

Concentration and Consolidation in Livestock Slaughter

Concentration in cattle slaughter increased dramatically in the last two decades, and three firms now dominate the industry. Market concentration in hog, chicken, and turkey slaughter is not particularly high when compared with other manufacturing industries, but has increased over the years. Large plants now dominate production in all major slaughter sectors, and consolidation among large plants over the past two decades is a major cause of increased concentration.

Concentration

The four-firm concentration ratio measures the share of an industry's output held by the four largest producers in the industry.⁹ Changes in four-firm ratios are widely used as summary indicators of structural change.

Using Census Bureau data, table 3-1 reports concentration ratios for cattle, hogs, chickens, and turkeys. The ratios measure the four largest firms' share of the dollar value of shipments from plants in each slaughter class.¹⁰

Four-firm concentration in cattle slaughter remained stable from 1963 through 1977, then rose from 25 per-

cent in 1977 to 71 percent in 1992 (table 3-1). The Census Bureau publishes four-firm concentration ratios for about 1,000 different product classes, and many of the series go back to 1947. The change in cattle slaughter concentration is unique: no other product class shows as dramatic an increase in any 15-year period.

Concentration in hog slaughter remained stable from 1963 through 1987, but then increased sharply between 1987 and 1992. Concentration in chicken slaughter rose sharply from 1977 to 1987, but has since remained stable. Similarly, turkey slaughter became much more concentrated between 1963 and 1972, and then stabilized (table 3-1). Of the four classes, only cattle could be described as having unusually high concentration today, when compared with other manufacturing classes.¹¹

Census data are subject to two potential problems. First, they measure concentration as the value of plant (establishment) shipments. But suppose that a firm operated a plant that only slaughtered cattle and then shipped the carcasses to a second plant that both slaughtered cattle and also cut up carcasses into boxed beef. The Census approach would count the value of shipments from both the slaughter-only plant and the fabrication plant. But since fabrication plant shipments already include the value of shipments from the slaughter-only plant, the Census measure double-counts shipments among slaughter plants, and this approach may overstate the value of shipments from the combined firm and thus exaggerate industry concentration. Second, Census measures may be too broad. Cattle plants specialize within species; the largest plants slaughter only steers and heifers, while other plants specialize in cows and bulls. Not only do the plants use different techniques, but the meat outputs are not ready substitutes: steer and heifer meat is

⁹ There are many potential concentration measures. The four-firm ratio is easy for statistical agencies to compute and provides confidentiality to individual firms. For those reasons, the measure has for several decades been calculated for many industries by Federal statistical agencies.

¹⁰ The classes are defined by the Standard Industrial Classification (SIC), a hierarchical coding for products and establishments in the economy. Establishments that primarily process food products are assigned to the two-digit SIC code "20"; those food processors that specialize in meat slaughter and processing are assigned to the three-digit class "201." Establishments that slaughter any live cattle, hogs, horses, or sheep and lambs are then assigned to the four-digit industry "2011" (those that process or slaughter poultry are assigned to "2015"). Finally, slaughter products from these plants are assigned to five-digit product classes: "20111" for cattle, "20114" for hogs, "20151" for chickens, and "20153" for turkeys. Our concentration measures are based on shipments from establishments assigned to the five-digit slaughter product classes.

¹¹ About 10 percent of U.S. manufacturing industries are more concentrated than cattle slaughter, while the other three slaughter classes are close to the mean for manufacturing.

Table 3-1—Four-firm concentration ratios, shipments basis, in four slaughter industries

Census year	Slaughter industry			
	Cattle	Hogs	Chickens	Turkeys
1963	26	33	14	23
1967	26	30	23	28
1972	30	32	18	41
1977	25	31	22	41
1982	44	31	32	40
1987	58	30	42	38
1992	71	43	41	45

Source: Longitudinal Research Database, U.S. Bureau of the Census.

used in steaks and roasts while leaner cow meat is more often combined with steer trimmings to make ground beef. It may be useful to measure concentration on a narrower basis.

