3. Concentration and Consolidation in Poultry Slaughter

Concentration in the poultry slaughter industry has increased over the years, but is not particularly high relative to other manufacturing industries. The top four firms control less than half of the final product market. More dramatic has been the growth in plant size. In 1972, plants with over 400 employees accounted for approximately a fourth of chicken and turkey output, but by 1992, the share controlled by these large plants had increased to over 80 percent. This shift to much larger plant sizes suggests that scale economies are important. Changes in industry concentration and plant size are documented in this chapter. Later, we empirically measure the extent of scale economies and assess their role in encouraging the growth of plant size.

Concentration

The four-firm concentration ratio measures the share of industry output held by the four largest producers and is widely used as a summary indicator of structural change.[3] Table 3-1 gives four-firm concentration ratios for chickens and turkeys based on the Longitudinal Research Database (LRD) plant-level data.

Industry categories are defined by the Standard Industrial Classification (SIC), a hierarchical coding for products and establishments in the economy. Establishments that primarily slaughter poultry and produce further-processed poultry products are assigned to the four-digit class "2015." In this report, plants with over 50 percent of their output from chicken slaughter products were assigned the five-digit code "20151," and those with over 50 percent of their output from turkey slaughter products were given "20153." Plants that produce only further-processed products, such as luncheon meats, frankfurters, and poultry hams, were assigned "20155."

Concentration in chicken slaughter rose sharply between 1977 and 1987, but remained constant thereafter. Similarly, turkey slaughter concentration increased substantially between 1963 and 1972 and then stabilized. Poultry processing concentration has varied over the 1963-92 period with no clear trend.

With concentration ratios below 50, neither chicken nor turkey slaughter nor poultry processing have particularly high concentration ratios relative to other manufacturing industries.[4] By contrast, MacDonald et al. (1999) report that the beef slaughter concentration ratio now exceeds 70 on a value of shipment basis and almost 80 for steers and heifers on an animal basis. Hog slaughter concentration is similar to chicken and turkey.

Economists often link differences in plant size and demand conditions to differences in concentration ratios. All four slaughter industries have shifted to larger plants, suggesting that four-firm concentration ratios should be similar across industries if there were no demand differences. However, consumption of chicken and turkey has been rising, and pork consumption has held steady since the 1970's, while per-capita beef consumption has declined by almost 30 percent from its peak in 1977 to 1999.

Heffernan et al. (1999) report higher concentration ratios for chicken (about 35 versus 42 percent in 1986 and 45 versus 41 percent in 1992) and lower concentration ratios for turkey (about 31 versus 38 percent in 1987 and 35 versus 45 percent in 1992) than those reported here. Heffernan et al.'s data come from surveys conducted by the National Chicken Council and *Turkey World* magazine. These surveys differ from Census surveys in that responses are voluntary for industry surveys and mandatory for Census, meaning that Census data include many more respondents. Additionally, Census data are based on the value of shipments, a measure that reflects both pounds of output and the price of that output, whereas Heffernan's data are based on pounds of ready-to-cook broilers and liveweight turkeys.

[3] There are many potential concentration measures. The four-firm ratio is commonly used and has been calculated by statistical agencies for several decades.

[4] The use of Census data results in some double-counting because it is based on the value of plant (establishment) shipments. For example, suppose that a firm operates a chicken slaughter plant and then ships whole birds to another of its own plants for cutting up and packaging. Assume that this second plant also packages birds slaughtered in its plant. At the firm level, the whole birds from the first plant are counted as one output and then counted again as another output when the second plant cuts them up and packages them.

Table 3-1: Four-firm concentration ratios in poultry slaughter and processing[1]

Census year	Chickens	Turkeys	Poultry processing
		Percent	
1963	14	23	52
1967	23	28	49
1972	18	41	35
1977	22	41	48
1982	32	40	37
1987	42	38	36
1992	41	45	46

[1] Values are based on total value of shipments.
Source: Longitudinal Research Database, U.S. Dept. of Commerce, Bureau of the Census.

Consolidation into Large Plants

Bugos (1992) links the adoption of the integrated production form to the near doubling of mean plant size and greater scale economies in chicken slaughter over the 1947-63 period. Under the integrated form, slaughter plants own the feed mills and provide chicks or poults, medicines, veterinary services, and other inputs to contract growers who return the birds to the plant after a grow-out period.

Bugos also indicates that by 1968, the basic automated slaughtering process had been established. In this process, live birds enter the plants; are slaughtered and cleaned; pass through an ice bath; are refrigerated and wrapped; and are either shipped or cut-up, deboned, or otherwise processed. The adoption of slaughtering innovations combined with the addition of cut-up, tray-pack, and further-processing operations increased slaughter plant line speeds and product complexity and led to continuous increases in plant size (see table 3-2, where the left-hand column contains the seven Census years beginning in 1963, while the interior cells indicate the share of industry output coming from plants with more than 400 employees).[5] From 1967 to 1992, the share of output held by plants with over 400 employees more than tripled in chicken slaughter and more than quintupled in turkey slaughter. The table also shows that the large-plant share of output almost doubled in poultry processing between 1972 and 1992.

