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# Location of Production and Consolidation in the Processing Industry: The Case of Poultry

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The poultry industry is the most vertically integrated of U.S. agriculture and food production and is rapidly progressing toward being one of the most concentrated. In 2002, the top 15 broiler states accounted for 94.4% of U.S. production. From 1982–2002, the top four broiler firms had a fivefold increase in Ready-to-Cook (R-T-C) pounds, a tripling of plants and four- and eight-firm concentration ratio increases of 27.9% to 48.2% and 44.1% to 66.6%. In a broad sense, chicken became more affordable, appealing, and available; total R-T-C pounds increased from 234 to 663 million pounds between 1982 and 2002.

*Key Words:* broilers, concentration, poultry pricing, poultry production, vertical integration

**JEL Classifications:** L11, L22, M11, Q13, R30

The poultry industry represents the most vertically integrated sector of all of U.S. agriculture and food production and is rapidly progressing toward being one of the most concentrated as well, especially when considering that this evolution has largely occurred over the past 50 years. In 1950, for example, there were over 250 firms operating in the broiler industry; today there are fewer than 50 (Watt PoultryUSA). It is estimated that over 95% of all broiler production occurs in and is marketed by vertically integrated firms, predominantly through contracting (88%) but also through direct ownership (Martinez).

Vertical stages of the poultry industry are comprised of the breeder farm, hatchery, feed mill, broiler grow-out farm, processing plant, and wholesale and retail markets. The integrated firms provide genetic stock, hatch the eggs, deliver chicks to independent contractors for grow-out, harvest birds at grow-out farms, and transport them to their plants for processing. Firms provide feed to the breeder farms and broiler grow-out farms. Independent contract growers are responsible for all grow-out facilities, utilities, insurance, labor, and management. Excellent and detailed discussions of broiler industry activities are available in many sources; two particularly succinct ones are Martinez and Rogers. Essentially, integrated firms have taken on price risks for inputs and outputs, which Knoeber and Thurman estimated to account for 84% of all risks—assuming risk is measured as a standard deviation of prices—and contract grow-

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The somewhat nontraditional approach taken in this article is a result of its purpose in the invited session to provide adequate background to those unfamiliar with the broad area of the poultry industry's integration and consolidation and to serve as a "set-up" piece for the more specific papers dealing with economic and legal issues surrounding contracting in Southern U.S. agriculture.

ers have taken on management risks for broiler grow-out, which account for the remaining 16% of all risks. Tsoulouhas and Vukina defend a similar position on this issue.

## Vertical Integration

Vertical integration and consolidation have been driven by a few key factors. In the mid-1950s, large grain and feed companies and manufacturers began integrating into broiler production in large part to ensure markets for their products and services. This process proceeded rapidly until, by 1960, 85% of all broiler production was under such arrangements. As this trend neared completion, firms began the process of acquiring other parts of the marketing channels through expansion, acquisition, and consolidation in a push to retain profits contributed by the various stages of production. This was driven by increasingly intense price competition for broilers at the wholesale and retail levels. The diversity of inputs and outputs necessary for modern broiler production, as well as risks associated with diseases and production bio-security, have made integrated systems, in which almost every facet of production is controlled by a necessity to manage price and production risk.

Perhaps a final, and by no means inconsequential, factor in the integration and consolidation of firms is the widespread use of grow-out contracts that, in effect, greatly limit the amount of capital necessary to provide slaughter-weight birds to and through a broiler complex. These contracts have the effect of eliminating roughly one half of the $180 million capital necessary for a production and processing complex of 500 43 × 500 foot houses with a weekly slaughter capacity of 1.2 million birds. Extensive treatments of the contract system in broiler production and the effect of the tournament payment system are presented in Goodhue; Tsoulouhas and Vukina; Vukina; and Thomsen, Goodwin, and Rodriquez.

## Location of Broiler Production

As poultry production and processing became more integrated and volumes of birds under contract increased, the geographic concentration of both production and processing occurred. Because 60–70% of production costs are for feed, it would be expected that birds would be located in or adjacent to areas of corn and soybean production. Several additional factors (such as the costs and availability of land and labor) have been key in determining location of bird production and processing, especially in the early stages of industrial development during the 1950s and 1960s, which can explain the dominance of the Ozark and Southern Appalachians as the industry evolved and expanded. Land quality, largely unsuitable for large scale crop production, resulted in low prices per acre and relatively small land holdings. Employment alternatives and educational levels in the same areas translated into adequate supplies of relatively low-cost labor. These traditionally held views were substantiated recently by Harrison and Sambidi, who investigated what factors affect complex location in the U.S. broiler industry. The top five factors were feed costs, community attitude towards broiler production, availability of potential growers, unemployment rates, and wage rates.

