

Meatpacking and prepared meats industry: above-average productivity gains

During 1967–82, industry restructuring brought on by the introduction of boxed beef and increases in capital expenditures per employee boosted productivity; labor requirements have been reduced by technological changes

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New products and packaging have encouraged industry restructuring and new technology in the red meat products industry¹ and helped boost productivity. Between 1967 and 1982, productivity (as measured by output per hour) increased at an average annual rate of 2.8 percent and from 1976 forward, the rate accelerated to 3.2 percent. In contrast, the comparable figures for all manufacturing industries were lower, 2.4 and 1.6 percent. The productivity growth for the meatpacking and prepared meats industry resulted from an annual increase in output of 2.2 percent and a decline in employee hours of 0.6 percent. (See table 1.)

As with many industries, year-to-year changes in productivity are often closely associated with changes in output. For the red meat products industry, 5 of the 6 years in which output declined were also years in which productivity decreased. Similarly, when output jumped 21 percent in 1976 and 1977, there was an increase in productivity of more than 18 percent.

The two subindustries (meatpacking and prepared meats) examined in this study that make up the red meat products group have different underlying rates of change in productivity. (See table 2.) The meatpacking industry (sic 2011), which accounts for 67 percent of the persons employed in

red meat products and for 80 percent of the value of shipments, had a productivity growth rate of 3.2 percent between 1967 and 1982. This growth accelerated to 3.6 percent since 1975. Productivity in the prepared meats industry (sausages and other prepared meats, sic 2013) grew at a slower 1.9-percent annual rate during the study period, and advanced to 2.4 percent since 1975.

The output and hours of these two industries also showed different rates of growth from 1967 to 1982. Output in the prepared meats industry rose at an annual rate of 3.4 percent and hours increased 1.5 percent, while in meatpacking plants output grew only 1.7 percent and hours dropped 1.4 percent. Both industries experienced output declines in 1969, 1973, 1975, 1978, and 1982. However, these decreases in output had less adverse effect on productivity in meatpacking plants than for prepared meat processors, as meatpackers were better able to adjust their work force hours to meet demand changes. For example, in 1982 when output dropped more than 4 percent in both the meatpacking and prepared meat industries, productivity fell 4.1 percent for meat processors and rose 1.3 percent for meatpackers.

Productivity in meatpacking plants has benefited from increased mechanization resulting from the marketing of boxed beef (vacuum packaged subprimal cuts of beef). For the makers of sausages and other prepared meats, productivity trends reflect both strong demand and more gradual technological changes in batch processing equipment typical of this industry.

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Table 1. Productivity and related indexes for the red meat products industry, 1967-82

[1977 = 100]

Year	Output per employee hour	Output	All employee hours	Employees
1967	74.8	76.5	102.3	100.2
1968	76.6	77.3	100.9	100.7
1969	75.7	76.2	100.6	100.2
1970	77.3	78.3	101.3	100.2
1971	79.3	81.8	103.1	101.5
1972	85.0	84.9	99.9	99.5
1973	82.8	78.2	94.5	94.8
1974	84.5	85.2	100.8	99.5
1975	84.4	82.3	97.5	97.4
1976	93.4	92.8	99.4	98.4
1977	100.0	100.0	100.0	100.0
1978	98.7	97.0	98.3	98.8
1979	101.7	97.9	96.3	96.1
1980	107.0	101.4	94.8	95.4
1981	107.9	100.5	93.1	93.5
1982	107.7	96.3	89.4	90.2
Average annual rates of change (in percent)				
1967-82	2.8	2.2	-0.6	-0.5
1967-72	2.2	2.1	-0.1	0.0
1972-75	0.0	-0.1	-0.1	-0.2
1975-80	4.2	3.4	-0.7	-0.5
1980-82	0.3	-2.5	-2.9	-2.8

Subperiod productivity trends

In the red meat products industry, four distinct subperiod trends in productivity emerge. During 1967-72, output per hour advanced at an annual rate of 2.2 percent. Productivity fell in only 1 year, 1969, due to a drop in demand linked with a significant increase in retail meat prices. From 1972 to 1975, there was no productivity change as a result of output declines in 1973 and 1975. This period was marked by a protracted 17-month recession and sharply rising meat prices. During 1975-80, productivity showed its greatest gains. Output per hour rose at an annual rate of 4.2 percent, as output rose 3.4 percent and hours declined 0.7. During this period, consumer meat prices increased more slowly than other components of the Consumer Price Index, helping to keep output above its long-term rate of growth. From 1980 to 1982, there was little productivity gain as a result of 2 years of declining output associated with the economic recession.

