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Exporting Processed Instead of Raw Agricultural Products

Gerald Schluter
William Edmondson

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Exporting Processed Instead of Raw Agricultural Products. By Gerald Schluter and William Edmondson, Agriculture and Rural Economy Division, Economic Research Service, U.S. Department of Agriculture. Staff Report No. AGES 89-58.

Abstract

Exporting processed agricultural products rather than raw commodities benefits society much more than just the increased value of the commodities themselves. Processing adds to the value of the products and generates greater business activity, more jobs, higher personal income, and greater tax revenues. The issue of adding value to exports becomes even more relevant in view of the recently expanded use of subsidies to spur growth of raw grain and oilseed exports. Do such subsidies fully exploit the U.S. agricultural competitive advantage? Processing wheat worth $1 million would generate as much as $9 million in business activity, 109 full-time jobs, $1.9 million in personal income, $160,000 in Federal personal income taxes, and $199,000 in Federal corporate income taxes. Processing other commodities could yield even greater economic benefits. Trade barriers, foreign demand, and domestic capacity could prevent full realization of the potential economic benefits.

Keyword: Agricultural trade, input-output, agricultural exports, trade policy, added-value products.

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Introduction

During the 1970's, the U.S. farm sector enjoyed the benefits of expanded agricultural exports. Agricultural exports grew from $7.3 billion in 1970 to $41.3 billion in 1981 [2].[1] For certain commodities, the role of export markets was particularly important. Seventy-six percent of total wheat production was exported, 41 percent of soybeans, and 24 percent of corn [2]. U.S. wheat, soybean, and coarse grain exports were about 40 percent of total world trade.

The farm sector has benefited from the expansion of foreign markets, as has the rest of the U.S. economy. Agricultural exports, which totaled $41.3 billion in 1981, generated over $94 billion of activity throughout the U.S. economy and over 1.2 million full-time jobs.

There is increasing concern, however, that America is not realizing its full competitive advantage from its production of agricultural products. If markets for processed agricultural products exist abroad, why does the United States not capture more of the potential jobs and related economic activity that domestic processing offers? Analyzing this issue must proceed along two fronts. First, what are the actual market possibilities for processed products and what are the institutional or trade rigidities that would work against such an effort? Second, what are the magnitudes of the domestic economic and employment effects involved in the tradeoff between exporting processed products instead of raw agricultural products? In addressing this latter question, we first briefly consider the trade realities facing agricultural sectors. We then update a net agricultural exports model which Schluter and Clayton developed using a modified input-output framework [4]. Using this model, we examine the national output, income, and employment effects for selected raw commodity-processed commodity combinations and study the implication of these national level effects for a policy of export subsidization.

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[1]Underscored numbers in brackets identify literature cited in the References at the end of this report.

Trade Realities

The social, political, and economic context within which international trade occurs cannot be overlooked. If foreign consumers do not like U.S. processed poultry, for example, they will not buy it, regardless of whether poultry processing for export has a large employment multiplier compared with unprocessed corn exports. Just as trade restrictions affect raw corn exports, an array of trade restrictions also apply to processed agricultural products. These restrictions may limit the size of the potential market to which the output and employment multipliers apply.

Domestic rigidities may also work against a shift in the product mix of agricultural exports, at least in the short run. The U.S. rail transportation system, for example, has made adjustments to realize available scale economies in handling large volumes of raw grain exports. Most grain transported by rail moves in giant hopper cars, instead of 40-foot narrow-door boxcars, often in unit trains. Ports are equipped to efficiently unload these vehicles. If the export of processed product expands significantly, can their handling be as effectively mechanized?

U.S. agricultural exports face a variety of tariff and nontariff barriers--licensing, State trading, special import duties for port improvement, special standards, and health regulations. Governments impose these barriers to protect domestic industries, limit the outflow of limited foreign exchange earnings, and to achieve other goals.

The reader should view the output and employment effects that are the major focus of this report as potentially available. They are the maximum effect that could be realized through expanded processed products exports. Whether, and to what extent, they might actually be realized will depend on the social, political, and economic realities of both the domestic production and the international agricultural trade environment.