Broiler production for the top 15 states for the years 1982 and 2002 are shown in Figure 1. These years are post-integration and are from a period of rapid expansion of the industry. Production of ready-to-cook (R-T-C) broiler meat grew from 4.3 billion pounds in 1960 to 12 billion pounds in 1982, then to 20.9 billion pounds in 1992, and 31.9 billion pounds in 2002 (National Chicken Council). Intensification of production during the period 1982 to 2002 is evident in the leading states of Georgia, Arkansas, Alabama, North Carolina, and Mississippi, with additional growth also particularly evident in South Carolina, Texas, Louisiana, Kentucky, and California.

One-time bird inventories for broilers and turkeys for the years 1982 and 2002 were assessed on a county basis for the 15 top-producing states. Results are shown in Tables 1 and 2. Notice that the top 15 states accommodated 94.4% and 90.9%, respectively, of all U.S. broilers and turkeys. It is also noteworthy that the share of birds in the top volume cat-

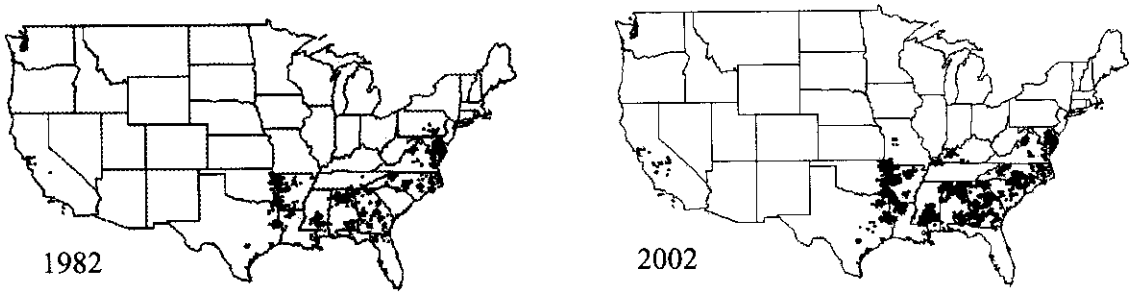


**Figure 1.** U.S. Broiler Production in 1982 and 2002, 15 Top-Producing States
Note: Each dot represents 1 million birds.
Source: U.S. Census of Agriculture.

egories has increased during the 20-year period, which can be partly attributed to the large increase in numbers of counties in these same top-volume categories. Total bird numbers tripled for broiler and doubled for turkeys, while bird sizes increased, a phenomenon to be discussed later in this manuscript.

## Industry and Consumer Trends

The changing nature of U.S. meat-consumption behavior in the past four decades has been well documented. To draw focus to the driving forces behind the increased size and consolidated nature of the U.S. poultry industry, particularly the broiler industry, it is necessary to review consumptive behavior as reflected by both prices and product characteristics. Trends in U.S. per capita meat consumption are shown in Figure 2. The period 1965 to 2003 reflects a gradual decline in beef consumption, an almost stable consumption of pork, a modest total increase in turkey consumption, and a dramatic increase in broiler consumption, exceeding per capita pork consumption by 1985 and per capita beef consumption by 1996. During this same period, total annual per capita meat consumption increased from approximately 165 pounds to around 210 pounds. Martinez analyzed USDA-ERS data and found that over the period 1955 to 1997, real price per pound of broiler meat declined from just over $2 per pound to under $.70 per pound, and per capita consumption increased from about 15 pounds per year to about 75 pounds per year. Rogers found similar results.

So what really happened to precipitate this dramatic alteration in U.S. meat consumption during the period? In a very broad sense, chicken became more affordable, more appealing, and more available. This "triple AAA" bonus was enabled largely by effective industry integration and consolidation. Examine each of the "triple AAA" factors in turn.

