

Poultry Plants Lowering Production Costs and Increasing Variety

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Over the past 30 years, large plants producing a variety of ready-to-cook poultry products have come to dominate the U.S. poultry slaughter industry. In 1967, less than one-third of our poultry was produced in large plants, but today more than four-fifths comes from plants employing more than 400 workers. Moreover, production has changed from mainly whole birds for domestic consumption to cut-up and deboned poultry packed in bulk containers for both the domestic and export markets and chicken and turkey parts packed in Styrofoam trays for domestic consumption.

An increase in average plant size can cause the number of plants to drop and the production share of the largest plants to rise because each plant would then account for more of industry production. However, the number of poultry slaughter and processing plants in 1992 was about the same as in 1967. The four-firm industry concentration ratio (the share of industry sales from the four largest firms) did not change substantially for turkey slaughter and stood at 35 in 1992. For chicken slaughter, the four-firm concentration ratio rose over the 1977-92 period from 22 to 41. This

level is not particularly high when compared with levels for other manufacturing industries. By contrast, similar increases in plant size for cattle and hog slaughter coincided with a 75-percent reduction in the number of hog and cattle slaughter plants between 1967 and 1992. Based on product value data from the Bureau of the Census, the four-firm concentration ratio in cattle slaughter increased from 26 to 71 during this time. Many economists believe that, when four-firm concentration ratios exceed 80, it is easier for large firms to raise prices without fear of a competitor taking away sales by selling a similar product at a lower price because many retailers may not even stock products from smaller firms, and larger firms have fewer competitors that would try to underprice them.

The trend toward larger plant sizes raises some public policy issues. Some critics argue that the need to continuously reduce production costs may come at the cost of worker safety and may impose compensation burdens on chicken and turkey farmers and slaughter plant workers. Then there's the issue of animal waste. Large slaughter plants require a vast number of live chickens that generate an enormous amount of animal waste. Historically, chicken and turkey farmers and slaughter plants have spread poultry waste on nearby farms as fertilizer. With bird farmers typically

located within 20 miles of a slaughter plant, bird farmers and plants have been disposing of a growing volume of animal waste within a confined area. In some parts of the country, animal wastes pose no environmental threat, but in other, more environmentally sensitive areas, the high concentration of animal wastes has resulted in nitrogen and phosphates leaching into ground water or washing into streams, causing water quality problems and environmental degradation.

Booming Demand Benefits Poultry Firms

Before 1970, most poultry bought by consumers was whole chickens and turkeys, and the export business was quite small. It would have been very difficult to find a restaurant or fast food outlet selling chicken sandwiches or nuggets; turkey luncheon meats, poultry frankfurters, and deboned chicken breasts did not exist. Today, exports account for almost one-sixth of U.S. poultry production. Consumers are besieged with neon signs alerting them to all sorts of fast food chicken products, and most supermarkets carry chicken nuggets, ground chicken patties, turkey bologna, and a wide variety of chicken and turkey traypacks containing various cuts. Indeed, Americans have come

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to take the availability of an eclectic mix of poultry products for granted.

Per capita poultry consumption has jumped from 34 pounds in 1960 (a level that was about one-half the level of beef) to 96 pounds in 1999—nearly 40 percent higher than beef consumption (table 1). The change began after 1950 when new poultry farming and processing techniques began to lower production costs, making poultry more price competitive with red meat. Price changes were particularly dramatic from 1960 to 1977 when the price of whole chicken fryers dropped from about half to about one-sixth the price of beef. Today, whole chicken fryers are about one-third the price of beef, and after accounting for inflation, are about half their 1960 price.

Already able to sell chicken at a much lower price per pound than beef, chicken companies further boosted chicken consumption with adept marketing programs. These companies enticed consumers worried about the amount of saturated fat in their diets by touting chicken's lower fat content relative to beef and pork. They also churned out a host of new, ready-to-use products such as boneless chicken breasts, marinated chicken pieces, and poultry frankfurters.

Chicken firms proved to be particularly canny marketers as they segmented their market along several dimensions. First, they observed that American consumers were willing to pay much higher prices for white meat breasts than for dark meat thighs and drumsticks. They also noted that some products, such as chicken feet, could fetch a higher price in overseas markets than in domestic markets. To take advantage of these taste differences, chicken processors began offering proportionately more white meat to domestic consumers and dark meat and other products to overseas consumers.

