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*Impact of the*  
**POULTRY INDUSTRY**  
*on the*

**E C O N O M Y**

*of North Carolina*

*North Carolina  
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*Technical Bulletin 307*

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*Impact of the Poultry Industry on the Economy of North Carolina*

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Raleigh, North Carolina 27695-7603  
\$5/copy (U.S. dollars only)

North Carolina Agricultural Research Service  
North Carolina State University  
Raleigh, North Carolina

Technical Bulletin 307  
August 1995

# Impact of the Poultry Industry on the Economy of North Carolina

## INTRODUCTION AND STUDY OBJECTIVES

The poultry industry in North Carolina includes the production and processing of broilers, turkeys, and table eggs. The economic importance of the poultry industry is significant and growing. Broiler and turkey production in North Carolina have grown dramatically between 1970 and 1993 (Table 1). Broiler production expanded from 1.1 billion pounds to more than 3.1 billion pounds, a 250% increase in live-bird weight. Turkey output increased seven and

or state. In addition, poultry farm buildings and equipment provide a basis for tax revenues which support state and county governments' programs. By purchasing goods and services (or "inputs"), poultry producers support a number of other industries in North Carolina including feed and pharmaceutical suppliers, rail transportation, and banking services. As suppliers of inputs, poultry producers support processing firms and, ultimately, retail establishments in the state. When we consider all linkages between the poultry industry and other sectors, the

poultry industry has significant ripple effects on overall state income and employment.

The objective of the study presented here is to quantify the importance of the poultry industry to the economy of North Carolina. Output, household income, value added, and employment are the primary measures of economic importance. The process of estimating the economic importance of an industry involves three steps. The first step is

**Table 1. Production, value, and national rank for major livestock commodities produced in North Carolina.**

Commodity	Units	1970	1980	1990	1992	1993
<b>Broilers</b>						
Production	mil lbs	1,137.3	1,544.0	2,593.4	2,852.4	3,137.5
Value	mil \$	154.7	286.0	804.4	855.4	1,004.0
State rank		4	4	4	4	4
<b>Turkeys</b>						
Production	mil lbs	176.0	396.6	1,160.0	1,320.6	1,366.4
Value	mil \$	38.1	158.7	452.4	475.4	519.2
State rank		3	2	1	1	1
<b>Eggs</b>						
Production	mil doz	305.9	264.5	252.8	252.2	256.8
Value	mil \$	132.2	175.4	206.0	180.0	195.2
State rank		3	6	8	8	8

Source: North Carolina Agricultural Statistics, annual issues.

one-half times from 176 million pounds to 1.37 billion pounds. The combined value of broilers, turkeys, and commercial eggs in 1993 accounted for more than 30% of North Carolina's agricultural marketings. North Carolina is a national leader in the production of both broilers and turkeys, ranking first in turkey production and fourth in broiler production in 1993.

The production of poultry products contributes to employment and household income of the region

data collection. We conducted an industry survey to collect production and marketing statistics at the farm and processing levels. In the second step we used survey results to identify the industry's backward and forward linkages. Backward linkages refer to the connections between poultry producers and the suppliers of inputs into the production of broilers, turkeys, or eggs. Forward linkages refer to the destination of poultry products after they pass through the farm gate. Processing facilities and feed mills are

## Impact of the Poultry Industry on the Economy of North Carolina

typically located adjacent to the production areas in order to reduce feed and bird transportation costs. The third step involved using input/output analysis to estimate the multiplier effects from a one-dollar change in final demand for processed poultry products on the total state income and employment. Since the poultry industry in North Carolina is vertically integrated (that is, processing firms typically own hatcheries, feed mills, and processing facilities and control through contracts), this study estimates the aggregate economic impacts from production and processing.

The outline for the remainder of this report is as follows: the second section presents the results of the 1993 *North Carolina Poultry Industry Survey* (Vukina and Carter, 1994). The third section includes a general description of economic impact analysis with the regional input/output model. The fourth section presents the estimates of the poultry industry's impacts on the economy of North Carolina. Summary and conclusions are presented in the fifth section.

### THE POULTRY INDUSTRY IN NORTH CAROLINA: 1993 INDUSTRY SURVEY

The rising importance of the poultry industry in North Carolina corresponds to a long-term trend in which agricultural emphasis has shifted from crop to livestock enterprises. The share of livestock receipts as a portion of the total market value of agricultural commodities in North Carolina has increased from 43% in 1969 to 54% in 1992 (Table 2). A major contribution to the growth in livestock production during that period came from the poultry sector. In 1993 the total farmgate values of poultry and eggs accounted for 57% of the total livestock marketings, with 30% earned in broiler production, 16% in turkey production, and 9% in egg production (Table 3). Long-term trends show more and more intensive poultry production in North Carolina (Table 4). From

1969 to 1992, Census of Agriculture data show a declining number of broiler farms, coupled with an increasing size of the animal units. In 1969, an average broiler operation handled 78,000 birds annually. By 1992, the typical operation grew out almost 236,000 birds a year, a threefold increase.

Since 1981, the North Carolina Cooperative Extension Service at North Carolina State University in cooperation with the North Carolina Poultry Federation has conducted an annual survey of North Carolina poultry producers and processors. Marketing and production data from poultry farms and processing facilities were collected and summarized. Total industry employment, the number of contract growers, and the level of contract payments were recorded. The 1993 survey format was extended to compile a more detailed picture of the industry's structure. In particular, the survey questionnaire attempted to document the intra- and interindustry flows of goods and services and to record the regional dispersion of the industry across the state. Like previous surveys, the 1993 survey divided the industry into three commodity groups: broilers, turkeys, and table eggs. The organization of the survey reflected the highly vertically integrated structure of the poultry industry by following each commodity group through all the production stages from breeding, through grow-out, to processing.

Using a mailing list provided by the North Carolina Poultry Federation, we sent the questionnaire to 60

**Table 2. Market value of agricultural commodities in North Carolina by crops and livestock.**

	Units	1969	1974	1978	1982	1987	1992
Market value of North Carolina agricultural products	mil \$	1,195	2,121	2,980	3,501	3,541	5,177
Crop receipts	mil \$	669	1,301	1,670	1,898	1,437	2,379
Livestock receipts	mil \$	514	804	1,310	1,603	2,107	2,801
Livestock percentage	%	43.0	37.9	44.0	45.8	59.5	54.1

Source: Census of Agriculture, U.S. Dept. of Commerce, various issues.

