agricultural industries (the first six in the table) contributed comparatively fewer indirect exports than non-agricultural industries. Indirect agricultural exports were 3.6 percent of direct exports in 1963, and 5.3 percent in 1972.

In many industries the value of output indirectly exported actually exceeded the amount directly exported. For example, in 1963 three industries (Primary Metals, Metal Products, and Auto and Parts) had indirect exports in excess of the amount they directly exported. In 1972 the same was true for five industries (Dairy Products, Paper and Paper Products, Primary Metals, Metal Products, Lead and Zinc Mining). Several other industries also had substantial indirect exports. In 1963, for instance, five industries (Meat Products, Textile and Apparel, Paper and Paper Products, Leather-Rubber-Plastics, other Electrical Products, and Airplanes and Aerospace) exhibit indirect exports which amount to at least 50 percent of their direct exports. Another four industries (Lumber and Furniture, Leather-Rubber-Plastics, other Electrical Products, and Auto and Parts) show the same result for 1972.

Effects of Exports on the Missouri Economy

Thus far, we have obtained the magnitudes of direct and indirect exports of the Missouri economy. The ultimate effect of exports by Missouri firms, however, extends beyond that simply implied by the

dollar values of these exports. Sales made directly or indirectly abroad by Missouri firms represent a source of basic income for the state. The process by which the introduction of basic income leads to the development of the economy is often referred to as the "multiplier" effect [3, 5]. The "multiplier" process depends upon detailed linkages that firms, consumers, and governments in the Missouri economy have with one another.

Since industries differ in regard to their linkages with other industries in the state, the ultimate effect of the introduction of a new dollar of basic income will vary depending upon the industry through which the dollar is generated, and that industry's linkages with other industries and consumers within the state. Some industries, for example, will exhibit strong linkages because they purchase large amounts of their material inputs from other Missouri firms and/or rely heavily on labor services from residents of the state. Other industries will exhibit weaker linkages because they import a large percentage of their material requirements from firms located outside Missouri and/or purchase only small amounts of labor services from the residents of the state.

In order to evaluate the overall impact of export sales on the Missouri economy, it is therefore necessary to have information concerning the linkages of the various Missouri industries and consumers with one another. From the calculation of various multiplier values for the generation of business activity, personal income, state tax revenues, and local tax revenues, we were able to trace through the impact of a dollar of basic income. 2/

The input-output multiplier values, along with the estimates of export sales of Missouri firms, can thus be utilized to evaluate the

overall impact of the export sector on the Missouri economy. The results of the multiplication of total exports with the output, household, and government multipliers of the Missouri economy for 1963 and 1972 are presented in Table 2. The first column for each year indicates for each industry the total amount of business output which was generated (including the initial export sales) within the state after all rounds of subsequent spending have occurred as a result of that industry's direct and indirect exporting activity. The second column indicates the amount of personal income (wages, salaries, profits, interest, and dividends) which was generated within the state as a result of exporting again after all subsequent spending rounds have occurred. The third column indicates the amount of state tax revenue originating from business activity created by exporting. Finally, the fourth column shows that amount of local government tax revenue generated as a result of the impact of export sales on business activity.

In terms of economy wide totals, export activity generated \$1,027 million worth of business output in 1963 and \$2,318 million in 1972. These total figures constitute 4.3 percent and 4.6 percent of total Missouri business output, respectively.

It is clear from our results that the most important exporting industry in terms of generating business activity within the state is Agriculture and Livestock products. The exporting activity of this industry accounted for over a half billion dollars of business activity in 1972 which was about 29 percent of total Missouri business activity. Other important sectors include Airplanes and Aerospace, Auto and Parts, Chemicals, and Industrial machinery. In particular, exports from the Airplane and Aerospace industry are rapidly increasing in the Missouri economy.

Table 2: Impact of Exports on Missouri Economic Activity, 1963 and 1972.

