

Can Rural Employment Benefit From Changing Labor Skills in U.S. Processed Food Trade?

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Every major farm bill since 1985 has included policies that emphasize increasing value-added American agricultural exports. At the same time, rural area planners have looked to international markets for new destinations for their resource-based products. The 1990s saw a gain in processed agricultural products trade and a gain in rural manufacturing employment. The gain in rural manufacturing was led by food processing (Drabenstott et al., Ghelfi), raising the possibility that the trade policy had borne fruit and the hopes of the rural planners may be realized.

But can increased demand for lower skilled workers in rural areas be linked to a changing international trade environment? For the recent expansion of meat trade, it can. Yet, some rural-based meat packers hired foreign workers to work in their packing plants (Broadway, MacDonald et al.), suggesting host rural areas did not have sufficient labor surplus to accommodate the rising employ-

In 1972, processed food exports used more skilled labor per unit of output than processed food imports. By 1992, this situation had reversed and the skill intensity of processed food trade had switched. Higher meat and poultry exports compared with other processed food trade could explain this switch in skill intensity. The growth in meat trade paralleled an urban-to-rural shift in the meat packing and poultry processing sectors. Because rural areas have a greater share of low-skilled workers in their labor force and have fewer employment opportunities for their workers, this may appear to be a win-win situation for rural areas. However, the jobs slaughtering livestock and processing meat often do not appeal to domestic rural workers. When sufficient domestic rural workers are not available, accommodating a larger share of commuter and migrant workers has challenged some rural communities that host meat processing plants.

ment opportunities. In this article, we explore the changes in the economic environment leading to this situation.

The first change of note is in the pattern of skilled and unskilled labor used in U.S. processed food trade. In 1972, processed food exports used a higher ratio of high-skilled labor to low-skilled labor per unit of output than did processed food imports. By 1992 (the most recent published input-output table available), this situation had reversed, as measured by skill intensity—the ratio of high-skilled to low-skilled labor per unit of exports to the ratio of high-skilled to low-skilled labor per unit of imports (Lee and Schluter).

In the absence of other factors, this switch toward low-skilled labor should benefit rural areas more than urban areas because food manufacturing (NAICS 311) is more

rural-based than most U.S. manufacturing (USDC, County Business Patterns). Also, the rural labor force tends to include a larger proportion of low-skilled workers. In this article, we assess the skill intensity of U.S. processed food trade in general and the meat trade in particular, to explore if meat trade is likely to appeal to those rural area planners looking to international markets for resource-based rural products.

How We Tell If Trade and the Demand for Low-Skilled Workers Are Linked?

The employment intensity of trade—a measure of the relative importance of employment in export production or import replacement—compares employment for producing exports with the employment needed if imports had been produced domestically. Differing sectoral trade balances

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and employment requirements can yield differing sectoral effects of net trade (exports less imports). As a share of total processed food employment, the net trade employment impacts in 1972 were negative (-39,000 of 1,768,000 workers), but small (-2.2 percent). Yet, the net effect of trade on employment in the industry was larger (in absolute terms) than the -0.2-percent (-139,800 of 84,586,400 workers) net trade effect on the whole U.S. economy.

Between 1972 and 1992, processed food exports grew faster than imports, although not enough to achieve a positive trade balance in processed food trade. The net trade effect on food processing employment fell from -2.2 to -1.0 percent (-17,400 of 1,671,900 workers), and the net trade effect on the U.S. economy rose from -0.2 to -0.5 percent (-627,300 of 121 million workers).

The skill intensity of trade analysis is measured similarly to employment intensity but with greater detail about the skill levels of the employees (Lee and Schluter). We conducted our analysis using the nine major occupational categories of U.S. workers as classified by the Bureau of Labor Statistics: (1) executive, administrative, and managerial; (2) professional; (3) technicians and related support; (4) sales occupations; (5) administrative support; (6) precision production, craft, and repair; (7) service occupations; (8) operators, fabricators, and laborers; and (9) farming, forestry, and fishing (BLS). We defined categories (1) through (3) as high-skilled and (4) through (9) as low-skilled to estimate the high-skilled and low-skilled labor demand for export production and import replacement.