**Table 3. Cash receipts from 1989 to 1993 of major livestock commodities in North Carolina and percentage of total livestock marketings.**

	1989	1990	1991	1992	1993
Cash receipts by commodity (mil \$)					
Poultry and eggs					
Broilers	843.2	804.0	777.0	855.7	1,004.0
Turkeys	406.6	452.4	431.3	475.4	519.2
Eggs and misc. poultry	324.7	320.9	308.6	281.2	296.4
Hogs	508.8	615.1	665.3	724.4	921.8
Other livestock <sup>a</sup>	427.0	466.3	435.1	467.4	464.5
Total livestock receipts	2,510.3	2,658.7	2,617.3	2,800.5	3,202.3
Percentage of livestock					
Poultry and eggs	62.7	59.4	58.0	57.6	56.8
Hogs	20.3	23.1	25.4	25.8	28.8
Other livestock	17.0	17.5	16.6	16.6	14.4

Source: North Carolina Agricultural Statistics, annual issues.

<sup>a</sup> Other livestock includes dairy, sheep, and beef animals.

**Table 4. Farm numbers, animals sold, and average concentration of North Carolina (NC) and United States (US) broiler operations.**

	1969	1974	1978	1982	1987	1992
NC broiler farms						
Number of farms	3,243	2,520	2,434	2,195	2,153	2,116
Birds sold (1,000 head)	252,004	225,566	296,848	348,434	408,721	499,072
NC avg birds per farm	77,707	89,510	121,959	158,740	189,838	235,859
US avg birds per farm	73,653	80,182	90,888	116,831	158,043	226,191

Source: Census of Agriculture, U.S. Dept. of Commerce, various issues.

companies or their profit centers<sup>1</sup> and independent producers in North Carolina in April 1994. Data for 1992 and 1993 were requested. After a long and extensive campaign of follow-up letters, faxes, and phone calls, the surveying process was terminated on

November 1, 1994 with 40 responses. The remaining 20 surveys went to companies that were either out of business, did not wish to disclose information, or simply ignored the questionnaire. Of the nonrespondents who were still in business, eight producers (one broiler, three turkey, and four commercial egg producers) had responded to the 1992 survey. These data were included in the 1993 data set by assuming production levels remained constant. Overall, survey data included 48 companies: 18 broiler producers, 18 turkey producers, and 12 egg producers. We estimate that the collected data represent more than 95% of the total North Carolina poultry industry production volume.

### General Economic Indicators

The 1993 *North Carolina Poultry Industry Survey* (Vukina and Carter, 1994) results for final point of sales, employment, and the number of contract growers are summarized in Table 5 and in Figures 1-6. Tables 6-11 present survey

results for production and value of production by industry group — broiler, turkey, and table eggs.

<sup>1</sup> A profit center represents one geographic location. A single company may operate several profit centers.

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A final-point-of-sale value was calculated as the total market value of the processed products (broilers, turkeys, and eggs), plus the market value of farm production that was exported out of North Carolina before processing (e.g., breeder pullets, breeder hens, poults, hatched chicks, and live birds). In 1993, final point of sales exceeded 2.3 billion dollars (Figure 1). Of that amount, 63% was attributed to broiler production and processing, 34% to turkey production and processing, and 3% to commercial egg production (Figure 2). Between 1981 and 1993 final point of sales for the poultry industry grew at an average annual rate of 6.4%.

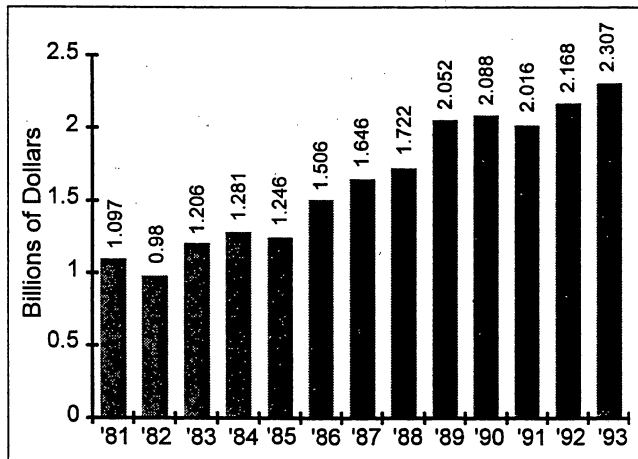


Figure 1. Final-point-of-sales value for the North Carolina poultry industry.

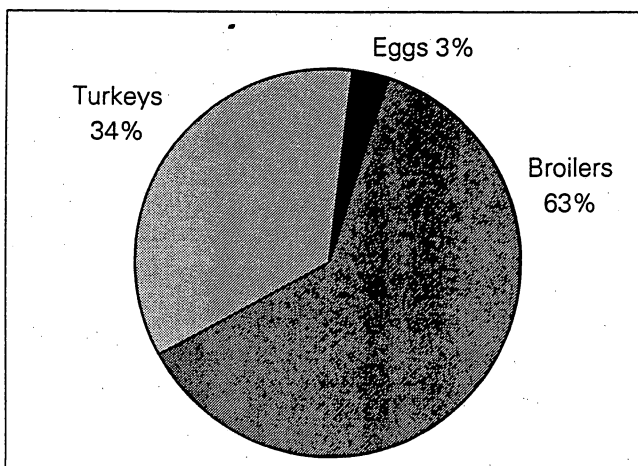


Figure 2. Breakdown of 1993's \$2.3 billion final-point-of-sales value by poultry commodity.