Productivity for meatpackers and prepared meat processors showed similar variability in these four subperiods. Productivity in meatpacking establishments grew 2.9 percent annually from 1967 to 1972, rose 0.4 percent during 1972-75, climbed 3.7 percent from 1975 to 1980, and advanced 2.9 percent since 1980. In prepared meat processing plants, productivity grew marginally during 1967-72, dropped at an annual rate of 1.0 percent from 1972 to 1975, jumped 5.4 percent annually from 1975 to 1980, and declined 7.4 percent in 1981 and 4.1 percent in 1982.

Demand for red meat products

Output for meatpackers and prepared meat processors grew at an average annual rate of 2.2 percent from 1967 to 1982, which is similar to the 2.4-percent trend for manu-

facturing as a whole. Demographic factors have helped raise demand for meat products during this period and include rising living standards, population growth, and the larger number of working women. This last factor has led to increased consumption of higher valued prepared meats away from home. Per capita consumption of beef rose 20 percent from 1967 to 1976, but has fallen since then. Per capita consumption of pork has risen, while that of veal, lamb, and mutton have declined. The falloff in per capita consumption of red meat products and increased use of poultry items is expected to make the constant-dollar demand for red meat smaller between now and 1987, about 1.5 percent annually.²

For meatpackers, the trend has been away from marketing whole carcass beef shipped by rail to the shipment of boxed beef transported in trucks. In addition, the growing institutional market has increased the need for prepared meat products and the packaging of smaller portions. In the prepared meat industry, there has been a product shift to hams, sausages, and luncheon meat and away from franks, bologna, and bacon. Canned ham has declined in relative importance and has been replaced by more efficiently packaged, film-wrapped ham. The trend toward two-earner families and consequently to more eating out is expected to continue with an increasing demand for a larger variety of processed convenience meat. Current emphasis in the meat industry is on ways to produce more products which have lower caloric, salt, and fat content.

Small declines in employment

Despite increased production, employment in the red meat products industry dropped 0.5 percent annually, from 242,000 in 1967 to 218,000 in 1982. Employment trends have varied among the subindustries. The meatpacking industry work force declined at an average annual rate of 1.3 percent. Employment fell in every year except 1974, 1976, and 1977, which were marked by above-average output increases. In the prepared meats industry, employment trends were positive during 1967-82, growing at an annual rate of 1.6 percent, with employment falling in only 2 years. In 1975, employment declined following the 1974 recession and an industry falloff in demand; in 1979, employment dropped following a decrease in industry demand in the preceding year.

The red meat products industry is more labor-intensive than manufacturing, in general, and has a higher-than-average proportion of production workers. To produce an additional \$1 in value-added sales requires 27 percent more production worker hours than for all manufacturing. For meatpackers, whose labor costs average one-half of all operating expenses, 36 percent more production worker hours are required than for all manufacturing and in the prepared meat industry, 11 percent more labor time is needed. In the meatpacking industry, production workers make up 82 percent of the work force and in the prepared meats industry

they account for 74 percent, compared with 68 percent for all manufacturing. In meatpacking, additional production workers are needed because of the difficulties associated with processing carcasses that are not uniform in size or weight.

Women account for a relatively small but growing percentage of the work force in the red meat products industry. During 1967–82, their proportion increased from 18 to 22 percent, compared with a higher level for total manufacturing where female employment increased from 28 to 32 percent. In meatpacking plants, which have a higher number of physically demanding occupations, the proportion of women has increased from 14 to 18 percent, while in the prepared meats industry their proportion has remained at about 30 percent. Average hourly earnings for production workers in the red meat products industry averaged \$9.02 in 1982, compared with \$7.67 for the private nonfarm economy and \$8.50 for manufacturing as a whole.