The skill level of processed food workers has shifted along with net trade over time. For example, in 1972, high-skilled labor used in producing exports of processed food totaled just 11.9 percent of the 43,700 low-skilled workers (table 1). The comparable share for imports was lower, 10.8 percent. Thus, the processed food trade skill intensity ratio was 1.097 (0.119/0.108) in 1972. A skill intensity ratio greater than one indicates that, in 1972, the food processing industry exported products requiring a higher proportion of high-skilled workers than required by imported processed food products.

By 1992, the share of high-skilled labor was lower for processed food exports (0.103) than imports (0.106), with a resulting skill intensity ratio of 0.973. Thus, there was a reversal in skill intensity between 1972 and 1992 in processed food industry trade. In fact, of the broad industry groups (ex. other agricultural processing, nondurable manufacturing, durable manufacturing, forestry, and mining) analyzed by Lee and Schluter, processed food was the only group that reversed skill intensity between 1972 and 1992.

Meanwhile, employment in the food processing industry declined

Table 1
U.S. food processing, and trade-related employment by place and skill level, 1972 and 1992

Rural and low-skilled workers gained the most from processed food export growth

Item	Workers (1,000)		Workers (1,000)		Percent change
	1972	Percent	1992	Percent	
Total	84,590	100.0	121,000	100.0	43.0
Urban	71,230	84.2	102,610	84.6	44.1
Rural	13,360	15.8	18,390	15.4	37.7
High-skilled	18,020	21.3	28,830	23.8	60.0
Low-skilled	66,570	78.7	92,170	76.2	38.5
Food processing	1,768	100.0	1,672	100.0	-5.4
Urban	771	43.6	687	41.1	-10.9
Rural	997	56.4	985	58.9	-1.2
High-skilled	162	9.2	149	8.9	-8.0
Low-skilled	1,606	90.8	1,523	91.1	-5.2
Exports	48.9	100.0	99.6	100.0	
Urban	36.0	73.6	66.0	66.3	83.3
Rural	12.9	26.4	33.6	33.7	160.5
High-skilled	5.2	10.6	9.3	9.3	78.8
Low-skilled	43.7	89.4	90.3	90.7	106.6
Imports	87.9	100.0	117.0	100.0	
Urban	65.7	74.7	83.4	71.3	26.9
Rural	22.2	25.3	33.6	28.7	51.4
High-skilled	8.6	9.8	11.2	9.6	30.2
Low-skilled	79.3	90.2	105.8	90.4	33.4

Sources: Employment of total and food processing from BLS. Urban and rural shares are from County Business Patterns data (USDC). Employment for exports and imports estimated by authors.

Methodology

We calculate the factor content of international trade—the amounts of primary factors such as land, labor, capital, and human capital (or skilled labor) used in the production of a good or service for export or equivalent import replacement—using an input/output (I/O) model. In an open I/O system, we can calculate the output of each sector of the economy needed to support a particular year's level of trade. We estimate the factor usage (a factor being farmland, capital, high-skilled workers, low-skilled workers) in that year's trade by multiplying our estimates of average factor usage per million dollars of output with the estimates of the output of each sector of the economy needed to support a particular year's level of trade demand. Comparing factor usage for traded products provides the empirical basis for much of this study. For example, comparing employment (factor is labor) for producing exports with the estimated employment had imports been produced domestically provides a measure of the relative importance of employment in export production or import replacement - the employment intensity of trade. We use CBP shares (USDC, County Business Patterns) of a sector's national production to allocate the trade-related employment to urban or rural counties. The availability of compatible input-output tables determined our period of analysis.

5.4 percent during 1972-92, even as employment in the U.S. economy as a whole grew 43 percent (table 1). The loss of food processing jobs fell more heavily on urban than rural workers (10.9 percent vs. 1.2 percent) and on high-skilled than low-skilled workers (8 percent

vs. 5.2 percent). This is the reverse of the U.S. economy as a whole (table 1).