[5]The Census Bureau has for many years reported plant-level data on value of shipments by employment size (average number of employees over the course of a year). That measure is used here to maintain comparability. The 400-employee cut-off point for large plants is used in order to meet Census Bureau confidentiality requirements.

Table 3-2: Share of industry value of shipments by large plants in poultry industry

Census year	Chickens	Turkeys	Poultry processing
		Percent	
1963	d	d	d
1967	29	16	d
1972	34	15	41
1977	45	29	51
1982	65	35	53
1987	76	64	65
1992	88	83	71

Cells labeled “d” contain data that cannot be disclosed, in order to retain respondent confidentiality. Large plants are defined as those with more than 400 employees.
Source: Longitudinal Research Database, U.S. Dept. of Commerce, Bureau of the Census.

Plant Entry and Exit

New technologies can come from within the industry through plant innovations or plant or firm expansions or from outside the industry through firm entrants. The LRD permits one to examine plant and firm entry and exit because each observation in the LRD includes plant and firm identification numbers.[6] These data characteristics allow us to (1) contrast plant entrants with plant acquisitions, and (2) compare the impacts of firm entrants and firm expansions.[7]

The 1967-92 period is characterized by high plant entry and acquisition rates, varying from about 10 to 30 percent of the total number of plants during each Census period (table 3-3). But these plant entrants did not survive for long. Between 60 and 70 percent of all plant entrants failed within two Census periods, perhaps because they were too small (table 3-4). A firm would buy a production plant only if it could be operated profitably, and, thus, would likely buy only plants

[6] Since these data codes do not vary from Census to Census and do not change with either name changes or business organization changes, plant or firm entry is known to have occurred if a plant or firm identification number appears in one Census but not in the preceding one. Existing plants and firms have identification codes in both the current and preceding Censuses.

[7] Plant entrants are new plants of new firms and new plants of existing firms. Plant acquisitions are existing plants bought by existing firms and existing plants bought by new firms. Firm entrants include those new firms that either buy existing plants or establish new plants. Firm expansions occur when existing firms buy existing plants or establish new plants.

Table 3-3: Number of entrant types in chicken and turkey slaughter and processing industries

Entrant type (initial stock)	1963	1967	1972	1977	1982	1987	1992
Entry plants							
New plants of new firms with less than 25 workers.	25	7	5	d	d	d	5
New plants of new firms with more than 24 workers	295	33	71	20	17	25	17
New plants of existing firms with more than 24 workers	—	12	12	20	7	17	37
New plants' share (%) of all plants	—	16.3	31.9	13.6	9.0	18.8	26
Acquired plants							
Number of existing plants with more than 24 workers bought by existing firms.	—	17	48	24	23	19	11
Number of existing plants with more than 24 workers bought by new firms	—	7	6	13	32	41	31
Plant acquisitions as a share (%) of all plants	—	7.5	19.6	12.6	20.7	26.9	18.5
New or existing plants of new firms							
New or existing plants of new firms with more than 24 workersa	—	47	82	33	49	66	48
New or existing plants of new firms as a share (%) of all plants	—	14.7	29.7	11.2	18.4	29.6	21.1
New or existing plants of existing firms							
New or existing plants of existing firms with more than 24 workers	—	29	60	44	30	36	48
New or existing plants of existing firms as a share (%) of all plants.	—	9.1	21.7	15.0	11.3	16.1	21.1
Total number of plants	320	276	294	266	223	227	270

Chicken industry refers to SIC 20151, turkey industry to SIC 20153, and poultry processing to SIC 20155.
Confidentiality concerns prevent disclosure of entries labeled "d."
Source: Authors' tabulations, using the Longitudinal Research Database (LRD) at the Center for Economic Studies, U.S. Dept. of Commerce, Bureau of the Census.

that had reached a size at which their production costs were about the same as those of their competitors (minimum efficient scale). Failed plants would be smaller since they may have underestimated minimum efficient scale.[8] Overall, the data indicate a dynamic industry in which there is considerable shifting of plant ownership, new plant construction, and firm entry.

Tables 3-3 to 3-5 contain several dimensions of entry in the poultry industry. Data are aggregated to the entire poultry industry level so as to avoid disclosure of confidential information. Only plants with 25 employees or more are examined in detail because confidentiality concerns prevent the disclosure of data for plants with fewer than 25 employees.

Table 3-3 shows how the number of plant and firm entrants varied for new and acquired plants and for new and existing firms over each Census period during the 1963-92 period. Interior cells show the number of new plants or firms from one Census period to the next. Looking at the first row under the left column headed "Entry plants," the table shows that there were only 7 new firms with new plants with fewer than 25 employees over the 1963-67 period, and only 5 over the 1967-72 period. Subsequent numbers of new plants could not be disclosed because of an insufficient number of observations. Of particular interest are sections showing new or existing plants of new firms and new or existing plants of existing firms. They show that the number of firm entrants was at least equal to the number of existing firm expansions (through either a new plant or an acquisition of an existing plant) in all Census years except 1977, suggesting a very fluid industry in which new firms continue to enter.