Exports of chicken began to take off after 1975. Before that time, the export market had never accounted for more than 5 percent of production. Exports doubled from 1975 to 1976 and, except for a couple of bad production years in the early 1980's, consistently increased, reaching 5 billion pounds (17 percent of production) in 1997.

Market segmentation by product quality preceded the surge in exports. In the late 1960's, some chicken and turkey producers realized that consumers would be willing to pay a higher price for higher quality birds. Frank Perdue and other chicken firms began earning a price premium on their higher quality birds by selling them under a brand name and selling lesser quality birds that just meet Grade A specifications to retailers for private-label (store brand) chickens. After brand names had been established, firms maintained their images by packaging cut-up and whole chickens in more expensive traypacks and other packaging and by launching ad campaigns that stressed the

high quality of their products. They also continued to reserve the highest quality birds for their own brands.

Chicken firms further stoked chicken consumption by marketing ready-to-eat products to nontraditional vendors, such as fast food restaurants and grocery store delis. By 1991, chicken nuggets, breaded parts, patties, popcorn chicken, and other semi-prepared chicken parts sold to restaurants and grocery stores accounted for over 10 percent of chicken sales. Recently, marinated whole birds have become popular items for take-out meals at both fast food restaurants and supermarket delis, and probably account for the increase in the percentage of chicken sold at retail as whole birds from 12.5 to 13.1 percent between 1995 and 1997, a reversal of a 35-year downward trend.

Credit: Ken Hammond, USDA.



The average chicken plant now produces about four times as much product as it did 20 years ago as Americans' appetite for chicken has grown along with the variety of products offered, from chicken nuggets to marinated, fully cooked whole chickens.

Credits: USDA.

Increased processing came a little later for the turkey industry than for chicken. Although per capita consumption had increased from 6 pounds to 10 pounds between 1960 and 1980, turkey was still a very seasonal product. The introduction of turkey luncheon meats, sausages, and deli products after 1980, however, encouraged consumption to grow to 18 pounds per capita by the early 1990's. Similar to chicken, turkey firms exported dark meat and sold white meat in the domestic market. But unlike chicken, restaurateurs have not been nearly as receptive to turkey products.

Consumer acceptance of the new poultry luncheon meats, frankfurters, and other ready-to-eat poultry products coming to market after 1972 likely contributed to the nine-fold increase in per capita consumption of processed poultry products

to about 18.5 pounds in 1992. Some of this growth appears to have come at the expense of processed red meat products, which, based on Census data, dropped about 7.5 percent to 51.5 pounds per capita over the 1977-92 period.

Plants Change Their Product Mix

To lower production costs and capitalize on consumers' desires for easier-to-use products, poultry slaughter plants changed dramatically. Perhaps no change was as dramatic as the shift from the production of whole birds to chicken cut up into parts and boneless chicken meat trimmed manually or mechanically from the bone, commonly called deboned chicken. Prior to the late 1960's, most consumers wanting pre-cut poultry or

specialty parts had to ask an in-store butcher to cut up a whole bird. Chicken and turkey companies later recognized that many consumers preferred buying chicken parts to whole fryers and marketed their products accordingly.

The vast majority of chicken and turkey is cut up in slaughter plants, and for good reason. Although this approach increases the number of workers per production line, it avoids the costly process of offloading whole birds and having higher wage butchers prepare them at stores or other production workers process them at wholesale establishments. Moreover, by cutting up chickens and turkeys within the slaughter plant, poultry firms could increase total revenues by selling bulk bird parts in either domestic or export markets, whichever valued them higher, or using parts within

Table 1
Poultry Consumption Per Capita and Net Exports Soar and Prices Decline Between 1960 and 1999