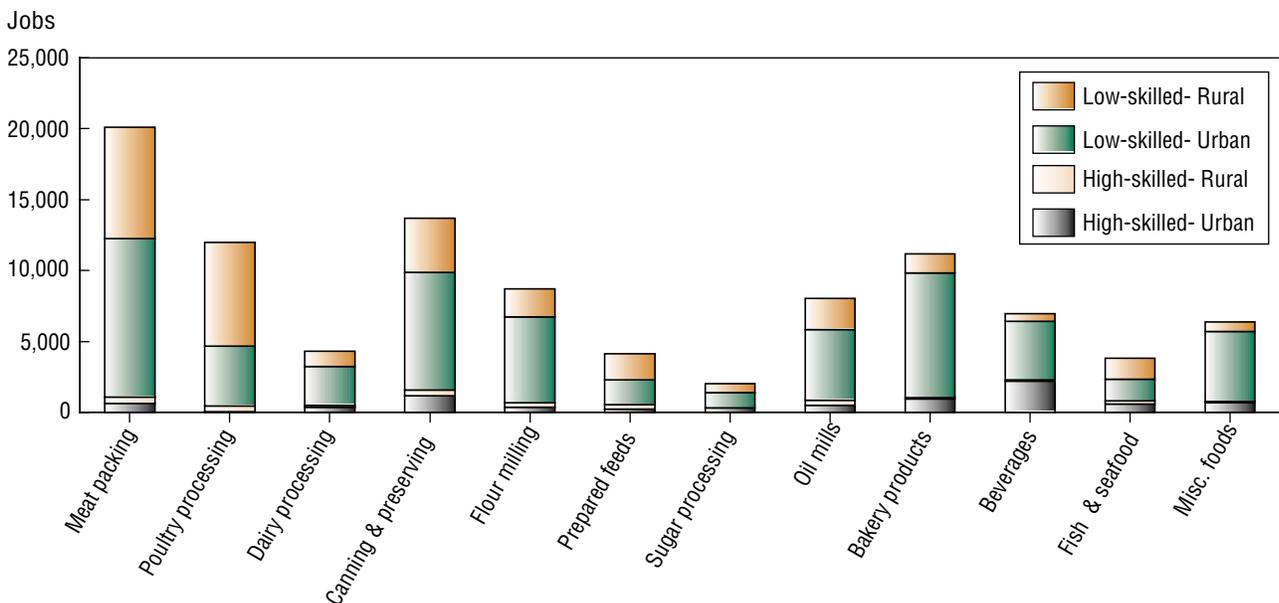
The low-skilled share of total U.S. employment declined from 78.7 percent (66.6 million out of 84.6 million total workers) in 1972 to 76.2 percent (92.2 million out of 121.0 million) in 1992 (table 1). In

food processing, however, the opposite occurred. Already employing a higher proportion of low-skilled workers than the economy-wide average in 1972, food processing employment dropped between 1972 and 1992, but high-skilled employment declined even more. As a result, the proportion of low-skilled workers in the sector rose.

Trade-Related Meat Packing and Poultry Processing Employment Has Become More Important

Export-related employment gained in 11 of 12 food processing subsectors from 1972 to 1992, led by poultry processing's 510-percent increase (table 2). Export-related rural employment gained substantially for most of the 12 subsectors (fig. 1). Import-related employment increased as well (except for sugar processing), but the increase in export-related employment was larger.

Figure 1
Export-related food processing employment, 1992
Meat processing jobs dominate export-related food processing employment



Source: Input-output analysis of traded food products.

Table 2

Changes in trade-related employment in food processing, 1972-92*Export-related meat packing and poultry processing employment grew fastest*