Poultry companies during 1993 reported employing 19,821 North Carolinians (Figure 3), paying a total annual payroll of \$332 million (Table 5). The largest number of people was employed by the broiler sector (67%), followed by the turkey sector (31%), and commercial eggs sector (3%) (Figure 4). These statistics include only those individuals who worked in company hatcheries, feed mills, and processing plants, as well as field supervisors, transportation workers, office personnel, and management.<sup>2</sup>

Additional employment occurred on the farms of contract growers. The total number of contract growers increased 2.4% from 4,020 in 1992 to 4,118 in 1993 (Figure 5). Contract payments in 1993 increased by 5% over 1992 levels to almost \$215 million (Table 5). Contract growers provide an additional source of employment. The survey did not provide data on

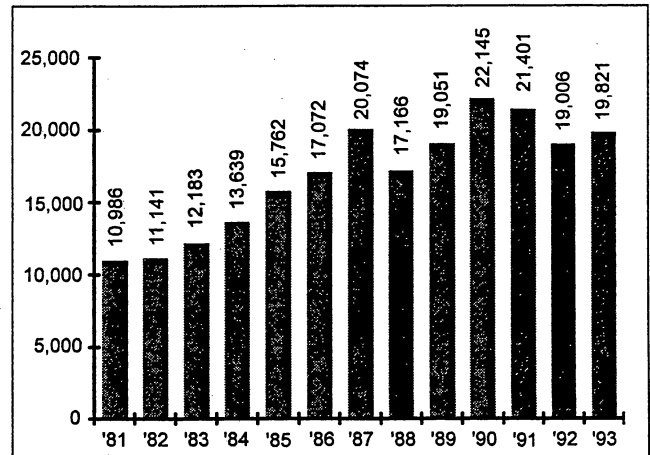


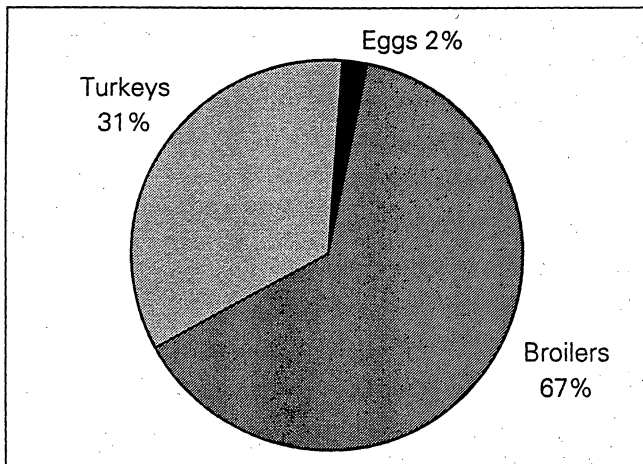
Figure 3. Number of North Carolinians employed by the state's poultry companies.

<sup>2</sup>The survey employment results could be compared to the North Carolina Employment Security Commission (NCESC) 1993 statistics which report 19,800 workers employed in poultry processing sector (Standard Industrial Classification [SIC] 2015) and 3,496 employees in production of broilers (SIC 0251), chicken eggs (SIC 0252), turkeys and turkey eggs (SIC 0253), poultry hatcheries (SIC 0254), and miscellaneous poultry and egg production (SIC 0259). The NCESC numbers include both full-time and part-time workers, whereas our survey did not ask respondents to distinguish between the two. Also, the NCESC coverage may be somewhat broader due to the classification criteria used. A firm is classified into a particular SIC code as long as its output is more than 50% of the designated SIC code.

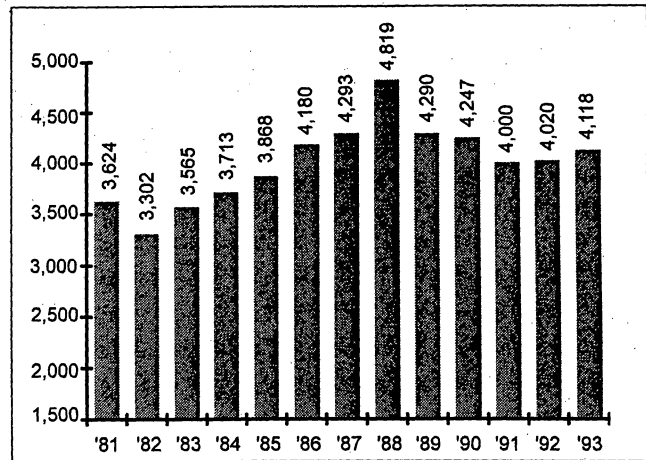
**Table 5. North Carolina Poultry Industry Survey summary.**

1992	Broilers	Turkeys	Commercial Eggs	Total
Number of firms (profit centers)	18	18	12	48
Total number of employees	12,933	5,718	355	19,006
Total payroll, excluding contract payments	\$207,154,395	\$105,293,607	\$5,945,852	\$318,393,854
Number of contract growers	3,097	866	57	4,020
Total contract growers' payment	\$139,627,880	\$58,556,091	\$6,085,658	\$204,269,629
Final-point-of-sale value	\$1,368,051,496	\$734,134,024	\$65,680,882	\$2,167,866,402
1993	Broilers	Turkeys	Commercial Eggs	Total
Number of firms (profit centers)	18	18	12	48
Total number of employees	13,376	6,076	369	19,821
Total payroll, excluding contract payments	\$211,682,530	\$113,138,637	\$7,039,402	\$331,860,569
Number of contract growers	3,170	891	57	4,118
Total contract growers' payment	\$146,795,294	\$61,694,919	\$6,283,115	\$214,773,328
Final-point-of-sale value				
Exported pullets	\$158,975	—	—	—
Exported breeders	\$13,410,262	\$408,143	—	—
Exported hatching eggs	\$31,055,731	\$12,800,000	—	—
Exported market birds	\$0	\$77,020,442	—	—
Processed output	\$1,397,285,567	\$704,962,581	\$70,025,125	—
Total final-point-of-sale value	\$1,441,910,335	\$795,191,086	\$70,025,125	\$2,307,126,546

Source: 1993 North Carolina Poultry Industry Survey.



**Figure 4. Breakdown of 1993's employment figures by poultry commodity. All together, the North Carolina poultry industry employed 19,821 people.**



**Figure 5. Number of contract growers in North Carolina's poultry industry.**



labor hired by the growers, but employment estimates were calculated and are reported later in this report. The largest number of contract growers was involved in broiler production (3,170), followed by turkey production (891), and commercial egg production (57) (Figure 6).