Product	1960	1963	1967	1972	1977	1982	1987	1992	1997	1999
<i>Retail pounds</i>										
Per capita consumption:										
Chicken	27.8	30.8	32.4	41.7	40.2	47.0	57.4	67.8	72.7	78.8
Turkey	6.3	6.9	8.7	9.0	8.8	10.6	14.7	17.9	17.6	17.8
Beef	64.2	69.9	78.8	85.1	91.5	76.9	73.7	66.3	66.9	65.4
<i>Dollars per pound</i>										
Nominal retail prices (December): ¹										
Chicken	0.41	0.40	0.37	0.41	0.58	0.68	0.74	0.88	1.00	1.06 ²
Turkey	.55	.49	.47	.57	.83	.89	.89	.93	1.06	n.a.
Beef	.80	.78	.86	2.38	3.09	4.67	4.86	2.87	2.80	3.01 ²
Inflation-adjusted retail prices (December 1997): ¹										
Chicken	2.23	2.11	1.80	1.59	1.53	1.14	1.05	1.01	1.00	1.06 ²
Turkey	2.91	2.59	2.27	2.18	2.21	1.50	1.20	1.07	1.06	n.a.
Beef	4.36	4.14	4.14	9.16	8.22	7.84	6.90	3.30	2.80	3.01 ²
<i>Million pounds</i>										
Net exports:										
Chicken	137	157	88	100	349	524	767	1,530	5,043	4,421
Turkey	24	31	49	36	54	51	33	202	605	400

n.a. = Not available.

¹Prices are whole fryers for chickens, young hens for turkeys, and weighted composite of choice beef for beef.

²Year average; prices are not adjusted to 1997 levels because the inflation factor was not available.

Sources: Published in various issues of *Livestock, Dairy, and Poultry Situation and Outlook*, USDA, ERS. Early data also in *Poultry Yearbook and Red Meat Yearbook*, USDA, ERS.

the plant for the firm's own poultry products. Today, cut-up and deboned poultry account for nearly 90 percent of chicken and more than 50 percent of turkey slaughter plant production (table 2).

Poultry slaughter plants produce traypacks of cut-up poultry using packaging machinery added to the end of a cut-up line. Similarly, they convert some deboned poultry into their own luncheon meats, frankfurters, and other processed products. Private-label whole birds, traypacks, and processed products can be produced by a wholesaler, retailer, or another processor. By

1997, traypacks and processed products accounted for about 35 percent of chicken slaughter production, and processed products accounted for about 21 percent of turkey slaughter production. Whole birds and cut-up/deboned poultry for exports constituted about 18 and 11 percent, respectively, of total chicken and turkey output. Slaughter plants shipped the remainder of their whole birds and cut-up/deboned poultry to other domestic plants dedicated to performing a particular processing operation or to retailers and wholesalers for sale as private-label products (table 2).

Turkey plants have traditionally faced highly seasonal demand, with most production in the last half of the year for the end-of-the-year holiday season. This seasonal demand imposes a cost on slaughter plants, as they shut down their plants and lay off employees, only to restart plant production and rehire and retrain employees when demand picks up again. By 1992, consumers' greater year-round consumption of turkey permitted more evenly distributed production schedules in which costly layoffs and rehiring of workers were avoided. Much of the added production came from

Table 2

Slaughter Plant Product Mix Requires Fewer Whole Birds as It Becomes More Complex

Product	Share of total slaughter production							
	1963	1967	1972	1977	1982	1987	1992	1997
	Percent							
Product mix:								
Styrofoam traypacks—								
Chicken	n.a.	n.a.	13.9	15.8	20.5	24.2	21.9	24.3
Further processed (from cut-up, deboned, or whole birds)—								
Chicken	n.a.	n.a.	2.7	2.1	5.1	6.5	9.6	11.4
Turkey	n.a.	n.a.	10.4	14.6	19.3	16.2	22.2	20.6
Bulk domestic: Cut-up, deboned, and whole birds in large containers—								
Chicken	97.4	98.9	82.3	78.7	69.9	64.6	60.8	46.0
Turkey	97.7	97.4	87.7	82.7	78.7	82.9	73.6	68.2
Bulk export: Cut-up, deboned, and whole birds in large containers—								
Chicken	2.6	1.1	1.1	3.4	4.5	4.7	7.1	18.3
Turkey	2.3	2.6	1.9	2.7	2.0	0.9	4.2	11.2
Raw bird processing:								
Total cut-up and deboned—								
Chicken	15.2	21.9	29.6	38.2	48.1	56.1	78.2	86.9
Turkey	3.4	6.8	16.7	22.5	29.9	36.6	55.1	n.a.
Total whole birds—								
Chicken	84.8	78.1	70.4	61.8	51.9	43.9	21.8	13.1
Turkey	96.6	93.2	83.3	77.5	70.1	63.4	44.9	n.a.

n.a. = Not available.