A Net Agricultural Exports Model

The issue posed in this paper might typically be analyzed by comparing the multipliers for raw commodity production sectors and for agricultural processing sectors. For example, the $1.67 of economic activity which is directly and indirectly generated per dollar of wheat exports could be compared with the $2.28 of economic activity generated by a dollar of flour exports. Such an approach has inherent shortcomings, however:

- it does not adequately account for the transformation of raw product export value to processed product export value so that multipliers derived do not incorporate the information in this transformation, and

- it does not appropriately net the forgone raw product export value from the processed product multiplier.

A major concern regarding the first shortcoming is that there is not a one-to-one matching of the raw product sectors to the processed product sectors. Processing adds other goods and services to the raw agricultural commodity. A dollar of processed product is a bundle of raw product plus the value of other goods and services added during processing. An implicit difficulty in the typical comparison is that either the value of the compared processed product is greater than that of the raw product itself or the value of the raw product differs between the compared multipliers. A direct comparison of the multipliers for the dollar's worth of wheat and a dollar's worth of flour as a measure of the additional effects of processing wheat is therefore misleading and does not properly reflect the multiplier effect of the processing activity. The appropriate comparison which better reflects the increase in economic activity from substituting flour exports for wheat exports, for example, is the comparison between the multipliers for a dollar's worth of wheat and for the value of flour that could be produced from a dollar's worth of wheat.

Proper identification of the effects of exporting processed agricultural products versus exporting their raw agricultural components requires the recognition that a given stock of raw commodity is available. If used in processing, the stock of raw commodities is unavailable for export. A net multiplier effect is, therefore, appropriate for two reasons. First, we want to be able to properly isolate the multiplier effect of the added value of processing. Second, we want to be able to estimate the multiplier effects on the U.S. economy of exporting our raw agricultural commodities as processed products instead of in their raw form.

To develop their net agricultural exports model, Schluter and Clayton began with an estimate of the rate at which raw product exports are transformed in processed product exports [4]. This transformation rate is not simply the engineering or physical transformation rate, although those rates provide the foundation for the desired rate. It also involves relative raw and processed product prices and sectoral interdependency measures that allow a comparison of two static general equilibrium situations. All of this information is available from the total requirements matrix of the input-output model. Reading the diagonal coefficient of the raw product sector in the total requirements matrix gives the amount of raw product freed by reducing raw product exports. The level of processed product exports that can be obtained from a unit of this freed raw product is given by the total requirement coefficient in the raw product row of the processed product column of the total requirement matrix. This coefficient specifies the amount of raw product required per dollar of final demand for the processed product.

For example, using relationships quantified in the 1977 national input-output table, decreasing wheat exports by $1 frees $1.0715 of wheat (the $1 of wheat and $0.0715 of seed expenditures). A dollar of flour exports requires $0.429 of wheat. So, flour

exports could potentially increase by \$1.0715/\$0.429, or \$2.4974, for every \$1 of wheat exports forgone.

In our computations, we adjust these multiplier effects (m in equation 1 below) through a weighted average of the multiplier effects of the raw product sector and the processed product sector. The weights used (w) include a -1 for the raw product sector and the raw product/processed product export transformation ratio for the processed sector, that is:

$$m = (I-A)^{-1} w \qquad (1)$$

where:

- m = an nxl vector of outputs associated with the added value of processing
- $(I-A)^{-1}$ = an nxn total requirements matrix
- w = an nxl vector whose elements are zero except elements $w_i = -1$ and $w_k = c_{ii}/c_{ik}$
- i = the sector producing the raw product
- k = the sector producing the processed product
- c_{ik} = the ikth element of $(I-A)^{-1}$.

The employment effects are given by:

$$e = Lxm \qquad (2)$$

where:

- e = an nxl vector of employment associated with the added value of processing
- L = an nxn diagonal matrix of direct employment requirement coefficients.

The personal income effects are given by:

$$h = Hxm \qquad (3)$$

where:

- h = an nxl vector of personal income associated with the added value of processing
- H = an nxn diagonal matrix of direct personal income per \$1 of sector output.

The personal income tax revenue is then given by:

$$t_p = RxlxHxm \qquad (4)$$

where:

- t_p = Federal personal income tax associated with the added value of processing
- R = an average tax rate (scalar)
- l = an lxn vector of ones
- H = an nxn diagonal matrix of personal income per dollar of output.