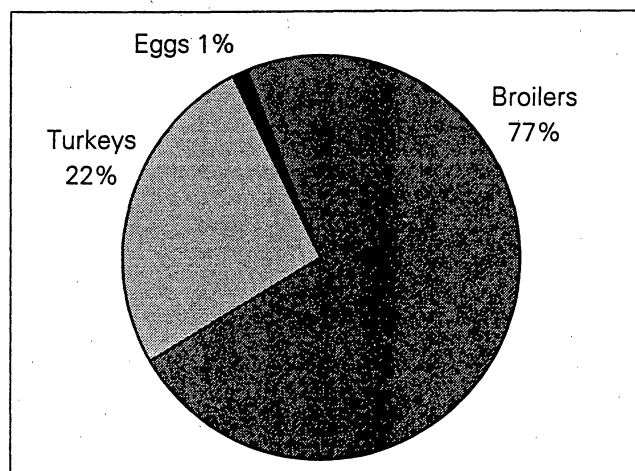
### *Broiler Complex*

The largest and the most important commodity group within the poultry industry in North Carolina is the broiler complex. Broiler production and processing is completely vertically integrated. The production, or farm sector, includes four distinct technological stages—breeder pullets, breeder hens, hatcheries, and grow-out. Production statistics from the broiler complex are presented in Table 6. According to the 1993 survey results, 586 million broilers were produced.<sup>3</sup> This volume was a 5.5% increase over the 1992 volume. The total live weight produced amounted to 3 billion pounds, or an average weight of slightly more than 5 pounds per bird. The total processed weight in 1993 was close to 2.4 billion pounds, approximately 7.8% more than in 1992. The number of broiler contract growers has increased by 2.4% in 1993, while the total capacity of chicken houses under contract increased by only 0.5%. The majority of the contract growers (79%) were involved in the grow-out phase.

The value of production from the broiler industry is presented in Table 7. Final-point-of-sale value for the broiler industry in 1993 was 1.44 billion dollars, an increase of 5.4% from 1992. The final-point-of-sale value was obtained as the sum of the total processed meat market value (\$1.397 billion) and the market value of the intermediary production that left North Carolina before the product reached the processing stage (breeder pullets, \$159,000; hatching eggs, \$13.4 million; and hatched chicks, \$31 million). Payments to broiler contract growers increased 5% in 1993, to \$147 million.

<sup>3</sup>This number can be compared with 615 million broilers for 1993 published by the North Carolina Agricultural Statistics.

<sup>4</sup>The North Carolina Agricultural Statistics reports that 62 million turkeys were produced in 1993.



**Figure 6. Number of North Carolina poultry industry contract growers by commodity.**

### *Turkey Complex*

During 1993, turkey production in North Carolina grew both in volume and value. As reported in Tables 8 and 9, almost 65 million birds<sup>4</sup> were produced in 1993, an increase of more than 11% from the previous year. The total live weight produced amounted to 1.3 billion pounds. Average weight per bird decreased from 21 pounds in 1992 to 19.6 pounds in 1993. The total number of turkeys processed in the North Carolina processing facilities was close to 53 million. Processed meat production reached 953 million pounds, a 5% increase over 1992. The turkey industry reported a final-point-of-sale value of \$795 million, which was 8.3% higher than in 1992. There were 891 contract growers involved in turkey production (almost 3% more than in 1992), most of them in the grow-out stage. Commercial market turkey growers were paid approximately \$62 million dollars in total payments, earning 5.4% more than in 1992. The turkey complex accounted for 34% of the total poultry industry sales, 31% of its employment, and 22% of its contract growers.

### *Commercial Eggs Complex*

The smallest segment of the North Carolina poultry industry is table egg production, which accounts for only 3% of the total poultry industry final sales, 2% of its employment, and 1% of its contract growers. The

**Table 6. Broiler complex — volume of production.**

<b>1992</b>	<b>Breeder pullets (pullets)</b>	<b>Breeder hens (eggs produced)</b>	<b>Hatchery (eggs set)</b>	<b>Grow-out (broilers)</b>	<b>Processing (broilers)</b>
Number of contract growers	159	465	0	2,473	0
Capacity of houses under contract (sq. ft.)	5,558,518	11,878,055	0	95,658,777	0
Number of company farms/hatcheries/processing plants	7	11	17	3	13
Volume of production Number	6,927,929	1,049,882,636	627,672,273	555,219,523	556,210,229
Pounds	n/a	n/a	n/a	2,766,478,969	2,178,629,622
<b>1993</b>	<b>Breeder pullets (pullets)</b>	<b>Breeder hens (eggs produced)</b>	<b>Hatchery (eggs set)</b>	<b>Grow-out (broilers)</b>	<b>Processing (broilers)</b>
Number of contract growers	187	487	0	2,496	0
Capacity of houses under contract (sq. ft.)	5,558,518	11,878,055	0	96,170,494	0
No. of company farms/hatcheries/processing plants	7	11	18	22	13
Volume of production Number	7,369,392	1,102,389,650	638,465,065	585,675,483	578,545,695
Pounds	n/a	n/a	n/a	2,955,754,456	2,348,150,019

Source: 1993 North Carolina Poultry Industry Survey.

table egg industry experienced no significant change in 1993 from the previous year. Production remained at about 1.6 billion eggs with a market value of \$70 million. The 57 contract producers earned slightly over \$6 million in contract payments. The survey results for the egg complex are summarized in Tables 10 and 11.

## **ECONOMIC IMPACT ANALYSIS: A GENERAL DISCUSSION**

### *Goals of Economic Impact Analysis*

High income and low unemployment are indicators of a healthy economy and are the focal points of economic development strategies. Attracting new firms or encouraging existing firms to expand is a common theme of regional economic development plans. Community leaders have at their discretion a variety of financial incentives to lure individual firms. These incentives may include tax waivers,

employment subsidies, and cost sharing, and they represent the public's cost for promoting economic development. Like any other investment decision, the public cost of granting these incentives must be weighed against the expected benefits of higher regional income and employment levels. Economic impact analysis allows community leaders to assess the expected income and employment effects from inducing particular firms or sectors to expand within the regional economy.