Why has chicken become more affordable? Improved genetics and breeding programs developed more feed-efficient birds, able to grow to increasing market weights in a decreasing numbers of days, while simultaneously increasing breast-meat yields. Improved nutrition using feeds more precisely structured to meet bird growth-stage requirements and more balanced feeds with respect to amino acids, vitamins, and micronutrients has also lowered costs. Breakthroughs in disease control through *in ovo* vaccinations, control of diseases such as Mareks, and use of coccidiostats in feeds have played an important role as well. Development of more reliable and efficient delivery systems for feed and water (automatic feeders and nipple drinkers), as well as improved air ventilation systems (tunnel ventilation houses for computerized controls), has greatly increased feed conversions and survivability of birds. All these factors translate into improved production efficiency and, as a result, lower costs of live broilers.

Why has chicken become more appealing? Simply put, the broiler industry has responded to the socio-demographic changes and increas-

**Table 1.** One-Time Inventory for Broilers by County, 1982 and 2002

| Range (million) | Total Birds (million) | | Number of Counties | | % of U.S. Total | |
|---|---|---|---|---|---|---|
| | 1982 | 2002 | 1982 | 2002 | 1982 | 2002 |
| 15 | 44,743 | 242,600 | 2 | 13 | 7.2 | 17.4 |
| 10–15 | 48,899 | 485,200 | 4 | 14 | 7.9 | 11.2 |
| 7–10 | 53,934 | 195,686 | 7 | 24 | 8.7 | 14.1 |
| 5–7 | 90,146 | 154,786 | 16 | 26 | 14.5 | 11.2 |
| 3–5 | 98,762 | 201,273 | 25 | 53 | 15.9 | 14.5 |
| 1–3 | 153,420 | 214,763 | 89 | 119 | 24.7 | 15.1 |
| 0.5–1 | 45,453 | 50,401 | 64 | 69 | 7.3 | 3.6 |
| Total | 535,357 | 1,544,709 | 207 | 318 | 86.2 | 87.1 |

Note: The 15 top-producing states accounted for 94.4% of all U.S. broiler production in 2002.

ing health awareness of the American consumer. Variation in product form, increased product versatility and convenience, and improved product packaging have been major thrusts of the industry response to higher income consumers with limited time for meal preparation. For example, in 1970, 70% of all chicken was sold whole and 30% was sold cut up. By 1980, 45% was sold whole, 50% cut up, and 5% processed. In 1995, only 15% was sold whole, 60% was cut up, 10% was processed, and 15% was sold in other forms. By 2003, totals were 10% whole, 50% cut up, 25% processed, and 15% in other forms. (National Chicken Council). Chicken is found in all serving styles, package sizes and types, and storage forms and lends itself well to various ethnic cuisines with little adaptation.

Why has chicken become more available? A product that used to be found only on the home dinner table can now be found almost everywhere. This process began with specialty fast food penetration (KFC, Church's, Popeye's, etc.), proceeded to diverse fast food penetration (McDonalds, Burger King, etc.), and has now achieved near 100% penetration of family restaurants and casual dining restaurants. Central to the progression have been KFC and the Chicken McNugget, the success of which enabled specialized product development to proceed by poultry processors in concert with eating establishments. Boneless, skinless breast meat and breast tenders are the dominant broiler cuts in their product and outlet progression (Goodwin et al). Cooperation between large processors and retailers has further evolved through use of vendor managed inventory (VMI) systems. Information from VMI further supports market segmentation and product development efforts of both processors and retailers.

The result of this evolution has been continued consumer satisfaction. There is currently more choice for consumers among consistent, high-quality products of relatively low cost than ever before. And industry has responded by becoming yet more consolidated, driven by product development successes, in-

**Table 2.** One-Time Inventory for Turkeys by County, 1982 and 2002

| Range (million) | Total Birds (million) | | Number of Counties | | % of U.S. Total | |
|---|---|---|---|---|---|---|
| | 1982 | 2002 | 1982 | 2002 | 1982 | 2002 |
| 2+ | 7,597 | 15,955 | 2 | 6 | 16.3 | 17.2 |
| 1–2 | 4,071 | 22,451 | 2 | 18 | 8.8 | 24.1 |
| 0.5–1 | 12,920 | 19,425 | 19 | 29 | 27.8 | 20.9 |
| 0.25–0.5 | 7,262 | 9,074 | 19 | 26 | 15.6 | 9.7 |
| 0.1-0.25 | 5,335 | 7,171 | 43 | 43 | 11.5 | 5.9 |
| Total | 37,185 | 74,076 | 85 | 122 | 80.0 | 77.8 |

Note: The 15 top-producing states accounted for 90.9% of all U.S. turkey production in 2002.