Federal corporate income tax revenues are given by:

$$tc = lxCtxm \qquad (5)$$

where:

tc = Federal corporate tax revenues associated with the added value of processing

Ct = an nxn diagonal matrix of coefficients of average corporate taxes paid per dollar of output.

Relating recent export experience to this model may illustrate the logic of this model. In calendar year 1987, the United States exported $3.043 billion (port value) of wheat. The $3.043 billion represents $2.432 billion of wheat at the farm level, $365 million of transportation services, and $246 million of trade services needed to get the wheat from the farm to the port, based on the trade and transportation margins from the 1977 input-output table. Because the input-output model used represents economic flows in 1977 dollars, we must convert these 1987 values to 1977 dollars. The $2.432 billion at the farm level represents $2.361 billion in 1977 dollars (using as a price deflator the index of prices received by farmers for food grains). If the $2.361 billion of wheat exported as wheat could have been exported as flour, this would have represented $5.897 billion of flour. To produce that value of flour would require $37 billion of direct, indirect, and induced output in the U.S. economy (using a gross output multiplier for flour of 5.69).[2]

But the export of wheat as wheat required $12.3 billion of direct, indirect, and induced outputs ($2.361 billion exports sales times a gross output multiplier for wheat of 5.21). The additional activity associated with processing the wheat into flour for export is thus $37 billion minus $12.3 billion, or $24.7 billion.

This $24.7 billion (1977 dollars) is the statistic we refer to as the net effect of exporting processed versus raw agricultural products and reflects the value of flour exports at the plant level rather than at the port level.

We used data from an industry-by-commodity total requirements matrix derived from an 85-sector aggregation of the 1977 U.S. Department of Commerce input-output table [5].

National Effects of Raw versus Processed Commodities

Exporting processed commodities instead of their bulk agricultural components provides an export market for domestic goods and services required to assemble, process, and distribute

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[2]We will discuss gross output multipliers, their interpretation and underlying assumptions later. The focus of this section is the internal logic of the model, the wheat to flour transformation, and the netting out of the raw product effects.

the processed commodities. Three measures of the potential increase in economic activity associated with processed commodities are appropriate for consideration: (1) direct plus indirect plus induced output or business activity, (2) the employment associated with this increased business activity, and (3) the personal income generated by the increased business activity.

Table 1 presents estimates for these three measures of economic activity.[3] For wheat, $1 million of wheat exported as wheat generates $5.21 million of direct, indirect, and induced business activity in the U.S. economy, jobs for 85 workers, and personal income of $1.25 million. The same quantity of wheat exported as flour (a product of SIC 2041) would generate an additional $9 million of business activity, 109 jobs, and $1.89 million of personal income. Table 1 reports similar results for dressed poultry for corn, soybean oilmill products for soybeans, cottonseed mill products for cottonseed, and wet corn milling products for corn.

Several assumptions underlie these estimates. First, using the relationships quantified in the 1977 national input-output table--$0.429 of wheat is required per $1 of flour exports and $1.0715 of wheat output is required per $1 of wheat exports--suggests that for every dollar of substitution of flour exports for wheat exports, flour exports could be increased $2.50. Second, the input-output model being used has the household sector endogenous. This type of input-output model tends to yield somewhat larger multiplier effects, because it considers the consumption made possible by the additional household income generated by the expansion of exports.

Third, the model assumes that households consume a fixed basket of goods and services with an average propensity to consume of 0.794. That is, households spend about 80 percent of each new dollar of income on consumption of the same items it spent the old income on. This consumption spending, in turn, stimulates another round of new production. To understand the working of the multiplier process, one must keep these different components of the multiplier separate. The open model (household sector not considered) direct plus indirect output multiplier for wheat is roughly 2.10. Including the household sector, we find the personal income (household income) generated per $1 of wheat exports is $1.25 (table 1). Consumption spending from this $1.25 of personal income generates an additional $1.86 of output. Thus, the total output effect per dollar of wheat exports is $2.10 of direct plus indirect output, $1.25 of personal income and $1.86 of output induced by new consumption. To get the full $5.21 output effect, the household sector must continue to receive, as income, the constant share of each sector's output, continue consuming the same fixed bundle of goods and services,

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[3]These multipliers are in 1977 dollars. Since 1977, the implicit price deflator for gross national product has increased 77 percent.