Over the past decade, labor turnover has been relatively high in the meat products industry. For meatpackers, the accession rate, which includes new hires and recalls, averaged 4.8 per 100 employees each year, compared with 4.0 for all manufacturing. The separation rate, which includes quits and layoffs, was also higher, averaging 5 per 100 employees, compared with 4.1 for all manufacturing. In the prepared meats industry, the accession rate was similar to the average for all manufacturing, while the separation rate was about 10 percent higher. In the past several years, labor turnover rates have narrowed between meatpackers and meat processors but still remain high, relative to other manufacturing industries.

In meatpacking plants, slaughtering and the processing of cattle carcasses into boxed beef require extensive use of manual labor. Unlike processed meat manufacturing, many

of these tasks are not suitable for machine processing. Major work functions in both meatpacking and prepared meat product plants include cutting, curing, and smoking prepared sausages and other meats; packing and shipping; and cleaning and plant maintenance. Additionally, meatpacking plants have workers engaged in animal handling and slaughtering operations. In 1980, operatives made up nearly two-thirds of the industry's work force, while craftworkers and laborers each accounted for about 8 percent. White-collar employees had declined in relative importance, which is in contrast to an increasing trend in many other manufacturing industries. White-collar employees accounted for 15 percent of the work force, while service workers represented 5 percent.

For meatpackers, 40 percent of the work force is located in the Middle West, while in the prepared meat industry 30 percent of the work force is concentrated in the Great Lakes area. Slaughter and fabrication facilities tend to be at the same location and close to a source of cattle. Metropolitan areas accounted for 60 percent of the meatpacking work force and nearly 80 percent of the prepared meat work force. Multiplant companies make up about two-thirds of those employed in meatpacking compared with slightly less than half in prepared meat products. Establishments operated by multiplant companies are several times larger than single plant companies. In 1979, multiplant establishments averaged 475 employees in meatpacking and 190 employees in prepared meats, compared with single plants with 85 employees in meatpacking and 70 in prepared meats.³

Plant size

In 1977, the Bureau of the Census reported 2,590 meatpacking establishments and 1,345 prepared meat establishments. A small percentage of these accounted for the bulk of industry shipments. In meatpacking, nearly one-half of the establishments reported fewer than four employees and collectively accounted for only 1 percent of shipments. In contrast, 11 percent of meatpacking establishments average more than 100 employees and generated more than 80 percent of the industry value of shipments. Similarly, in the prepared meats industry, establishments averaging fewer than four employees made up 32 percent of total industry establishments but less than 1 percent of shipments. Fourteen percent of the establishments employed 100 workers or more and generated 72 percent of sales.

During 1967–77, there was little change in the number of establishments or the average number of employees per establishment for the meatpacking and prepared meats industry. However, the component industries showed different movements. In meatpacking, the number of establishments declined 4 percent and the number of employees per establishment fell from 63 to 56. In the prepared meats industry, there were 2 percent fewer establishments than in 1967, while the average number of employees per establishment rose from 40 to 48.

Since 1967, there has been a trend toward fewer large-

Table 2. Productivity indexes for the red meat products industry and two components, 1967–82

[1977 = 100]

Year	Red meat products	Meat-packing	Sausages and other prepared meats
1967	74.8	73.6	79.2
1968	76.6	76.1	78.9
1969	75.7	76.3	73.8
1970	77.3	78.7	72.8
1971	79.3	79.8	78.8
1972	85.0	87.1	80.2
1973	82.8	88.7	69.1
1974	84.5	88.1	76.7
1975	84.4	88.6	74.8
1976	93.4	97.5	84.2
1977	100.0	100.0	100.0
1978	98.7	100.9	93.6
1979	101.7	104.9	94.6
1980	107.0	109.1	101.8
1981	107.9	114.1	94.3
1982	107.7	115.6	90.4
Average annual rates of change (in percent)			
1967–82	2.8	3.2	1.9
1967–72	2.2	2.9	0.1
1972–75	0.0	0.4	-1.0
1975–80	4.2	3.7	5.4
1980–82	0.3	2.9	-5.8

scale cattle and hog plants but those remaining have increased their volume of operations. In 1975, 211 cattle plants accounted for 73 percent of commercial slaughter; by 1982, 134 plants made up 80 percent of such slaughter. Economies of scale in hog slaughtering have been similarly affected.⁴