Table 3-2 provides a check on the Census Bureau data, with data collected by USDA's Grain Inspection, Packers and Stockyards Administration (GIPSA). That agency reports data for some precisely defined slaughter classes, such as steers and heifers, and for one precisely defined steer and heifer slaughter product—boxed fed beef. The GIPSA data are calculated on a quantity basis, the share of animals procured for slaughter by the largest firms (for boxed beef, the measure is the share of boxed beef output). The timing also differs from Census; GIPSA measures begin in 1980, but are produced in each year, and the most recent as of this writing was 1997. The GIPSA data are in some cases more direct measures than the Census concepts, and the two series provide checks on each other.

GIPSA and Census data tell the same story. Concentration in GIPSA cattle slaughter measures

increased dramatically, more than doubling after 1980 (table 3-2). Concentration is especially high in steer and heifer slaughter, and shows the most dramatic increase there. And concentration in boxed beef production is equally dominated by the four largest steer and heifer slaughter firms (83 percent of output). GIPSA data, like Census, show the same recent increase in hog concentration, as well as a high level of concentration in sheep and lamb slaughter, with a sharp increase between 1982 and 1987 (we gathered no Census data on sheep and lamb slaughter).

Census and GIPSA concentration measures are similar for hog slaughter, but GIPSA cattle concentration falls consistently below the Census measures. GIPSA cattle concentration should be lower, partly because of Census double-counting, but also because the four largest firms receive higher prices for their meat products than other firms do and therefore hold higher shares of (value of) shipments than of animals. Smaller firms are more likely to slaughter lower valued cows, and less likely to slaughter higher valued steers and heifers; higher animal prices lead to higher meat prices. Moreover, large plants also do more in-plant fabrication, breaking carcasses down into boxed beef and fetching higher product prices.

Consolidation Into Large Plants

Concentration could increase because of mergers among many independent firms, or because plants become larger. Over the last 25 years, large plants have become vastly more important in slaughter industries, as evidenced by two different measurement bases.

GIPSA data sort cattle slaughter plants by size; the largest slaughter more than half a million cattle in a year, while large hog plants slaughter more than a mil-

Table 3-2—Four-firm concentration ratios, animal input basis, in slaughter classes

Year	Slaughter class					
	Cattle			Boxed fed beef	Hogs	Sheep and lambs
	Cows/bulls	Steers/heifers	All			
Ratio						
1980	10	36	28	53	34	56
1982	9	41	32	59	36	44
1987	20	67	54	80	37	75
1992	22	78	64	81	44	78
1997	31	80	70	83	54	62

Source: U.S. Department of Agriculture (1999).

Table 3-3—Percent of animals slaughtered in large plants

Report year	Slaughter classes, and size cutoff ¹					
	All cattle	Steers/heifers		Cows/bulls	Hogs	Sheep/lambs
	(>500,000)	(>500,000)	(> 1 million)	(>150,000)	(>1 million)	(>300,000)
			<i>Percent</i>			
1977	12	16	nr	10	38	42
1982	28	36	nr	15	59	73
1987	51	63	31	20	72	84
1992	61	76	34	38	86	74
1997	65	80	63	57	88	71

¹ The size cutoff, in parentheses, refers to the number of animals slaughtered annually.

nr = not reported.

Source: U.S. Department of Agriculture (1999).

lion. Notions of “large” can change over time; the agency did not separately report cattle plants that slaughtered more than a million animals until 1987; by 1997, 14 plants were in that newly established category.

The emergence of large plants is quite striking. In 1977, 84 percent of all steer and heifer slaughter occurred in plants that slaughtered less than half a million a year. By 1997, plants in that category saw their share drop to 20 percent, while 63 percent of slaughter occurred in plants that slaughtered more than a million steers and heifers (table 3-3). In hog slaughter, large plants handled 38 percent of all slaughter in 1977, but 88 percent by 1997.

Census data report on the value of shipments by employment size of firm. We use that basis here, to maintain some comparability to other Census industries. We define large plants as those with at least 400 employees, in order to meet Census confidentiality rules.

Table 3-4—Share of industry value of shipments in large plants (> 400 employees)

Census year	Slaughter industry			
	Cattle	Hogs	Chickens	Turkeys
	<i>Percent</i>			
1963	31	66	d	d
1967	29	63	29	16
1972	32	62	34	15
1977	37	67	45	29
1982	51	67	65	35
1987	58	72	76	64
1992	72	86	88	83

d = cannot be disclosed, due to confidentiality concerns.