An industry's contribution to the overall regional economy can be separated into three components—direct, indirect, and induced effects. The goal of economic impact analysis is to quantify each type of effect, and then sum the three components in order to estimate the industry's total regional economic contribution. An important facet of the analysis is to determine what is produced and consumed within the region. Imports of either production inputs or consumption goods lessen the industry's overall impacts.

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**Table 7. Broiler complex — value of production.**

1992	Total	Stays in NC		Leaves NC	
	\$	%	\$	%	\$
<b>Breeder pullets</b>					
Total contract growers' payment	6,792,391				
Market value of pullets	42,129,495	97	41,001,496	3	1,127,999
<b>Breeder hens</b>					
Total contract growers' payment	21,292,036				
Market value	110,059,541	88	96,841,519	12	13,218,002
<b>Hatchery</b>					
Market value of chicks hatched	84,327,953	55	46,301,772	45	38,026,182
<b>Grow-out</b>					
Total contract growers' payment	111,543,453				
Total farmgate value	669,813,197	100	669,813,197	0	0
<b>Processing</b>					
Total processed value	1,315,679,293				
1993	Total	Stays in NC		Leaves NC	
	\$	%	\$	%	\$
<b>Breeder pullets</b>					
Total contract growers' payment	6,755,780				
Market value of pullets	46,203,215	100	446,044,240	0	158,975
<b>Breeder hens</b>					
Total contract growers' payment	20,694,750				
Market value	114,014,492	88	100,604,430	12	13,410,062
<b>Hatchery</b>					
Market value of chicks hatched	85,226,980	64	54,171,249	36	31,055,731
<b>Grow-out</b>					
Total contract growers' payment	119,344,764				
Total farmgate value	782,348,515	100	782,348,515	0	0
<b>Processing</b>					
Total processing market value	1,397,285,567				

Source: 1993 North Carolina Poultry Industry Survey.

**Table 8. Turkey complexes — volume of production.**

1992		Breeders (eggs produced)	Hatchery (eggs set)	Grow-out (turkeys)	Processing (turkeys)
Number of contract growers		19	—	847	—
Capacity of houses under contract (sq. ft.)		448,750	—	112,888,540	—
Number of company farms/ hatcheries/processing plants		88	7	29	6
Volume of Production	Number	283,189,032	77,695,125	58,235,996	52,665,394
	Pounds	—	—	1,224,303,338	907,753,234
1993		Breeders (eggs produced)	Hatchery (eggs set)	Grow-out (turkeys)	Processing (turkeys)
Number of contract growers		19	—	872	—
Capacity of houses under contract (sq. ft.)		448,750	—	115,242,540	—
Number of company farms/ hatcheries/processing plants		88	8	28	6
Volume of Production	Number	293,662,068	84,052,658	64,748,715	52,718,374
	Pounds	—	—	1,268,595,954	952,857,621

Source: 1993 North Carolina Poultry Industry Survey.

An industry's direct effects are readily apparent. A firm's hiring and payroll statistics are close approximations of its *direct effects* on the region's employment and income levels. Suppose, for example, a new broiler processing facility opens. It hires 500 workers and pays an average annual wage of \$20,000 per worker. If these workers live within the region and were previously unemployed, the new facility would be credited for boosting employment by 500 jobs and increasing regional household income by \$10 million dollars.

An individual firm operates within a network of other firms where one firm's output becomes another firm's input. For example, fast food restaurants that sell chicken purchase the output of a broiler processing plant. Likewise, a broiler processor depends on farms to provide a steady flow of live birds. Farms, in turn, depend on feed mills to supply feed rations. Feed mills depend on growers of corn and soybeans to supply their raw ingredients.

This network of suppliers produces what are known as *indirect effects*. To illustrate, assume a new 500-worker broiler processing facility has an annual

processing capacity for 30 million birds. If the existing regional broiler production is fully utilized and live birds are not imported from outside the region, the regional production of live birds must expand by 30 million. The additional employment and income opportunities created at the farm level are indirectly credited to the processing facility. These in turn create additional sales of building equipment, feed, veterinary services, and other goods and services. Documenting indirect effects identifies the important economic linkages among industries. The magnitude of indirect effects depends on the amount of inputs being purchased and the extent to which those inputs are produced within the region. The more inputs produced and purchased within the region, the greater the magnitude of indirect effects. It is also important to note that industries supply some of their own inputs. For example, if broiler production expanded by 30 million birds to meet additional processing capacity, a proportional increase in breeding stock would be required. The total increase in live birds would be greater than 30

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**Table 9. Turkey complexes — value of production.**

1992	Total	Stays in NC		Leaves NC	
	\$	%	\$	%	\$
<b>Turkey breeders</b>					
Total contract growers' payment	1,040,667				
Market value of eggs produced	20,860,645	98	20,430,378	2	430,267
<b>Hatchery</b>					
Market value of poults hatched	62,036,648	80	49,876,648	20	12,160,000
<b>Turkey grow-out</b>					
Total contract growers' payment	57,515,424				
Total farmgate value	449,048,075	83	372,546,805	17	76,501,270
<b>Processing</b>					
Total processing value	645,042,487				
<hr/>					
1993	Total	Stays in NC		Leaves NC	
	\$	%	\$	%	\$
<b>Turkey breeders</b>					
Total contract growers' payment	1,059,360				
Market value of eggs produced	20,746,596	98	20,338,453	2	408,143
<b>Hatchery</b>					
Market value of poults hatched	71,742,439	82	58,942,439	18	12,800,000
<b>Turkey grow-out</b>					
Total contract growers' payment	60,635,559				
Total farmgate value	466,034,473	83	389,014,031	17	77,020,442
<b>Processing</b>					
Total processing market value	704,962,501				

Source: 1993 North Carolina Poultry Industry Survey.

million birds, directly because of an increase in the demand for broiler production and indirectly because of an increase in breeding animals.

