

## 8. Conclusions

Overall conclusions of this study are presented in three areas. First, the extent of structural change in chicken and turkey slaughter is discussed. Next, the major findings are presented. Finally, the two are linked by discussing the impact of industry cost structure on structural change.

### Structural Change in Chicken and Turkey Slaughter

Major structural changes occurred in poultry slaughter as the market share for large chicken plants doubled to about 88 percent of output and the market share for large turkey plants quintupled to about 83 percent between 1972 and 1992. As poultry plant size grew, the number of growers dropped by about 33 percent, and their average size almost tripled.

The shift to larger poultry plants likely contributed to a tripling of the four-firm concentration ratios in chickens and a doubling of the four-firm concentration ratios in turkeys. However, concentration remains modest—the four largest plants control less than 50 percent of output in both industries. The dramatic rise in domestic and export demand over the 1963-92 period may have restrained the industry from greater concentration.

The shift to large production facilities convinced most chicken slaughter plants to become integrated with poultry growers to ensure an ample supply of high-quality birds. Under the integrated form, integrators are able to control both the quality and supply of poultry inputs by providing contract growers with chicks, medicines and vaccines, feed, management assistance, and veterinary services. The growers contribute housing, care for the chickens, and usually pay part of the fuel bill. Turkey slaughter plants differ in that many either purchase turkeys from independent growers, own their growing facilities, or have contract growers.

Changes in poultry plant product mix were quite dramatic over the 1963-92 period. Whereas a typical plant in 1963 sold the whole bird to a retailer or wholesaler, typical plants in 1992 converted some birds into whole birds, but mainly sold cut-up and deboned birds in consumer traypacks, as restaurant products, or for further processing into luncheon meats and other further-processed products. More quantitatively, by 1992 over 70 percent of chicken production consisted of cut-up and deboned chicken for use in

consumer-ready traypacks, restaurant products, and further-processed poultry. Similarly, over 17 percent of the output from turkey plants was further processed and almost half of production was either further processed, cut-up, or deboned. Output consisted almost exclusively of whole birds.

The shift to further processing was particularly important in turkey slaughter. In the 1960's, most turkey was consumed during the last quarter of the year. This seasonality in demand required many turkey growers to almost halt bird production during the first quarter and then gradually build up for the peak demand during the end-of-the-year holiday season. This cyclical process required plants to carry excess capacity, giving them an incentive to fill off-season production capacity. Many turkey slaughter plants responded by producing turkey parts and further-processed products.

The changes in factory output were accompanied by geographic shifts to the Southeast in chickens and the Middle South in turkeys. A number of factors likely contributed to this shift but were not examined in this report.

### Cost Structure

Results from a translog cost function show that substantial unexploited scale economies exist in both chicken and turkey slaughter, suggesting that plant size will continue to increase. In chicken slaughter, scale economies have enabled plants operating at four times the sample mean size to produce chicken at a cost about 15 percent less than a plant operating at the sample mean size. Similarly, turkey plants that are four times the sample mean size have costs about 17 percent less per pound than plants at the sample mean size.

Failure to account for product mix was shown to have a substantial effect on results. If neither bulk output share nor whole-bird output share were included in the model, estimated scale economies were almost constant, but after accounting for product mix, very strong scale economies become evident. Although similar effects were detected for cattle and hog slaughter (MacDonald et al.), the product mix effects are much stronger for chicken and turkey slaughter.

Increased conversion of whole birds into parts and further-processed products may suggest economies of

scope. However, results do not suggest a decline in the cost of producing further-processed products as plant size increases. Rather, results show that the bulk output share and the whole-bird share of output strongly affect total costs, but that these costs are independent of plant size.

Elasticity estimates derived from the estimated parameters suggest that poultry slaughter plants can more readily substitute labor for material, and that their demand for (poultry) meat inputs drops much more sharply as (poultry) meat factor prices rise than in red meat slaughter. We speculate that these differences arise because, due to contract growing, live bird prices vary across poultry plants, whereas most cattle are purchased at market prices from independent feedlots.

Live bird costs constituted about two-thirds of total production costs, suggesting that prices paid by consumers will drop only modestly even with large improvements in labor productivity. This does not mean that improved productivity will not generate higher profits. Rather, the small capital factor share suggests that improvements in labor productivity have a dramatic impact on return on invested capital.

It was not possible to account for disembodied technological change because time-shift variables used to control for temporal changes and the whole-bird output share term are constant across plants for any given year, causing insufficient model variance and model failure if both are included in the same model. A model leaving out whole-bird output share and including the time-shift variables was rejected because it exhibited regressive technological change, i.e., costs rose over time. The model including whole-bird output share, on the other hand, was retained because its results were consistent with economic theory.

## Costs and Plant Size

Results indicate that substantial scale economies exist in chicken and turkey slaughter, i.e., larger plants produce poultry products at lower costs than smaller plants do, and scale economies are still not fully exploited. These unexploited scale economies are much stronger than for cattle and hogs, but, unlike them, show no signs of decreasing with plant size.<sup>23</sup>

The increase in plant size over the 1972-92 period coincided with an increase in four-firm concentration ratios only in chickens and, in that industry, only over the 1977-87 period. By contrast, similar increases in plant size driven by more modest scale economies for cattle slaughter coincided with a sharp increase in four-firm concentration levels. Differences in changes in concentration ratios could be attributed to many factors, such as differences in demand, differences in labor costs across plants, etc.

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<sup>23</sup> Factors such as market demand, transportation costs, and environmental and legal restrictions are not controlled in the translog cost function; thus, these constraints can limit plant size before scale economies are completely exhausted.