Plants survive from one period to the next if they continue to operate under the same ownership. Thus, exit refers to plants, not firms, and can occur due to plant closure, a change in product line to products outside of the industry, or sale. Closed facilities may be reopened under new owners, and, if that were to happen, would be reported later as a plant entry. Table 3-4 identifies

[8] This failure rate is not particularly high relative to other industries and is lower than that for cattle and hog slaughter, which had failure rates approaching 90 percent. The difference is likely due to demand changes.

the rate of failure for plants with 25 or more employees. Cells in the interior of the table show the percent of plants surviving from the Census year indicated in the second column to the Census year indicated in the top row. All diagonal terms are 100 because diagonal cells match identical years, e.g., the 1963 Census column intersects the horizontal 1963 Census line.

The second cell of the first data row indicates that about 48 percent of all 1963 plants survived under the same ownership until 1967, and the third cell indicates that about 29 percent survived until the 1972 Census. After 1967, about two out of every three plants failed in the first 5 years after entry, but then this rate of decline tailed off dramatically. Failure rates in the first 5 years are comparable to those that occurred in cattle and hogs, but the modest decline in poultry plant failure after the first 5-year period contrasts with continued sharp declines (failure rates of about one out of two plants) during the second 5-year period for cattle and hogs.

Table 3-5 is constructed like table 3-3 except that the interior cells indicate the market share of plants that entered the industry between Census years. For example, the first cell in the second interior row indicates

Table 3-4: Survival of cohort plants with more than 24 workers in chicken and turkey slaughter and processing plants

Cohort	1963	1967	1972	1977	1982	1987	1992
				Percent of plants surviving from entry year			
1963 (initial stock)	100	47.8	29.2	19.0	11.5	6.1	3.1
1967	0.00	100	18.2	d	d	d	d
1972	0.00	0.00	100	57.7	39.4	29.6	23.9
1977	0.00	0.00	0.00	100	35.0	30.0	d
1982	0.00	0.00	0.00	0.00	100	35.3	35.3
1987	0.00	0.00	0.00	0.00	0.00	100	28.0
1992	0.00	0.00	0.00	0.00	0.00	0.00	100

The chicken industry refers to five-digit SIC 20151, the turkey industry refers to SIC 20153, and the chicken processing industry refers to SIC 20155.
Entries labeled "d" represent shares that could not be disclosed due to confidentiality restrictions.
1963 plants include all plants in the sample.
Source: Authors' tabulations, using the Longitudinal Research Database (LRD) at the Center for Economic Studies, U.S. Dept. of Commerce, Bureau of the Census.

Table 3-5: Market share of new plants with over 24 workers in chicken and turkey slaughter and processing industries

Plant type	1967	1972	1977	1982	1987	1992
			Market share of plant entrants			
New plant of new firm	8.5	24.2	3.3	3.1	5.5	1.7
New plant of existing firm	d	d	6.8	d	3.6	13.7
New plant market share[1]	8.5	24.2	10.1	3.1	9.1	15.4
			Market share of acquired plants			
Existing plant bought by existing firm	10.1	24.5	9.8	8.5	6.8	d
Existing plant bought by new firm	d	d	5.7	13.7	18.8	9.1
Total plant acquisitions	10.1	24.5	15.5	22.2	25.6	9.1
			Market share of new or existing plants of new firms			
New or existing plants bought by new firms[1]	8.5	24.2	9.0	16.8	24.3	10.8
			Market share of new or existing plants of existing firms			
New or existing plants bought by existing firms[1]	10.1	24.5	16.6	8.5	10.4	13.7

Chicken industry refers to five digit SIC 20151, turkey industry refers to SIC 20153, and poultry processing industry refers to SIC 20155.
[1]Does not include entries labeled "d."
Source: Authors' tabulations, using the Longitudinal Research Database (LRD) at the Center for Economic Studies, U.S. Dept. of Commerce, Bureau of the Census.

that new plants of new firms over 1963-67 had an 8.5-percent market share in 1967. Notice that, like cattle and hogs, the market share of plant acquisitions generally exceeded the relatively small market share of plant entrants. Since there was no apparent change in market share, it appears that the basic location and facilities of existing plants were compatible with low-cost production. We explore geographic shifts and changes in production outputs and inputs in more detail in the next chapter.

Conclusion

The shift to large plant size in chicken and turkey slaughter industries over the 1967-92 period was accompanied by an increase in industry concentration that was much more moderate than that reported by MacDonald et al. (1999) for cattle slaughter. Additionally, with plant and firm entry rates exceeding those for cattle and hog slaughter, the poultry industry appears to be more open and entrants able to survive longer than in cattle and hog slaughter (see Ollinger et al., 1996). Most likely, the relatively high share of output produced by large plants in the presence of relatively low industry concentration and the relatively high entry and survival rates stem from increases in demand. Over the 1977-99 period, per capita poultry consumption doubled, while per capita beef consumption dropped about 30 percent.