**Table 3.** Percent of Broiler Industry Volume (lbs. R-T-C), 1982–2004

| Firms, by Volume Share | 1982 | 1992 | 2004 |
|---|---|---|---|
| Top 3 | 26 | 35 | 47 |
| 4–5 | 11 | 11 | 12 |
| 6–10 | 18 | 14 | 15 |
| 11–20 | 21 | 18 | 17 |
| Others Surveyed | 24 | 22 | 9 |

Source: Watt Poultry USA (various years).

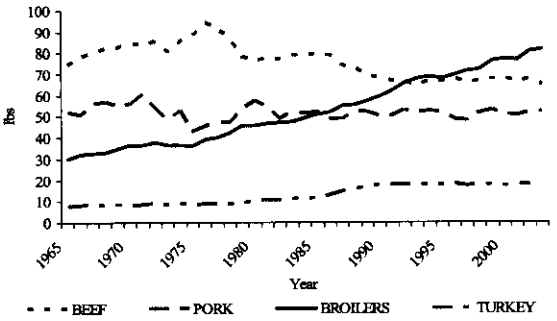


**Figure 2.** Per Capita U.S. Meat Consumption, 1965–2003
Source: National Chicken Council.

creased price competition for market share, increasing capital intensity to respond to expansion requirements, governmental regulatory measures, and penetration of new and diverse markets.

## Industry Consolidation

Detailed and extensive accounts of the consolidation of the U.S. broiler industry have been developed and presented by the USDA-ERS in work by Martinez, MacDonald et al., and Ollinger, MacDonald, and Madison (2000); the reader is urged to review these excellent prior works. For the purpose of this paper, a practitioner's view is taken to capsulize consolidation over the past 20 or so years.

Each year, Watt PoultryUSA conducts a survey of broiler and turkey processors and ranks respondents based upon several size and volume characteristics; respondents comprise virtually 100% of all integrated firms producing broilers. Summary results of this survey are presented in Table 3 for the period 1982 through 2004. Increased volumes of R-T-C pounds processed annually by the top three firms are readily visible, as is the dramatic decrease of R-T-C pounds by firms not in the top 20 by volume. In 2004, nearly one half of all broiler meat was processed by the top three firms.

A more traditional measure of size is the four-firm and eight-firm concentration ratios (Table 4). Watt PoultryUSA data were reorganized, and these ratios were computed for five-year intervals 1982–2002. The four-firm ratios reflect a nearly fivefold increase in total R-T-C pounds processed, a near tripling of the number of plants operating, and an increase in share from 27.9% to 48.2% from 1982 to 2002. The eight-firm ratios indicate a fourfold volume increase, a doubling of plants operating, and a share increase from 44.1% in 1982 to 66.6% in 2002.

These large changes in volumes and concentrations are a result of both increases in number of birds processed and in the average

**Table 4.** Broiler Production Analysis by Number of Plants and R-T-C (lbs. million)

| | | | Four Largest Firms | | | Eight Largest Firms | | |
|---|---|---|---|---|---|---|---|---|
| Year | Number of Plants | R-T-C | Number of Plants | R-T-C | % | Number of Plants | R-T-C | % |
| 1982 | 148 | 233.9 | 28 | 65.3 | 27.9 | 57 | 103.1 | 44.1 |
| 1987 | 155 | 346.9 | 48 | 123.4 | 35.6 | 85 | 187.6 | 54.1 |
| 1992 | 173 | 475.8 | 57 | 192.7 | 40.5 | 83 | 262.3 | 55.1 |
| 1997 | 171 | 581.7 | 70 | 254.1 | 43.7 | 97 | 357.8 | 61.5 |
| 2002 | 171 | 663.1 | 78 | 319.4 | 48.2 | 107 | 441.6 | 66.6 |

Source: Watt Poultry USA (various years).