New jobs mean greater household incomes and/or a greater number of households in the region earning income. Household income includes wages, profits (self-employment income), corporate dividends, and rental property income. When a household's income increases, its spending volume also increases. The spending of additional household

income creates *induced effects*. Some of the \$10 million dollars earned by the newly employed broiler processing workers are spent on the purchase of necessities such as food, clothes, utilities, and housing. Another portion of the increased regional income is spent on luxury goods such as televisions, boats, cars, vacation homes, and restaurant dining. The purchases of household goods stimulates income and possible employment effects in the industries that provide those products. Similar to indirect impacts,

**Table 10. Table egg complex — volume of production.**

<b>1992</b>	<b>Breeders (eggs produced)</b>	<b>Hatchery (eggs set)</b>	<b>Production (table eggs)</b>
Number of contract growers	0	—	57
Capacity of houses under contract (sq. ft.)	0	—	2,333,710
Number of company farms/hatcheries/processing plants	0	0	7
Volume of production (number)	0	0	1,535,131,188
<b>1993</b>	<b>Breeders (eggs produced)</b>	<b>Hatchery (eggs set)</b>	<b>Processing (table eggs)</b>
Number of contract growers	0	—	57
Capacity of houses under contract (sq. ft.)	0	—	2,966,280
Number of company farms/hatcheries/processing plants	0	0	7
Volume of production (number)	0	0	1,585,179,828

Source: 1993 North Carolina Poultry Industry Survey.

the magnitude of induced effects depends on the proportion of additional income that is spent on goods produced within the region. The impact from induced effects is reduced when income is either not spent (i.e., not used for consumer or investment purchases) or is spent on imported commodities.

### *Measures of Economic Importance*

Business activities are summarized by a number of economic statistics—output, sales, taxes, number of employees, and payroll, among others. Each statistic can be used as a measure of economic importance. *Total industry output* (TIO), measured by gross sales receipts, is frequently reported as a measure of an industry's regional economic importance. However, measuring the economic importance of an industry with TIO can be misleading. Summing the gross sales receipts overestimates economic size of an industry because values of inputs are recounted at each succeeding stage of production (Walden, 1989). The extent to which TIO overestimates an industry's size depends on the industry's structure. For example, in a region where the broiler industry is vertically integrated, market sales occur only when the final processed products are sold to retail outlets. Contrary to that, in a region where

broiler growers are independent of processing firms, TIO includes the market sales of all intermediary products (hatching eggs, chicks, live broilers) as well as processed final products. While the physical volume of production is the same in both regions, TIO for the second region is inflated by the value of intermediary sales occurring among various production stages.

This deficiency could be mitigated if regional economic accounting procedures would standardize TIO on the basis of the *final-point-of-sale* (FPS) values. FPS is defined as the sum of the value of final processed products and the value of intermediary goods which are exported (sold) outside of the region before entering the processing phase. The remaining problem with using FPS is that it includes imported inputs, giving credit to production from outside the region (Walden, 1989).

An alternative measure of regional economic importance is household income. This measure includes employee compensation (wages), self-employment income (profits), and income from property ownership (rents and dividends). An industry's contribution to regional income presents a more consistent picture of economic importance than TIO because income earned is not double counted and is independent of industry structure.

**Table 11. Table egg complex — value of production.**

1992	Total	Stays in NC		Leaves NC	
	\$	%	\$	%	\$
Commercial egg production					
Total contract growers' payment	6,085,658				
Total market value of eggs	65,680,882	64	42,095,428	36	23,585,454
1993	Total	Stays in NC		Leaves NC	
	\$	%	\$	%	\$
Commercial egg production					
Total contract growers' payment	6,283,115				
Total market value of eggs	70,025,125	63	44,100,413	37	25,924,712

Source: 1993 North Carolina Poultry Industry Survey.

Employment is a third measure of an industry's regional economic importance. While employment statistics avoid the double-counting problems of TIO, employment indicators alone do not always accurately reflect an industry's importance. For example, a long-term decline in farm employment does not necessarily mean a reduced economic importance of agricultural production. Aggregate income level was maintained by increased worker productivity through technological improvements.

Closely related to household income as a measure of economic importance is the *value added* (VA). VA equals the value of a firm's output minus the value of inputs purchased from other firms (Walden, 1989). Practitioners of economic impact analysis (Johnson, 1993; Walden, 1989) argue that VA is the most meaningful measure of an industry's contribution to a regional economy. It is a net measure of economic contribution, independent of industry structure. VA includes all components of household income plus indirect business taxes. Indirect business taxes are fees, surcharges, excise taxes, and property taxes paid by firms to government treasuries. These taxes help support government services and public infrastructure. Gross domestic product (GDP) is a commonly stated national measure of value added. State domestic product (SDP) is the measure of value added produced by firms within a state.

### *Analytical Framework of Economic Impact Analysis*

The total economic contribution of an industry is the sum of direct, indirect, and induced effects. Measuring these components requires that the economic interdependencies among regional industries be quantified. Input/output analysis provides the analytical tool that identifies and measures regional firm interdependencies. Input/output analysis begins with the premise that total industry outlays equal the value of total industry outputs. *Outlays* are payments made by firms for inputs, labor wages, machinery or land rental, business taxes, and business retained earnings (profits). Wages, rental payments on real property, taxes, and profits are factor payments and known as value-added components. Inputs are purchased locally (within the region) or imported from outside the region. *Outputs* are goods and services produced by the industry. They can be consumed directly by households within the region, exported outside the region, or retained in the region and sold to other industries as intermediate products.

Input/output analysis requires that the regional economy maintain equilibrium between quantities demanded and quantities supplied. Several assumptions are imposed which ensure equilibrium. First, prices are held constant. Second, demand changes are

matched by appropriate changes in supply so that new equilibrium is reestablished instantaneously. This condition is met by assuming that all inputs, including labor, flow freely across regional borders. Third, technology is fixed and production uncertainties are ignored. Therefore, as long as demand is unchanged, production remains constant. Fourth, households spend their income in fixed proportions, implying that their spending patterns are unaffected by income levels. If a household earns \$10,000 and spends \$200 on restaurants, when household income increases to \$20,000, restaurant spending would increase to \$400. Finally, production technology is assumed to be linear. Linear production technology implies that industries purchase inputs in fixed proportions and that there are no economies of scale. If inputs double, output will double.