Source: Longitudinal Research Datafile, U.S. Bureau of the Census.

Census measures are not directly comparable with the GIPSA series, but they show the same trend. Large-plant shares in all four categories (cattle, hogs, chickens, and turkeys) increased dramatically during 1963-92 (table 3-4). GIPSA data generally show a much sharper increase than Census data. Since the GIPSA data are based on the number of animals, while Census data use an employment cutoff, the contrast suggests a substantial increase in labor productivity at large plants. Each source shows sharply increased concentration in cattle slaughter, and a more recent concentration in hogs.

Conclusion

The evidence shows a dramatic consolidation of slaughter in large plants in all four animal classes. That pattern suggests that scale economies may be important in slaughter industries, and that something happened to make scale economies more important in recent years. Later in this report, we explore those issues with statistical cost models. We estimate the extent of scale economies in slaughter, and identify a growing importance of scale economies.

A second interesting pattern stands out. Dramatic consolidation among large plants in four slaughter industries led to dramatic concentration increases in just one—cattle slaughter. Changes in concentration have been far more modest in hog, chicken, and turkey slaughter. Demand growth has likely played a role here. As chapter 2 shows, per capita poultry consumption has grown sharply in the United States over the last two decades, while per capita pork consumption has grown modestly and beef consumption has been

flat. When combined with modest export and population growth, the cattle slaughter industry has faced very slow to declining demand growth. When set against shifts to large plants, the results should be increased concentration.

Appendix 3A: Sources of Establishment Data for Livestock Slaughter

Three Federal agencies—USDA's Grain Inspection, Packers and Stockyards Administration (GIPSA) and Food Safety and Inspection Service (FSIS), and the Bureau of the Census (U.S. Department of Commerce)—report data on animal slaughter. Each has different goals, which lead to different methods of data collection. In general, the three agencies report data from the same set of large and medium-sized plants, but differ substantially in their coverage of very small plants.

GIPSA is a regulatory agency whose mission is to guard against anticompetitive, deceptive, and fraudulent practices in the pricing and movement of livestock and meat products. FSIS is also a regulatory agency, whose primary activity is inspection of meat and poultry sold in interstate commerce, primarily to ensure animal and human health. The Census Bureau, as part of its census of manufactures, aims to measure the economic characteristics—such as sales, costs, and employment—of meat and poultry industries. Different agency missions lead to different reporting requirements.

GIPSA data are based on reports from slaughtering meatpackers operating in commerce in the United States. Small packers (who purchase \$500,000 or less of livestock annually) are exempt from GIPSA reporting requirements. We can assume that plants that slaughter fewer than 10 steers or 90 hogs a week (roughly) are omitted from GIPSA reports, as are plants that do not purchase livestock for slaughter but instead perform custom slaughter services for livestock owners. For reporting plants, GIPSA obtains data on livestock volumes by plant, species, and location of seller.

All plants that slaughter or process meat to be sold in interstate commerce are subject to Federal safety inspection. FSIS reports therefore cover a wide range of plant sizes, but do not cover plants that sell only

within States, exempting many very small plants but still capturing more small plants than GIPSA. In support of its regulatory responsibilities, FSIS obtains useful summary data on livestock volumes by plant and species.

The census of manufactures reports data from all plants whose primary business is manufacturing. As a result, facilities that do some animal slaughter, but that are primarily in retailing or wholesaling or other nonmanufacturing activities, are not reported in the census of manufactures. Of those whose primary business is manufacturing, the Bureau assigns all plants that do any red meat slaughter to SIC code 2011, meatpacking, even if they are primarily active in meat processing. Plants that only process meat, conducting no slaughter on premises, are assigned to SIC code 2013, meat processing. The Bureau has an additional small business exemption for some data: plants with fewer than 20 employees are not required to make detailed reports. The Census Bureau counts those plants, but does not obtain detailed information on slaughter volume from them. Thus, Census procedures likely count more small plants than GIPSA, but exempt more volume.