Table 1--National net effects of raw versus processed exports, 1977

Item	Gross output			Gross employment			Personal income		
	Raw product	Processed product	Net change	Raw product	Processed product	Net change	Raw product	Processed product	Net change
	Million dollars			Workers			Million dollars		
Flour for wheat	5.21	14.2	9.00	85	194	109	1.25	3.14	1.89
Dressed poultry for corn	5.09	47.57	42.48	75	658	583	1.09	9.73	8.64
Soybean oilmill for soybeans	5.50	8.99	3.49	71	105	34	1.59	2.15	0.57
Cottonseed mill products for cottonseed	5.70	13.71	8.01	84	178	94	1.43	3.10	1.67
Wet corn milling products for corn	5.09	16.05	10.96	75	223	148	1.09	3.65	2.56

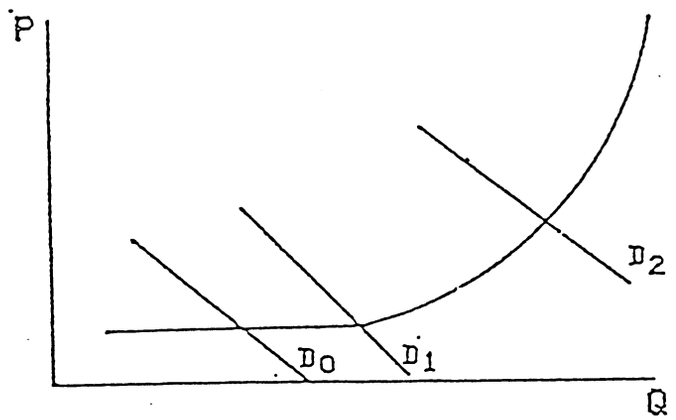
Based on $1 million in sales of raw commodity exports and equivalent amount of processed products.

and spend 80 percent of its income during the period in which it is received.

An additional crucial assumption is that each sector can buy all the inputs and resources it needs to meet new demands without having to pay higher prices. This assumption results in a perfectly elastic industry supply curve as illustrated in figure 1. In figure 1, a shift in demand from D_o to D_1 would meet this assumption, a shift from D_o to D_2 would not because the demand increase results in a price increase.

Thus, generating our results assumes a definite sequence of economic consequences (table 2). First, $1 million of wheat exports can be transformed into $2.5 million of flour exports. The direct production of this flour requires the milling sector

Figure 1--Hypothetical Industry Supply Curve



to purchase a fixed set of inputs from other sectors of the economy. The first column of table 2 gives this set of direct effects. In combination with the $1 million of wheat, the flour milling sector uses $205,000 of other crop products, $89,000 of other processed crops, $140,000 of other processed foods and other manufactured goods, and $466,000 of purchased services to produce the $2.5 million of flour exports (table 2, column 1). Of this $2.5 million, the flour milling sector retains $598,000 of income for wages and salaries, interest payments, indirect business taxes, depreciation allowances, and retained earnings. Thus, the export of $2.5 million of flour can be viewed as exporting a package of goods and services that includes all the components just listed.

The $1.9 million of domestic goods and services directly used in the production of the $2.5 million of flour exports in turn must be produced in a supporting round of economic activity. The second column of table 2 gives the estimated level of indirect supporting activity. Producing the $2.497 million of flour exports requires an additional $32,000 of processed crop products, $907,000 of additional output from other manufacturing sectors, and $905,000 of additional services. Thus, excluding the $598,000 income retained in the flour milling sector, the domestic economy must provide $6.406 million ($2.497 + $4.507 - $0.598) of goods and services to support the production of $2.5 million of flour exports. We assume that all of this $6.4 million of goods and services are available at prevailing prices.

Many input-output analyses stop at this point. This is technically an open model I/O analysis of the substitution of flour for wheat exports. However, if the flour exports are new exports for the U.S. economy (this is a critical assumption), all the supporting economic activity required for the flour exports will be new economic activity. Thus, this activity generates new household income within the economy. When households spend this new income, they introduce a round of additional demands for output in the economy. All the rounds of new economic activity

Table 2--Components of the total economic activity associated with $1 million of wheat exported as flour

Item	Direct	Indirect	Household	Induced	Total
			1,000 dollars		
Livestock	0	47	NA	97	144
Crops	1,205	102	NA	84	1,391
Processed livestock	70	17	NA	139	226
Processed crops	89	2,529	NA	213	2,831
Other manufacturing	70	907	NA	1,524	2,502
Services	466	905	NA	2,601	3,972
Households	276	NA	3,142	NA	3,142
Nonhousehold GNP	322	NA	NA	NA	NA
Total	2,497	4,507	3,142	4,658	14,208

NA = Not applicable.

generate $3.142 million of new household income, inducing $4.7 million in economic activity to support the consumption resulting from this new household income.