**Table 5.** Evolution of Poultry Production over 1982–2002 Period: Selected Statistics

| | | Live Weight | | R-T-C | |
|---|---|---|---|---|---|
| Year | Million Head | Average | % Increase | Million Lbs. | % Increase |
| 1982–1987 | 79 | 4.06 | 5.7 | 234 | 48.3 |
| 1987–1992 | 105 | 4.29 | 7.7 | 345 | 32.7 |
| 1992–1997 | 138 | 4.62 | 4.8 | 476 | 22.3 |
| 1997–2002 | 157 | 4.84 | 6.8 | 582 | 14.0 |
| 2002 | 169 | 5.17 | | 663 | |

Source: WATT Poultry USA (various years).

live weight of the birds processed (Table 5). Number of broilers processed increased from 79 million head in 1982 to 169 million head in 2002, while average live-weight increased from 4.06 pounds per bird in 1982 to 5.17 pounds per bird in 2002. The overall effect was an increase in total pounds of R-T-C broilers, from 234 million pounds in 1982 to 663 million pounds in 2002. Percentage increases in R-T-C pounds was far greater than percentage increases in average live weight. This increased output was a result of higher processing line speeds from 70 birds per minute on SIS systems in the 1970s and 1980s, to 91 birds per minute on NELS systems in the 1990s, to 140 birds per minute on current high-speed lines. Numbers of shifts per week also increased on average, thus enabling more birds to be processed in the same number of plants, expanding greatly the number of birds required to supply the refitted plants in existing areas of production (recall Figure 1). Ollinger, MacDonald, and Madison examined factors affecting technological change and economics of scale in poultry processing in their recent AJAE article (2005).

## Observations and Outlook

It is worthwhile to examine the future of the broiler industry from the perspective of foregoing highlighted developments. The growth in broiler production and processing has been almost staggering since 1980. Rapid expansion driven by production and processing efficiencies, changing consumer tastes and preferences, and product developments have expanded per capita consumption by some 250% since 1965. Similarly, exports of broiler meat have reached levels between 15 and 20% of all U.S. production, albeit exports are over 90% dark meat or parts. National Chicken Council projections to the year 2010 indicate an expected annual increase in per capita chicken consumption in the U.S. of about 3% per year compounded (Roenigk). The same NCC source predicts a roughly 8% increase per year compounded to 2010. But by many accounts, such expansion in domestic chicken demand is slowing and may be nearing a plateau. It is difficult to imagine that domestic demand, which is predominantly for white-meat products, can expand much more. And increased export demand is vulnerable to lower-priced competitors.

Accordingly, there will continue to be an imbalance domestically between supplies of and demand for dark meat. This translates into the need to recover costs incurred for dark meat currently produced, processed, and sold at a loss through sale of more profitable white meat products. Recapturing costs from sale of higher priced white meat products is a partial solution to the white meat–dark meat imbalance, but it is a limited solution. In the long run, there will need to be a vigorous and successful push to develop dark meat products that consumers will consistently purchase at reasonable prices for processor cost recovery. Until that time, U.S. processors will continue to rely upon foreign markets to keep dark meat out of inventories. But this is a strategy not without risk. Domestic exports are subject to the whims of trade regulations and politics. Compounding the problem is the increased competiveness of Brazil and Argentina to the south and China and Thailand to the east. The South American industry already holds an advantage in production costs. As technology is transferred into Asian production, Asian producers are becoming more competitive, but currently they lack the capacity and the biosecurity system to be a consistent supplier to importing markets.

What might these developments mean for the U.S. industry? There is likely to be a lev-

eling off in total U.S. production in years to come. Expansion of production to meet increasing foreign demand resulting from higher income levels is most likely to occur in the four aforementioned producing countries. Domestic U.S. demand will continue to be met by U.S. production, although total production is likely to shrink somewhat in the future. Concerns over homeland security, food safety, bio-security, and animal health will preserve current production levels in the near future. Growth in the U.S. broiler industry will depend on its ability to export processed products and "fast food/food-away-from-home" concepts into countries with rapidly increasing disposable incomes.

Regarding locational shifts in concentrated poultry production, relocation or closing of complexes is possible as facilities become obsolete technologically or mislocated politically (e.g., environmental concerns). Regulation will encourage consolidation of growers in the next several years, similar to that seen in integrated companies in the past, and pressures will intensify for less profitable growers to exit the industry. Any immediate impacts will be localized. Less profitable complexes will close unless decreased broiler placements and grower attrition are large enough to offset surplus production. The trend toward increased competitiveness outside the United States will continue, but replacement of U.S. production in the domestic market is quite unlikely. In areas where production will decrease, potential displacement of growers from profitable family-owned-and-operated broiler-cattle operations may likely challenge the ability of rural decision makers to respond to economic and societal disruptions efficiently and equitably (Goodwin et al.).

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