Input/output analysis is frequently criticized because of these unrealistic assumptions of fixed proportions for household spending patterns and firm production processes. It is reasonable to expect that individual spending patterns change as income increases. The fact that the production units in many industries, particularly in the agricultural production sector, are expanding indicates that economies of scale are prevalent. These criticisms can be addressed somewhat if one interprets input/output results with a short-term perspective and uses an input/output model that reflects current technology.

The assumptions about fixed proportions make it easier to mathematically compute the total effects coefficients and multipliers which are needed to estimate indirect and induced effects. Total effects coefficients and multipliers are computed for a specific industry and can be determined for any measure of economic performance. A *total effects coefficient* predicts changes in regional output, income, value added, or employment for a given change in an industry's final demand. The total effects coefficient is a summation of direct, indirect, and induced effects. A *multiplier* is related to a total effects coefficient, but expresses impacts slightly differently. Multipliers predict changes in regional output, income, value added, or employment from a corresponding change in an industry's output, income, value added, or employment.

This study used Micro IMPLAN (Olson et al., 1993), a software package for microcomputers, to perform the regional input/output analysis.<sup>5</sup> IMPLAN allows regional economic impact analysis at the national, state, or county level. Industries are grouped into 528 sectors according to their four-digit Standard Industrial Classification (SIC) codes. Annual data sets are assembled from various secondary sources. The IMPLAN data set offers an initial set of technological relationships among regional industry sectors. In the study reported here, we used the 1990 IMPLAN data set for North Carolina.

The flexibility of the IMPLAN software allows the input/output model to be modified with better information on current technology and industry production statistics. In this study the original 1990 IMPLAN data set was modified to reflect the 1993 production year using the information gathered in the 1993 *North Carolina Poultry Industry Survey* (Vukina and Carter, 1994). Specifically, the survey provided information on the value of poultry farm and processing output (TIO), employment, wages, grower payments, and taxes. The survey also provided the breakdown of the North Carolina poultry farm output between production that was shipped out of North Carolina before reaching the processing stage and the production that was retained in the state for further processing.

## ESTIMATES OF ECONOMIC IMPACTS FROM THE POULTRY INDUSTRY

The total final-point-of-sale value for the poultry industry in 1993 was \$2.3 billion (Table 5). Because the industry is vertically integrated, this estimate was a mixture of farm production and processed output. Economic impacts of the poultry industry were developed by evaluating farm production independently of processed output. One reason for dividing the industry into a farm and processing sector was to

<sup>5</sup> The Minnesota IMPLAN Group (Olson et al., 1993) is a private firm which has been given the distribution rights to the IMPLAN software.



conform with the IMPLAN framework, which has separate sectors for farm and processing output. Another reason for isolating the farm production effects is to allow for comparisons of economic impacts against other agricultural commodities.

### *Farm Production Sector*

Farmgate value based on final point of sales includes live birds shipped to processing plants in North Carolina plus any birds, poult, or eggs that were either consumed directly by North Carolina residents or exported out of the state. Table 12 itemizes 1993 farmgate value at final point of sale for each poultry commodity. Based on this approach poultry production farmgate value in 1993 was estimated at \$1.477 billion.<sup>6</sup>

For the purposes of our study, farm employment was measured in terms of full-time equivalents (FTEs). One should not confuse FTEs with numbers of farmers or employment statistics quoted by the news media. Employment statistics frequently count working persons regardless of their tenure and daily work schedule. FTEs standardize employment by assuming one FTE works 2,000 hours per year (40 hrs/week x 50 weeks/yr). Consequently, two half-time workers would be combined into one FTE. Likewise, an individual with a work schedule greater than 40 hours per week would be credited as more than one FTE.

During 1993 an estimated 10,123 FTEs were employed in poultry production in North Carolina. Employment on the farm level of poultry production comes from two sources — integrator companies (company farms, field personnel, hatcheries) and contract growers. Employment on the companies' side was estimated from the 1993 *North Carolina Poultry Industry Survey* (Vukina and Carter, 1994). It was assumed that workers were full-time employees and that one worker equaled one FTE. Firms reported total

employment and the distribution of employment within the firm for various activities including processing. Company employees not involved with processing were assumed to be employed by the production sector. Out of a total of 19,821 workers, 15,146 workers were engaged in processing, leaving 4,675 workers employed in production.

Contract growers provided a second source of poultry farm employment. The survey reported a total of 4,118 growers. While employment data on grower operations were not available, the survey did provide grower production capacities by the type of operation. Using this information, farm level FTE employment on contract production facilities was estimated using enterprise budgets. Data from enterprise budgets were used to estimate labor requirements per square foot by type of poultry house (Vukina, 1993). Multiplying per unit labor requirement by total capacity yielded total hours of required labor. Dividing the total by 2,000 hours estimated the number of FTEs employed. The assumptions and calculations used to estimate employment by contract growers are summarized in Table 13. A total of 5,448 FTEs were estimated to be employed by contract growers. Together with the 4,675 FTEs employed by integrators, the farm sector employed 10,123 FTEs during 1993.

Income, or value-added payments, includes payments to factors of production (labor, land, capital, and management) and indirect business taxes. Table 14 shows a breakdown of the value-added expenditures for the farm sector. Wages were calculated by multiplying the number of FTEs by an average annual wage. An estimate of average annual wage was provided by the North Carolina Employment Security Commission which collects employment and payroll data by four-digit industrial classification codes (SIC codes). Wages totaled over \$164 million, accounting for almost 50% of value-added expenditures. Property taxes were estimated on the basis of house capacities, 1987 valuation schedules, and an assumed tax rate of \$0.70 per \$100 of valuation. As a state total, property taxes were not sizable values. The farm sector was estimated to have paid \$6.1 million in property taxes. However, since property taxes are collected at the county level, counties with greater concentrations of poultry opera-

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<sup>6</sup> North Carolina Agricultural Statistics estimated the total value of poultry and eggs output to be \$1.819 billion for 1993. This method combines the total value of pullets, breeding hens, hatching eggs, table eggs, and market birds, and is obtained as a sum of cash receipts for broilers (\$1,004 million), turkeys (\$519.2 million), eggs (\$195.2 million), farm chickens (\$13.3 million), and miscellaneous poultry (\$87.9 million). For reference see Tables 1 and 3.