Including the effect of new household income represents more than an attempt to use a more complete economic model. It has taken the raw versus processed export question beyond a point where the location of the processing activity no longer matters. That is, for those raw products where processing is necessary to transform the raw product into a consumable form, the open I/O model basically assumes a fixed market for processed products.

Processed products are either produced in the United States and exported or the essential raw products are exported and they are processed in the consuming nation. If one considers the induced income effect, where the processing occurs is important. The economy which does the processing receives the benefits of the larger market resulting from higher income levels.

The economic sequence leading to the reported effects is illustrated in table 2 and summarized as follows:

	Million dollars
The direct and indirect effect of exporting $1 million of unprocessed wheat	2.103
The direct and indirect effects of exporting $1 million of wheat as flour	6.406
Economic activity due to the added value of processing wheat into flour	4.303
The induced income and consumption effects of exporting $1 million of wheat as flour ($3.74 million is the induced income and consumption effects of exporting $1 million of wheat as wheat)	7.800
The total effects of exporting $1 million of wheat as flour ($6.406 million + $7.800 million)	14.206

Under these conditions, $1 million of wheat exported as wheat generates 85 jobs for full-time workers in the U.S. economy (see table 1). Exported as flour (SIC 2041), this same amount of wheat generates 194 jobs. Similarly, $1 million of corn exported as corn generates 75 jobs in the U.S. economy. Exported as processed poultry (SIC 2016), this same amount of corn generates 658 jobs. And, $1 million of soybeans exported as soybeans generates 71 jobs, while the same amount exported as soybean meal, cake, or oil generates 105 jobs.

The sale of processed versus raw agricultural commodities also affects personal income in the household sector (see table 1).

At the national level, $1 million of wheat sold as flour adds $1.89 million in income for households; the export of dressed poultry from $1 million of corn adds $8.64 million; soybean oilmill products from $1 million of raw soybeans adds $0.57 million; cottonseed mill products from $1 million of cottonseed adds $1.67 million; and wet corn milling products from $1 million of corn adds $2.56 million in personal income.

Tax Impacts

If processing raw agricultural products before exporting them influences economywide private output, employment, and personal income, one might logically question the stake the public sector has in the form of agricultural exports. Because the public sector finances a large share of its activities by taxing private incomes, higher levels of personal and corporate incomes yield higher tax revenues. We can estimate the magnitude of associated tax revenues by applying average tax rates to the new incomes, as in equations 4 and 5.[4]

Using this approach, we estimated Federal tax revenues associated with the additional activity of processing agricultural products before exporting and report the results in table 3. For example, when exporting wheat as wheat, each million dollars of exports generates $54,000 in corporate income tax and $131,000 in personal income tax, for a total Federal revenue of $185,000. The same wheat first milled into flour and then exported would generate $214,000 in corporate tax revenues and $330,000 in personal income tax, or $544,000 in total Federal revenues.

The net additional Federal tax revenue associated with the processing is the difference--$160,000 in corporate taxes, $199,000 in personal income taxes, or $359,000 in total Federal revenues.

Some of the estimated Federal revenue effects are rather large. For example, if the United States diverted corn, otherwise destined for export as grain, to the production of poultry and then exported the processed poultry, the expected net additional Federal tax revenue would be nearly 1.4 times larger than the original value of the corn. This result deserves further explanation.

The key factor underlying this large multiplier is the relatively small cost of the original corn in the final export value of processed poultry. During the production process for poultry, many other domestic goods and services combine with the corn.

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[4]Average personal tax rates were Federal Government personal income tax revenues from Survey of Current Business, July 1988, (table 3.4) divided by personal income (table 2.1). Average corporate tax rates are corporate tax liabilities (op. cit. table 6.20B) divided by corporate profits (table 6.19B) times corporate profits per dollar of output in base year (1977).