Capital expenditures

Increases in capital expenditures are important and frequently contribute to advances in output per hour. During 1967–81, the annual rate of growth in new capital expenditures per employee averaged 8.9 percent in meatpacking and 10.2 percent in prepared meats. In comparison, the average for all manufacturing during this same period was 10.6 percent. In 1981, the level of capital expenditures per employee was less in meatpacking and prepared meats than for manufacturing in general. In 1981, meatpackers expended \$2,400 per employee and prepared meat processors, \$2,600 per employee for new capital expenditures, compared with \$3,900 for all manufacturers. In 1980, the most recent year for which data are available, meatpackers and prepared meat processors spent slightly more than 70 percent of their new capital expenditures on machinery and equipment, compared with 80 percent for all manufacturing. The remainder was used to finance new structures and plant additions.

Technological advances

The structure of the red meat industry has changed rapidly over the study period. For meatpackers, the low return on sales, relative to other manufacturing sectors, has encouraged volume operations. Because of increasing market demand for products such as boxed beef, rebound meat, and portioned packaging, there has been an ongoing need for new equipment and redesigned plant layouts. Technology has been introduced which has resulted in increased yields and improved product flow. Consumer demand for convenience products and smaller portions has encouraged the use of equipment capable of processing a larger variety of meat products with higher speed and product consistency.

In meatpacking plants, significant technological innovations were made in the 1960's and 1970's, which automated processing and helped reduce unit labor requirements. For beef slaughtering, carcasses are moved on an overhead rail system between cutting stations replacing the older "bed" system. To reduce steps, workers equipped with power knives and saws are positioned on moving platforms. These platforms, which are raised and lowered as the carcass passes, allow the operator to use a balanced power saw with a minimal need to alter the saw position.

For hide removal, skilled workers have largely been eliminated through the use of mechanical hide pullers. Labor requirements in rendering operations have been reduced in some cases to as few as one worker operating a central control panel.⁵ For hog slaughtering, similar labor-saving

technology has been introduced.

When beef is boxed, it goes through further fabrication as the carcass is processed into primal and subprimal cuts. This stage of processing requires extensive use of manual labor and has been difficult to automate except for the packaging and warehousing of boxed beef. After cutting, the beef is vacuum packed and placed in cartons according to specific market requirements. Boxed beef currently accounts for more than 50 percent of the federally inspected slaughter of steers and heifers. In the future, packers are expected to further fabricate meat into final retail cuts, which may lead to more automated cutting and packaging equipment.

In the prepared meats industry, portion-control steak cuts require more labor to fabricate than the processed meat products. Boneless steaks must be tenderized and individually portion-cut with powered meat slicers. These products are then wrapped, weighed, vacuum packaged, and blast frozen. In contrast, processed and shaped meats are prepared in batch and use more automated grinding and blending equipment. Production lines are centrally controlled with computers, which are used to monitor and control ingredients and the proportion of fat content.

Equipment used to process meat includes continuous vacuum sausage stuffers and vacuum packaging machines. Labor requirements have been reduced by the use of automatic sausage- and weiner-making equipment that provides a continuous filling, linking, and looping operation. Labor requirements have also been reduced by automatic deboning of meat, which is currently equaling yields obtained in manual boning. Slicing machines are being introduced in the prepared meats industry that make use of microprocessor technology to ensure portion-controlled cuts, high speed, and uniform stacking. In ham processing, a recent technological change is the cooking of ham in the finished package, which has lowered labor requirements.