How do the three sources compare? In general, aggregated numbers are quite similar, because the three sources cover a common set of large plants. For example, appendix table 3-1 compares total slaughter volumes for 1992. USDA's National Agricultural Statistics Service (NASS) estimates the total commercial slaughter of cattle and hogs. Federally inspected slaughter totals (FSIS) account for 97.6 percent of total commercial cattle and hog slaughter—the difference presumably slaughter in State-inspected plants. GIPSA totals sum to 94.9 percent of total commercial cattle slaughter, and 96.5 percent of total commercial hog slaughter, with the differences reflecting slaughter by exempt entities—very small plants. Finally, Census totals, which exempt establishments primarily outside of manufacturing and exempt very small plants from detailed reporting of species volume, capture 94.5 percent of commercial cattle slaughter and 91 percent of hog slaughter.

The three series can disagree widely on plant counts, because very small plants make up substantial shares of any plant count. For example, all three agencies report substantial declines in plant numbers between 1977 and 1992 (appendix table 3-2): Census red meat slaughter plants declined by 46.4 percent, GIPSA by

Appendix table 3-1—Slaughter volumes, by reporting system (1992)

Plant category	Cattle		Hogs	
	Number	Percent of commercial	Number	Percent of commercial
All commercial plants	32,874	100.0	94,889	100.0
Federally inspected	32,094	97.6	92,611	97.6
Reporting to GIPSA	31,200	94.9	91,550	96.5
Census, SIC 2011	31,068	94.5	86,308	91.0

Sources: U.S. Department of Agriculture (1997), and Longitudinal Research Database, U.S. Bureau of the Census.

43.1 percent, and FSIS by 33.1 percent. But the absolute levels differ sharply. The Census reports over twice as many plants as GIPSA does, and is mostly higher than FSIS counts. This is because the Census approach counts more small plants than GIPSA does while its exempt plants (those outside of manufacturing that may do some slaughter) may overlap with the plants that FSIS does not count (those that slaughter but do not sell in interstate commerce).

Comparisons are more difficult at the species level. GIPSA and FSIS count plants as cattle slaughter facilities if they slaughter any cattle, even if they primarily slaughter other species such as hogs. They then report the same facilities as hog slaughter plants if they slaughter any hogs. Census counts exempt very small plants from reporting livestock volumes, so they are not captured in counts of cattle or hog slaughter plants. Furthermore, for purposes of counting plants, we count a plant as a cattle (hog) slaughter plant only if its primary activity is cattle (hog) slaughter. That is, we count Census plants only once, while GIPSA and FSIS plants may be counted several times when summing slaughterers of particular species.

Appendix table 3-2—Livestock slaughter establishments, by reporting system, 1977-96

Year	Reporting system		
	GIPSA	Federally inspected	Census, SIC 2011
	Number		
1977	1,000	1,682	2,590
1982	884	1,688	1,780
1987	722	1,483	1,434
1992	569	1,125	1,387
1996	418	988	nr

Sources: U.S. Department of Agriculture (1997), and Longitudinal Research Database, U.S. Bureau of the Census.

Thus, Census reports the fewest plants (appendix table 3-3) because it does not count very small plants and because we assign a plant to one species only. GIPSA counts are higher because that agency assigns plants to more than one category and because it probably counts more very small plants. Finally, FSIS reports on more very small plants, for these purposes, than either of the other agencies, and also assigns plants to more than one species category. Still, the three sources all show large declines in the number of slaughter plants over time.

The empirical analyses in this report are primarily based on data reported by the Census Bureau establishments in appendix table 3-3 (exceptions are some aggregated data from GIPSA records). We hence omit many very small establishments. However, those establishments account for very small shares of industry production.

Appendix table 3-3—Slaughter plants, by species and by reporting system

Year	Cattle			Hogs		
	Census	GIPSA	FSIS	Census	GIPSA	FSIS
	<i>Number</i>					
1963	1,817	nr	nr	1,410	nr	nr
1967	1,031	nr	nr	797	nr	nr
1972	782	920	nr	575	594	nr
1977	598	814	1,568	404	469	1,231
1982	391	632	1,506	325	466	1,344
1987	265	474	1,317	214	352	1,182
1992	215	342	971	182	300	921
1996	nr	274	812	nr	232	770

nr = not reported

Census refers to Census of Manufactures ("cattle" covers plants primarily producing in SIC 20111, while "hogs" covers plants primarily producing in SIC 20114).

Sources: U.S. Department of Agriculture (1997), and Longitudinal Research Database, U.S. Bureau of the Census.