The transformation coefficient, the value of processed poultry exports which can be produced from the corn freed by not exporting it as raw corn, is 1.06134/0.15972 or 6.648. Thus, $6.65 of processed poultry can be exported per $1 of corn exports forgone. This transformation coefficient is large because of the multiple stages of production and processing involved. When the processing route is direct and accounts for much of the flow of the intermediate product, the transformation coefficient can be disaggregated. For example, the corn to live poultry transformation is 1.06184/0.22635 or 4.681. The live poultry to processed poultry transformation coefficient is 1.00784/0.69778 or 1.444. The product of the two intermediate transformation coefficients is 4.681 x 1.444 or 6.759, within 1 percent of the direct estimate.

Personal Income Tax Receipts

Examining the associated Federal personal income tax illustrates the effect of this large transformation coefficient upon estimated tax revenue. Exporting $1 million of corn as corn generates $1.09 million of personal income. Taxed at an average personal income tax rate of 0.105, this generates a total of $114,450 of personal income tax.

The related personal income multiplier for processed poultry is $1.464 million of personal income per $1 million of exports. Diverting $1 million of corn from the export market to poultry feed frees enough corn to produce $6.648 million of processed poultry for export. Thus, $6.648 million of exports times the $1.468 million of personal income per $1 million of export generates $9.73 million of personal income. Taxed at a rate of $0.105 of personal income tax per $1 of personal income yields a gross Federal personal income tax revenue of $1.022 million. Subtracting the forgone potential income tax effect of exporting corn as corn of $114,450 gives an estimated net personal income tax revenue from the processing activity of $907,000 for corn exports diverted to processed poultry. Table 3 presents these results and similar calculations for several other raw/processed product combinations.

Corporate Income Tax Receipts

The estimated corporate tax revenue generated is not as easily calculated. Corporations are taxes on profits. Particular tax code provisions affect industries and their corporations differently. Average profit rates of industries and of individual corporations within the industries vary over a broad range. We use an implicit tax liability per unit of sector output as our tax rate. We compute our estimates of corporate income tax receipts using these implicit tax liabilities per unit of output on 84 separate sectors in equation 6. We sum the 84 separate estimates of corporate tax revenue to an economywide total. For the corn-dressed poultry example, this procedure results in $491,000 per $1 million of corn exported as dressed poultry. Table 3 summarizes results for several processed product categories.

How Good Are 12-Year-Old Estimates?

The enormous data needs for constructing a national input-output table and the lags in assembling these data have led to about a 7-year lag for publishing recent U.S. tables. One indication of whether the multipliers reported in this paper are still appropriate is a comparison with similar multipliers calculated using the 1972 national table. Tables 1 and 3 report the 1977 estimates and tables 4 and 5 give 1972 data. Between 1972 and 1977 the first oil crisis, concern about worldwide food shortages, and major changes in the international monetary system occurred, yet the multipliers changed relatively little. The net multipliers generally changed more than the individual product multipliers. Larger changes in the net multipliers than individual product multipliers result from more variability in the estimated raw to processed product transformation coefficients. Even if the physical transformation rate (for example, bushels of wheat to hundredweight of flour) did not change, the transformation coefficient could change as input-product and relative price conditions change and affect valuations of activity and relative shares of valued transactions.

Table 3--National tax revenue effects of raw versus processed exports, 1977

Item	Corporate income taxes			Personal income taxes			Total Federal taxes		
	Raw product	Processed product	Net change	Raw product	Processed product	Net change	Raw product	Processed product	Net change
	1,000 dollars								
Flour for wheat	54	214	160	131	330	199	185	544	359
Blended and prepared flour for wheat	54	859	805	131	1,215	1,084	185	2,074	1,889
Macaroni for wheat	54	1,210	1,156	131	1,544	1,413	185	2,754	2,569
Blended and prepared flour for flour	86	354	268	132	500	368	218	853	635
Macaroni for flour	86	495	409	132	631	499	218	1,126	908
Dressed poultry for corn	54	545	491	115	1,022	907	169	1,567	1,398
Red meat for corn	54	423	369	115	893	778	169	1,315	1,146
Wet corn milling products for corn	54	202	148	115	384	269	169	586	417
Soybean oilmill products for soybeans	58	96	38	167	226	59	225	322	97
Cooking oil for soybeans	58	264	206	167	496	329	225	759	534
Cooking oil for soybean oil	68	190	122	161	357	196	229	547	318
Cottonseed mill products for cotton	60	175	115	150	325	175	210	500	290

Based on $1 million in sales of raw commodity exports and equivalent amount of processed product.