Item	Meat packing	Poultry processing	Dairy processing	Canning & preserving	Flour milling	Prepared feeds	Sugar processing	Oil mills	Bakery products	Fish & sea-food	Misc. foods	Total	
<i>Change in jobs</i>													
Exports	13,400	10,200	100	7,199	1,601	2,100	1,000	-1,000	8,400	2,600	100	5,000	50,700
Urban	6,857	3,713	4	4,792	777	945	568	-1,145	7,179	2,341	-439	4,359	29,951
Rural	6,543	6,487	96	2,407	824	1,155	432	145	1,221	259	539	641	20,749
High-skilled	800	600	0	700	200	300	0	-100	600	400	0	600	4,100
Urban	425	218	-8	466	89	135	-6	-132	512	357	-59	525	2,522
Rural	375	382	8	234	111	165	6	32	88	43	59	75	1,578
Low-skilled	12,600	9,600	100	6,499	1,401	1,800	1,000	-900	7,800	2,200	100	4,400	46,600
Urban	6,432	3,495	12	4,326	688	810	574	-1,013	6,667	1,984	-380	3,834	27,429
Rural	6,168	6,105	88	2,173	713	990	426	113	1,133	216	480	566	19,171
Imports	3,100	1,900	100	9,100	1,500	600	-13,300	1,200	7,700	9,200	4,200	3,800	29,100
Urban	-758	682	4	6,034	1,013	207	-9,177	644	6,392	8,347	1,119	3,229	17,736
Rural	3,858	1,218	96	3,066	487	393	-4,123	556	1,308	853	3,081	571	11,364
High-skilled	200	0	0	900	200	200	-1,400	100	500	1,000	500	400	2,600
Urban	-20	-1	-8	599	134	87	-966	40	408	908	149	338	1,668
Rural	220	1	8	301	66	113	-434	60	92	92	351	62	932
Low-skilled	2,900	1,900	100	8,200	1,300	400	-11,900	1,100	7,200	8,200	3,700	3,400	26,500
Urban	-738	683	12	5,435	879	120	-8,211	604	5,984	7,439	970	2,891	16,068
Rural	3,638	1,217	88	2,765	421	280	-3,689	496	1,216	761	2,730	509	10,432

Source: Calculated by USDA's Economic Research Service from USDC-BEA's interindustry and County Business Patterns data and USDL-BLS employment data.

Two sectors—meat packing (NAICS 311611-3) and poultry processing (NAICS 311615)—accounted for nearly half of the growth in export-related food processing employment over the 20-year period. Total export-related employment in the meat packing and poultry processing sectors increased 271.3 percent, from 8,700 jobs in 1972 to 32,300 in 1992 (table 3). Export-related rural employment increased 437 percent, versus an urban employment increase of 185 percent. Import-related employment in the two sectors increased only 27.6 percent (from 18,100 jobs to 23,100).

Processed food trade shifted from exports using more high-skilled workers per unit than imports in 1972 to exports using fewer high-skilled workers per unit than imports in 1992. Without the meat packing and poultry processing sectors, there would have been no sectorwide switch in skill intensity of trade. With these two sectors, food processing's skill intensity of trade fell from 1.097 in 1972 to 0.973 in 1992. While U.S. food processing employment fell between 1972 and 1992, employment related to meat exports more than tripled. In 1972, the skill requirements for meat production

for trade were already more skewed toward low-skilled labor than was food processing in general, and this grew slightly more pronounced in the next 20 years. With the shift of meat production from urban to rural areas during 1972-92, rural areas became the primary host of this shift in skills.

How Did This Jump in Trade-Related Meat Processing Employment Happen?

Changes in the level of meat and poultry trade alone account for the reversal of skill intensity in total food processing from 1972 to 1992. In other words, the shift in skill

Table 3

Changes in meat packing and poultry processing trade-related employment, 1972-92

Rural and low-skilled workers gained the most from meat export growth

Item	1972		1992		Percent change
	Workers	Share	Workers	Share	
Exports	8,700	100	32,300	100	271.3
Urban	5,719	65.7	16,289	50.4	184.8
Rural	2,981	34.3	16,011	49.6	437.1
High skilled	400	4.6	1,800	5.6	350
Low-skilled	8,300	95.4	30,500	94.4	267.5
Imports	18,100	100	23,100	100	27.6
Urban	12,973	71.7	12,897	55.8	-0.6
Rural	5,127	28.3	10,203	44.2	99.0
High-skilled	1,000	5.5	1,200	5.2	2.0
Low-skilled	17,100	94.5	21,900	94.8	28.1

Source: Calculated by USDA's Economic Research Service from USDC-BEA's interindustry and County Business Patterns data and USDL-BLS employment data.

intensity in the processed food trade was not so much a shift in skills required for food processing production as it was a change in product mix to a larger share for exported meats. Because meat packing and poultry processing use a larger proportion of low-skill workers than food processors in general, the average skill intensity fell.

As with most economic changes, the increase in meat trade was not an isolated event resulting from one change in the economic or policy environment. In fact, the economic pressures that fostered more U.S. meat trade fall under three categories: (1) pressures that affected the cost of production, (2) pressures that affected the demand for the product, and (3) pressures resulting from public policy.