Sources: U.S. Department of Commerce, Bureau of the Census, *Longitudinal Research Data Base*, 1963-97; U.S. Department of Agriculture, Economic Research Service, *U.S. Egg and Poultry Statistical Series*, 1960-90, 1991; National Turkey Federation and the National Chicken Council for 1992 and 1997 raw bird processing data.

cooked or otherwise processed products, which accounted for 15 percent of turkey slaughter plant production in 1992 versus only about 3 percent for chicken slaughter plants.

Larger Plants Enable Cost Reductions

Before 1950, chicken comprised a small part of the American diet. Chickens were raised by farmers as a way either to produce eggs or to put spilled grain, grass, and insects around the farmyard to productive use. Typically, chickens intended for egg production were hatched in the early spring, and since many young males were not needed for egg production, they were slaughtered together with hens not needed for egg production during the summer months. Large numbers of hens then became available for slaughter in the late fall when egg production dropped off.

Chicken farming changed dramatically after 1950 when improved feeds, veterinary services, and medicines made it possible to grow chickens in large quantities at much lower costs. Additionally, new chicken breeds enabled farmers to raise both meatier and more uniform-sized birds. Around this time, chicken supply contracts between slaughter plants and farmers emerged as a way to reduce the risk associated with raising chickens and permitted better control over chicken quality (see box). Glenn Bugos, a historian and fellow at the German Marshall Fund of the United States, asserts that by 1960, specialized bird breeds of uniform size, combined with advancements in slaughtering techniques and the availability of large numbers of chickens, led to large scale economies for chicken slaughtering plants (lower per unit production costs in larger plants than in smaller ones). These reductions in production costs were passed on to consumers in the

form of lower prices. Consumers responded by increasing consumption and making chicken a staple in the American diet.

Uniform bird size is particularly important to the low-cost conversion of live chickens into ready-to-cook and ready-to-eat products in modern chicken slaughtering plants. Typically, plants specialize in products made from breeds of uniform-sized chickens with similar quality characteristics because chickens of different sizes require costly plant equipment adjustments and specialized breeds are most suitable for certain types of products. Small chickens are usually cut up into parts for processing and export.

Medium-sized chickens are bred for traypack plants where chicken parts are packaged on Styrofoam trays for sale in grocery stores, and large chickens are used in deboning plants for production of boneless products.

After 1960, consumer tastes began to shift away from a preference for whole chickens toward semi-processed products, such as chicken parts in Styrofoam traypacks, and, after 1970, toward processed chicken products, such as luncheon meats, nuggets, and frankfurters. Most of these new products required cut-up and deboning operations that were typically added to the end of production lines. The combination of

Slaughter Plants Rely on Contracts With Chicken Farmers

Before the 1950's, farmers were reluctant to undertake chicken farming because investments in buildings, other equipment, feed, chicks or poults, and other inputs could easily be lost due to disease or natural calamities. Chicken feed suppliers recognized that they could increase their own sales by extending credit to farmers, enabling them to remain in business while they paid off their debts. This risk-sharing arrangement spurred chicken production and eventually evolved into the grower contracting arrangements now common to all poultry production. Meanwhile, the feed suppliers integrated further into slaughter and processing operations and now are the integrated chicken firms that provide much of the Nation's poultry.

Through contracting arrangements, integrated chicken firms accept much of the risk of chicken growing in exchange for greater control over both the quality and quantity of the birds. Usually, the firm provides company-owned chick or poult hatchlings and feed, veterinary services, medication, part of the fuel, and field supervisors to monitor operations. Ownership of the breeding stock and most of the

other inputs enables the firm to develop chicken breeds specifically to meet market needs and to better control feed and medication quantities, quality, and costs. The contract farmer provides housing, equipment, labor, water, and management, and then returns the fully grown chickens to the firm for slaughter. Usually, the firm pays a pre-established fee per pound for live broilers plus a bonus or penalty for performance relative to other chicken farmers. Performance is determined mainly by the amount of weight gained per unit of feed and losses due to disease.