Table 4--National net effects of raw versus processed exports, 1972

Item	Gross output			Gross employment			Personal income		
	Raw product	Processed product	Net change	Raw product	Processed product	Net change	Raw product	Processed product	Net change
	-----Million dollars-----			-------Workers-------			----Million Dollars----		
Flour for wheat	5.42	14.26	8.84	143	335	192	1.54	3.45	1.91
Dressed poultry for corn	5.32	50.22	44.90	147	1300	1153	1.40	10.69	9.29
Soybean oilmill for soybeans	5.21	8.00	2.79	135	183	48	1.48	1.91	0.43
Cottonseed mill products for cottonseed	5.61	13.28	7.67	209	372	163	1.36	2.96	1.60
Wet corn milling products for corn	5.32	14.21	8.89	147	337	190	1.40	3.37	1.97

Based on $1 million in sales of raw commodity exports and equivalent amount of processed product.

Table 5--National tax revenue effects of raw versus processed exports, 1972

Items	Corporate income taxes			Personal income taxes			Total Federal taxes		
	Raw product	Processed product	Net change	Raw product	Processed product	Net change	Raw product	Processed product	Net change
				1,000 dollars					
Flour for wheat	47	159	112	178	399	221	225	558	333
Blended and prepared flour for wheat	47	465	418	178	1,056	878	225	1,521	1,296
Macaroni for wheat	47	547	500	178	1,290	1,112	225	1,837	1,612
Blended and prepared flour for flour	62	254	192	156	576	420	218	830	612
Macaroni for flour	62	244	182	156	576	420	218	820	602
Dressed poultry for corn	46	449	403	163	1,241	1,078	209	1,690	1,481
Red meat for corn	46	427	381	163	1,297	1,134	209	1,724	1,515
Wet corn milling products for corn	46	161	115	163	392	229	209	553	344
Soybean oilmill products for soybeans	43	81	38	172	221	49	215	302	87
Cooking oil for soybeans	43	260	217	172	582	410	215	842	627
Cooking oil for soybean oil	61	199	138	166	445	279	227	644	417

Based on $1 million in sales of raw commodity exports and equivalent amount of processed product.

Conclusions

The nations aspiring to expand trade in processed agricultural products face a minefield of market and trade barriers. A prize, expanded domestic income and employment, awaits the successful nations. If U.S. exporters successfully market $1 million of expanded domestic income and employment, awaits the successful nations. If U.S. exporters successfully market $1 million of wheat as wheat flour instead of as grain, the domestic economy stands to gain, perhaps as much as $9 million of business activity, employment for 109 workers, $1.9 million of personal income, $160,000 of Federal personal income taxes, and $199,000 of Federal corporate income taxes. For many raw product/processed product pairs, the potential domestic payoff is even higher.

Should these findings cause us to emphasize exports of processed goods instead of raw materials? They certainly point in that direction. Before applying the gains listed in this paper to actual U.S. exports, though, one should remember that we have made two very critical assumptions:

1. We assume that the agricultural processing industries could expand production, often substantially, without bottlenecks. If bottlenecks develop, costs per unit will no longer remain constant. (Furthermore, the model does not adequately reflect the perhaps temporary loss in economies of size inherent in the shift from an infrastructure that handles bulk, raw commodities to one emphasizing trade in processed products.)

2. Perhaps the most critical assumption is that the newly employed resources in the processing industries were formerly unemployed. If they were not, then a correct accounting of the processing activity's addition to the Nation's income and product would require subtracting the income and product the resources produced before, from the increases estimated here.

In the high-employment economy of the United States in 1989, that either of these assumptions is accurate seems unlikely. Thus, the gains estimated here should be regarded as upper bounds on the gains likely to occur if processed products were actually to substitute for raw materials exports.

Our results also reflect farm production and processing plant conditions as they existed in 1977. Furthermore, the results do not consider the realities of world trade patterns. Wanting to export more processed corn does not necessarily mean other countries will buy from us. Institutional rigidities will greatly influence whether any of the potential gains from processed product exports can actually be realized.

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