Once meat is processed, the packaging and shipping stage is highly automated. Labor requirements have been reduced with high-speed packing equipment, conveyors, automatic palletizing machines, and storage and retrieval systems controlled by computer. In the shipping department, orders are placed in word processing equipment which activate computer-controlled cranes to move products to the loading docks. Plant storage and shipping include computerized robotics to automatically inventory and transfer boxed beef.

Unlike the semiautomated line operations of the volume packing and processing houses, small plants in the red meat products industry are often involved in a diversified and varied range of activity. It is not uncommon for a small plant to have a slaughter operation for beef, pork, lamb, veal, and goats; processing that includes cutting, wrapping, and freezing of fresh products; curing, including brine, stitch, or artery pumping, smokehouse operations, and aging and drying activity; locker rentals; portion-control cutting; custom processing; direct retail sales through service counters; and various seasonal production changes. This emphasis on

the further processing of meat products suggests that small plants will continue to be more labor intensive and less amenable to automation.

Industry trends

Declining employment and plant closings have resulted from the low-capacity utilization rates experienced in many meatpacking and prepared meat establishments.⁶ Many plants have become outdated and subject to competitive pressure from large production facilities capable of slaughtering and processing more than 5,000 cattle and 15,000 hogs per day. In the prepared meat industry, larger capacity plants are also becoming more common as is the trend toward a greater variety of "further processed" meat products. Pork processors have increased their size of operations and further diversified their production. Boneless, vacuum-packaged pork is available for retail display or in larger cuts which can be further processed by the butcher.

More and more prepared meat products are being marketed to fit the requirements of the expanding commercial and institutional market and also to meet consumer needs for convenience foods and smaller portions. Some processed meats, for example, weiners and lunch meats, have declined as a percent of the market but product variety has increased. New food products are being developed which will make use of nonmeat protein along with red meat protein. At

present some beef and lamb cuts are underutilized because of toughness and end up being sold as ground meat.

As technology improves, restructured meat will replace some of the beef currently marketed as ground products and intact muscle cuts. Restructured meat requires that muscles and large meat pieces be reduced in size and rebound into a desired shape such as steaks and roasts; flaking machines are needed to form and texture such meat. Restructured meat products now account for a small part of the retail meat sales but their proportion is expected to grow. Research is continuing to provide restructured meat products to the institutional meal market. Equipment is needed that will meet rigid portion control and composition control.⁷

AN INCREASE IN PRODUCTIVITY in the red meat products industry is expected during the 1980's as a result of more sophisticated equipment and further industry restructuring. Major technological changes have been made in slaughtering operations over the past 15 years and emphasis will probably shift to technology needed for the further fabrication of meat. Boxed beef production is continuing to influence plant size by encouraging volume operations. In the more capital-intensive prepared meat industry, batch processing is already highly mechanized but productivity should also grow as equipment is modified to meet the needs for new product development. □

—FOOTNOTES—

¹The red meat products industry makes up part of meat products which is designated as SIC 201 in the *Standard Industrial Classification Manual 1972* and its 1977 supplement, issued by the U.S. Office of Management and Budget. Meatpacking plants, SIC 2011, are composed of establishments primarily engaged in the slaughtering, for their own account or on a contract basis for the trade, of cattle, hogs, sheep, lambs, and calves for meat to be sold or to be used on the same premises in canning and curing, and in making sausage, lard, and other products. Sausage and other prepared meat products plants, SIC 2013, are composed of establishments primarily engaged in manufacturing sausages, cured meats, smoked casings, and other prepared meats and meat specialties from purchased carcasses and other materials. Sausage kitchens and other prepared meat plants operated by packing houses as separate establishments also are included in this industry.

²1983 U.S. *Industrial Outlook* (U.S. Department of Commerce, Bureau

of Industrial Economics, 1983), p. 37-7.

³*Industry Wage Survey: Meat Products, May 1979*, Bulletin 2082 (Bureau of Labor Statistics, 1980), p. 2.

⁴*Meatfacts, 1983 Edition* (Washington, American Meat Institute, 1983), p. 13.