Industry	1963				1972			
	Business Activity	Personal Income	State Taxes	Local Taxes	Business Activity	Personal Income	State Taxes	Local Taxes
-----Million Dollars-----								
Livestock	78.0	21.8	1.8	1.1	104.4	26.4	2.9	1.5
Agriculture	353.1	152.6	14.4	6.8	557.3	230.6	30.3	11.7
Meat Processing	20.2	5.2	.3	.2	45.5	9.5	.9	.5
Dairy Prod.	13.0	3.4	.2	.2	8.2	1.6	.1	.1
Grain Mill Prod.	86.3	26.5	1.8	1.1	89.8	23.1	2.5	1.2
Other Food Prod.	43.6	12.4	.6	.6	58.5	15.6	1.3	.8
Textile & Apparel	10.5	3.8	.1	.2	17.9	6.6	.4	.3
Lumber & Furniture	9.1	3.6	.2	.2	14.3	4.9	.3	.2
Paper & Paper Prod.	10.1	3.6	.1	.2	17.3	5.5	.4	.3
Printing & Publishing	6.4	2.5	.1	.1	23.5	9.2	.5	.5
Chemicals	78.0	24.9	.9	1.1	188.9	54.5	3.7	2.8
Petroleum Prod.	1.0	.2	*	*	5.1	1.3	.1	.1
Leather, Rubber, Plastics	18.2	6.6	.2	.3	42.2	14.6	.9	.7
Stone, Clay, Glass	33.4	12.3	.5	.7	42.5	15.2	1.0	.8
Primary Metals	18.5	4.4	.2	.3	95.0	28.9	2.0	1.5
Metal Prod.	31.4	14.0	.5	.6	51.9	19.5	1.2	1.0
Industrial Mach.	66.8	24.8	.9	1.1	169.9	63.9	3.7	3.2
Household Appliances	5.1	1.9	.1	.1	9.8	3.1	.2	.2
Other Electrical Prod.	24.7	9.2	.3	.4	113.7	39.4	2.3	2.0
Auto & Parts	35.2	6.9	.3	.3	264.6	78.9	5.3	4.0
Airplanes, Aerospace	7.3	2.3	.1	.1	277.4	77.0	5.1	4.0
Other Transportation	1.7	.6	*	*	47.8	14.0	1.0	.7
Other Manufacture	70.3	21.1	1.0	1.7	62.6	22.3	1.4	1.1
Lead & Zinc Mining	.2	.1	*	*	6.9	2.2	.2	.1
Oil & Gas Mining	*	*	*	*	*	*	*	*
Coal Mining	1.3	.6	*	*	*	*	*	*
Other Mining	4.4	1.8	.1	.1	3.0	.9	.1	*
Totals	1027.8	367.1	24.7	17.5	2318.0	768.7	67.8	39.3

*Indicates a value less than 100,000 dollars.

The contribution of total exports to the state's personal income also grew over our observation period. The \$367.1 million of personal income attributable to exports in 1963 constituted 3.4 percent of the state total, while the \$768.7 million in 1972 represented 3.6 percent of the total.

Again, Agriculture was the leading industry in terms of personal income generated as a result of export sales. Agricultural production contributed about 37 percent of total Missouri exports in 1963 and 26 percent in 1972. In turn, the impact of agricultural exports to the state's personal income was considerably higher, amounting to about 48 percent in 1963 and 34 percent in 1972. Other important exporting sectors contributing to personal income in 1972 were Auto and Parts, Airplanes and Aerospace, Industrial Machinery, and Chemicals.

Turning now to the effect of export sales on state and local tax revenues, one can observe that exports were ultimately responsible for \$24.7 million of state taxes in 1963, or 3.1 percent of the total, and \$67.8 million in 1972, or 4.1 percent of the total. Furthermore, export activity ultimately generated \$17.5 million of local tax revenues in 1963 or 3.2 percent of the total, while in 1972 \$39.2 million of local revenues were dependent upon exports, or about 2.4 percent of the total.

Agriculture once again was the leading industry in terms of its impact on state and local revenues. Total agricultural exports (including the Livestock sector) accounted for some \$33 million of state revenues and \$13 million of local revenues in 1972. This represented 49 percent of total state revenues and about 34 percent of local taxes in the state. The great significance of agricultural export sales in the generation of state and local revenues in Missouri is clearly underscored by our results.

Conclusions

This study investigates the impact of international marketing of agricultural products on the Missouri economy for the years 1963 and 1972. A methodology based on I-O information for both the state and the U.S. as a whole is utilized to derive an estimate of the extent of direct and indirect export activity by Missouri industries. Farm products constitute the single largest export product of Missouri, contributing about 37 percent of total state exports in 1963 and 26 percent in 1972. Thus, Missouri is considerably more dependent upon agricultural exports than is the U.S. as a whole (approximately 20 percent).

The estimated value of total state export sales was used with state I-O multipliers to obtain the magnitude of the export sector's impact on the Missouri economy. After accounting for all multiplier repercussions, the total direct and indirect state exports were responsible for generating nearly 5 percent of the total business output and about 3.6 percent of personal income, 4.1 percent of state taxes, and 2.4 percent of local tax revenues within the state in 1972. Agriculture was by far the most important sector in terms of the impact of its export sales on state economic activity. Export sales of farm products were ultimately responsible for 29 percent of state business activity, and contributed 34 percent of personal income, 49 percent of total state revenues, and about 34 percent of local taxes in Missouri in 1972.

FOOTNOTES

1. A description of the Missouri Input-Output Industry Classification System along with a concordance between it and the National Input-Output Classification System and the Standard Industrial Classification System is provided in [4].
2. Personal income, state and local tax multipliers were computed by Harmston et al., by treating local and state government and households as endogenous sectors [1]. Their reasoning is that in an open trading economy, as is the case of a particular state, the role of the above sectors as producers outweigh their roles as consumers.

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