Chicken firms adopted grower contracting much more vigorously than did turkey firms. Chicken contracts accounted for over 90 percent of all chicken production in 1955 and almost 100 percent by 1994. In turkeys, contract growing accounted for only 56 percent of production by 1994, up from 4 percent in 1955. By contrast, about 30 percent of turkey farms are owned outright by the turkey firm, whereas, chicken firms own about 1 percent of chicken farms. Some economists attribute this difference in farm ownership to the greater riskiness of turkey farming.

these new, more labor-intensive operations and the increase in output caused a jump in the number of employees per chicken slaughtering plant. U.S. Bureau of Census data indicate that, by 1992, the average chicken plant produced about four times as much product as in 1972, and that production from plants with more than 400 employees rose from less than 30 percent of industry output to more than 85 percent.

Researchers at USDA's Economic Research Service used data from USDA and the Census Bureau to analyze slaughtering costs over the 1972-92 period for chickens and the 1967-92 period for turkeys. The Census data give plant-level information on all plants with more than 20 employees, including quantities slaughtered, dollar values of different products produced, materials used, employment, and capital equipment. Our analyses suggest the existence of scale economies that are much greater than those in cattle and hog slaughter, and, unlike those

of cattle and hogs, they show no signs of decreasing with plant size. Chicken plants that were two times larger than the average-sized plant had 8 percent lower per-unit costs relative to average-sized plants, and those four times larger had 15 percent lower per-unit costs (table 3). Similarly, turkey plants that were two times larger than average plants had 11 percent lower per-unit costs, and plants four times larger had 17 percent lower costs.

The existence of large scale economies enabled the largest chicken and turkey plants to decrease labor, nonmeat material, and capital costs by about 10 percent over those of their smallest competitors. To remain competitive, smaller plants had to either increase their own production, reduce production costs, or switch their product mix to highly specialized products for niche markets. Some plants increased output, but few, if any, were able to lower production costs while remaining the same size and

were therefore compelled to exit the industry. We estimate that about two-thirds of all plants exited the industry over each 5-year Census period during the 1967-92 period and that almost no plants with fewer than 100 employees existed after 1982. Despite this dramatic shift in plant size, new plant construction caused the number of poultry slaughter and processing plants to remain almost constant.

Whether or not the chicken or turkey slaughter industries will consolidate to the same extent as the cattle and hog slaughter industries may depend on growth in demand for poultry. Many economists believe that scale economies are a driving force in industry consolidations. Yet, even though scale economies in poultry slaughtering are stronger than in cattle and hogs, the number of poultry slaughtering plants has not declined. New, large plants have been built to supply the tremendous growth in domestic consumption and exports. If growth in poultry consumption and exports were to slow, however, it appears likely that plant consolidation would follow.

Table 3

Poultry Production Costs Are Much Lower in Larger Plants

Product	Plant size	Process cost ¹	Average cost index ²	Plant size relative to 1992 mean
	Million pounds	Percent of total costs	Ratio	
Chicken	37.4	32.4	1.05	0.26
	74.8	31.6	1.00	.53
	149.6	30.8	.92	1.06
	299.2	29.9	.85	2.11
Turkey	21.9	35.0	1.04	.19
	43.7	33.8	1.00	.38
	87.4	32.6	.89	.75
	174.8	31.3	.83	1.51

¹Process costs include the costs of labor, all packaging and shipping materials and other nonmeat materials, energy, and capital costs. It does not include the cost of live animals for slaughter.

²All costs are relative to average-sized plants. Average-sized chicken slaughter plants during the study period from 1972 to 1992 produced about 74.8 million pounds of chicken meat per year, and the average-sized turkey slaughter plants during the study period from 1967 to 1992 produced about 43.7 million pounds of turkey per year.

Source: Michael Ollinger, James MacDonald, and Milton Madison, *Structural Change in U.S. Chicken and Turkey Slaughter*, forthcoming AER, U.S. Department of Agriculture, Economic Research Service.

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