⁵*Technology and Labor in Four Industries*, Bulletin 2104 (Bureau of Labor Statistics, 1982), pp. 1-8.

⁶1983 U.S. *Industrial Outlook*, pp. 37-4 to 37-6. See also "The Return of the Meatpackers," *Fortune*, May 2, 1983, p. 257; and Rod Bowling, "SWMPA Generates Ideas," *The National Provisioner*, Sept. 3, 1983, pp. 6-8.

⁷Roger Mandigo, "Restructured beef products may help reverse market trends," *The National Provisioner*, Apr. 2, 1983 p. 56.

APPENDIX: Measurement techniques and limitations

Indexes of output per employee hour measure changes in the relation between the output of an industry and employee hours expended on that output. An index of output per employee hour is derived by dividing an index of output by an index of industry employee hours.

The preferred output index for manufacturing industries would be obtained from data on quantities of the various goods produced by the industry, each weighted (multiplied) by the employee hours required to produce one unit of each good in some specified base period. Thus, those goods which require more labor time to produce are given more importance in the index.

In the red meat products industry, real output was estimated from data on both physical quantities and value adjusted for change in price. Physical quantity data on carcass beef, and primal and fabricated cuts of beef were obtained from the U.S. Department of Agriculture. The boxed beef component of this physical quantity was adjusted to reflect the additional labor required to fabricate and package this product. The other components of output for SIC 2011 and 2013 were estimated using a deflated value technique. Changes in price levels were removed from current-dollar values of production by means of appropriate price indexes.

To combine segments of the output index into a total

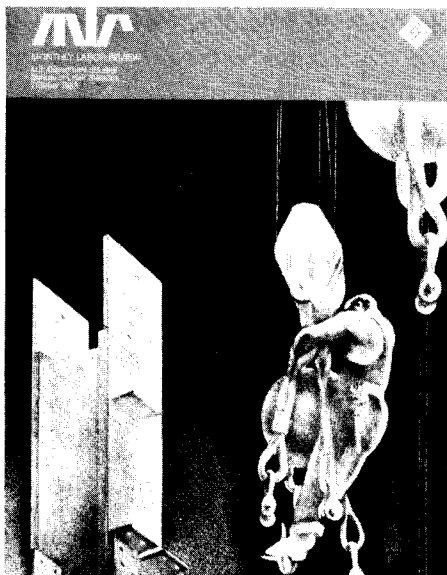
output measure, employee hour weights relating to the individual segments were used, resulting in a final output index that is conceptually close to the preferred output measure.

The indexes of output per employee hour relate total output to one input—labor time. The indexes do not measure the specific contribution of labor, capital, or any other single factor. Rather, they reflect the joint effect of factors such as changes in technology, capital investment, capacity uti-

lization, plant design and layout, skill and effort of the workforce, managerial ability, and labor-management relations.

The average annual rates of change presented in the text are based on the linear least squares trend of the logarithms of the index numbers. Extensions of the indexes appear annually in the BLS bulletin, *Productivity Measures in Selected Industries*. A technical note describing the methods used to develop the indexes is available from the Division of Industry Productivity Studies.

Mid-Air—1931 and 1984



Louis Lozowick's lithograph, "Mid-Air" (left picture), which appeared on the front and back covers of the October 1983 *Monthly Labor Review*, drew praise from art lovers but not from those conscious about safety on construction sites.

Thorne G. Auchter, then Assistant Secretary of Labor for Occupational Safety and Health, wrote the *Review* that, in 1931, "a construction worker riding to work on the ball and hook of a crane" may have been "a symbol of the American work-force—tough, fearless, and hard-working. But to the modern safety professional, this scene is another, more frightening kind of symbol. It illustrates deadly hazards that were common practices 50 years ago."

"Even today," Auchter added, "improper hoisting of personnel causes tragedies. Last spring, for example, four

workers were killed while being lifted by a crane during construction at a Florida football stadium."

Auchter provided a photograph (right picture) of a hoisting scene at a temporary site. He reported that OSHA has prepared safety standards for hoists and has circulated them for public comment.