Because of the United States' abundant and productive cropland and the resultant abundant supply of livestock feed, the U.S. should have long had a competitive advantage in international meat trade.

However, the recent consolidation of meat processing (NAICS 31161) firms into larger businesses with larger processing plants enabled underlying cropland/feed availability forces to be more fully realized. This allowed meat processing costs to drop and the average costs of industry marketing, research, and development to be spread over larger production complexes, lowering the per-unit cost of production (MacDonald et al.). Low-skilled labor became complementary to the technology used on the processing lines as the size of the processing plants increased. Ollinger et al. estimated that a 1-percent increase in meat processing output at constant factor prices is associated with less than a 1-percent increase in total cost—0.901 for poultry, 0.953 for cattle, and 0.926 for hogs. That is, average costs fall as output increases, and more so for poultry than beef and pork.

Consequently, far fewer meat-packers now slaughter livestock than 20 years ago, but their plants

are much larger. In 1997, the top four firms handled nearly 80 percent of all steer and heifer slaughter, versus 36 percent just two decades earlier. In addition to the effects of consolidation, changes in slaughter plant technology may have created scale economies, altered the mix of slaughter plant products, and changed the location and operation practices of cattle and hog production.

Industry consolidation has also been accompanied by important changes in labor relations. Between 1980 and 1987, union membership in the meat products industry fell from 46 percent to 21 percent, and has remained low (MacDonald et al.). The decline in unionization paralleled the routinization of packing plant tasks and a drop in real wages of 40-50 percent between 1972 and 1992. These forces combined to make employment in meat processing less attractive to domestic low-skilled workers. And slaughterhouses have always been risky places to work. Consequently, many immigrant workers operate slaughter and fabrication lines.

Growing meat exports reinforced the cost-lowering effects of consolidation by allowing processing plants to operate nearer to capacity and thereby more fully realize their economies of size. The U.S. meat trade has also been helped by technological innovations in transportation, which have facilitated trade in chilled fresh and frozen products and extended the shelf life of higher quality meat produced from abundant U.S. grain.

Consumer preference and growing incomes in other countries, like Japan and Korea, increased demand for U.S. meat products. These countries are importing a rising share of their meat consumption as import barriers

ers fall. Japan has dismantled its quota system for beef imports and reduced its tariffs since 1995. South Korea opened its beef market with an import quota in 1988, and has raised the quota level several times since.

Meat exports have been further facilitated by regional trade agreements (NAFTA, MERCOSUR) and multinational trade liberalization. In addition to policy changes facilitating trade, active efforts by the U.S. government to establish and maintain disease-free status has opened or preserved some overseas markets for U.S. meats.

Opportunities and Challenges for Rural America

Since 1972, industry consolidation and economies of scale in meat processing have lowered the industry's cost of production. Consumer preferences for high quality meats and rising consumer incomes in customer nations have expanded potential meat export markets, as have bilateral and regional trade agreements. This growth in meat trade paralleled a shift of the meat packing and poultry processing sectors from urban to rural locations. Because, on balance, rural areas have a greater share of low-skilled workers in their labor force and have fewer employment opportunities for their workers, this may appear to be a win-win situation for rural areas. Meat processing seemed to be just what was needed for rural areas—more rural jobs related to a growing industry enjoying growing trade.

However, while more jobs are available, they are predominantly low-skill jobs. Although rural areas have a greater share of low-skilled workers in their labor force, the jobs slaughtering livestock and processing the meat often do not

appeal to rural domestic workers. Accommodating a larger share of commuter and migrant workers has challenged some rural communities that have meat processing plants.

Have rural areas benefited from the reduced skills required of labor in U.S. processed food trade? It depends on one's point of view. A rural community that adds a new meat processing plant certainly adds to its economic base. Consumer spending and opportunities for businesses supporting the new

plant will grow. If the number of available workers in the community is inadequate to support the plant's employment needs, commuter and migrant workers will supplement the local labor force. Commuter workers will bring additional traffic and lessen the potential benefits from higher consumer spending. Migrant workers may introduce strains on the community educational system and housing. Some community members will like the changes. Some will not. ^{RA}

For Further Reading . . .

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