**Table 12. Distribution of 1993 poultry products to North Carolina consumers, exports, and North Carolina processors.**

Type of farm	Final point of sale (million dollars)		
	To NC consumers	To export	To NC poultry processors
<b>Broiler production<sup>a</sup></b>			
Pullets	0	0.159	0
Breeder hens	0	13.410	0
Hatching eggs	0	31.056	0
Grow-out	0	0	782.349
<b>Turkey Production<sup>b</sup></b>			
Breeder hens	0	0.408	0
Hatching eggs	0	12.800	0
Grow-out	0	77.020	389.014
Table eggs <sup>c</sup>	44.100	25.925	0
Spent fowl <sup>d</sup>	0	13.289	0
Miscellaneous poultry <sup>e</sup>	0	87.900	0
<b>Total</b>	<b>44.100</b>	<b>262.000</b>	<b>1,171.400</b>
<b>1993 Farmgate value</b>			<b>\$1,477.500</b>

<sup>a</sup> See Table 7, value of broiler production.

<sup>b</sup> See Table 9, value of turkey production.

<sup>c</sup> See Table 11, value of table egg production.

<sup>d</sup> 1993 North Carolina Poultry Industry Survey.

<sup>e</sup> North Carolina Agricultural Statistics.

tions collected the greater share of total property taxes. Rental income was assumed to be the net difference between total grower payments and estimated payments to labor wages and property taxes. From the survey, grower payments were estimated to be \$214.8 million, implying rental income of \$121.6 million.

### *Direct Impacts*

Output, income, and employment from poultry farms and processing facilities define the direct economic impacts of the poultry industry. The direct impacts from the 1993 North Carolina poultry production and processing sectors are summarized in Table 15. The combined farmgate values of live birds and commercial eggs totaled \$1.477 billion. Sales of

processed broilers (\$1.397 billion, Table 7) and turkeys (\$0.705 billion, Table 9) in 1993 totaled \$2.102 billion. Almost 80% of poultry production in North Carolina (\$1.171 billion) was retained in the state as an intermediate input for the poultry processing sector. Over \$260 million worth of commercial eggs, hatching eggs, breeder pullets, live turkeys, spent fowl, and miscellaneous poultry were exported out of North Carolina. The remaining output (\$44.1 million) was consumed by North Carolina households in the form of commercial eggs (see Tables 11 and 12).

Input/output analysis requires that the value of industry output equal value of industry spending. Industry spending consists of three categories—locally purchased inputs, imported purchased inputs, and value-added components. The allocations of 1993

**Table 13. Assumptions and estimation of employment by contract growers.**

	Labor <sup>a</sup> hrs/house	House <sup>a</sup> ft <sup>2</sup> /house	House Capacity <sup>b</sup>		Employment <sup>c</sup> FTE (1993)
			hrs/ft <sup>2</sup>	ft <sup>2</sup> (1993)	
<b>Broilers</b>					
Pullets	730	21,000	.0348	5,727,504	199,317
Breeder hens	1,400	20,000	.0700	12,265,366	858,576
Grow-out	1,120	24,000	.0467	96,170,494	4,491,162
<b>Turkeys</b>					
Toms	1,460	40,000	.0365		
Hens	1,460	28,000	.0521		
Average (toms and hens)			.0443	115,577,443	5,120,081
Breeder hens			.0348	448,750	15,617
Table Eggs			.0700	2,966,280	207,640
<b>Total</b>					<b>5,448</b>

<sup>a</sup> Data source: Vukina (1993).

<sup>b</sup> Data source: 1993 North Carolina Poultry Industry Survey.

<sup>c</sup> One full-time-equivalent (FTE) equals 2,000 hours per year.

expenditures in the farm production and processing sectors are presented in Table 15. Enterprise budgets suggested that approximately 23% of total expenditures to produce live birds and eggs are allocated to value-added components. Another 50% of total expenditures to produce live birds and eggs went toward imported inputs, primarily feed grains.

IMPLAN data were used to allocate expenditures within the processing sector. Purchases of imported inputs in the processing sector were only 16% of total spending. Processing facilities are located near production areas and live birds are the principal input.

### Total Economic Impacts

Total economic impacts include direct, indirect, and induced effects. Indirect impacts result from the network of regional suppliers who sell inputs to the poultry industry and induced impacts result when households spend their additional income on consumer goods available within the region.

Total economic impact of the poultry industry was determined by adding up the separately estimated impacts of farm and processing sectors. This approach required that the farm (processing) sector be "deleted" from the IMPLAN input/output matrix while estimating the impacts of the processing (farm) sector. For example, when developing impacts for poultry production, the regional output from the processing sector was assumed to be zero. Therefore, any inputs purchased from the processing sector had to be imported. Likewise, when developing impacts for the processing sector, regional live-bird and egg production were assumed to be zero, forcing IMPLAN to estimate indirect and induced impacts as if live birds and eggs were imported from outside of North Carolina. The artificial removal of production or processing sectors was necessary to avoid double-counting impacts when the sector impacts were merged. Input/output models calculate indirect and induced impacts by "looking backward." Indirect impacts associated with the processing sector include all indirect impacts associated with live bird produc-

**Table 14. 1993 value-added expenditures on farm production of broilers, turkeys, and commercial eggs.**

	Estimated <sup>a</sup> employment FTE/yr	Average <sup>b</sup> annual wage \$/worker-yr	Grower <sup>c</sup> payment mil \$	Wages mil \$	Property taxes mil \$	Rental Income mil \$
<b>Broiler farms</b>						
Companies	2,578	14,600		37.639	.788	0
<b>Growers</b>						
Pullets	100		6.756			
Breeder hens	429		20.695			
Grow-out	2,246		119.345			
Total growers	2,775	14,600	146.796	40.515	2.683	103.598
<b>Turkey farms</b>						
Companies	1,728	18,000		31.104	.908	0
<b>Growers</b>						
Breeder hens	8		1.059			
Grow-out	2,561		60.636			
Total growers	2,569	18,000	61.695	46.242	1.634	13.819
<b>Table egg farms</b>						
Companies	369	18,950		6.993	.003	
Growers	104	18,950	6.283	1.971	.083	4.229
<b>Farm sector totals</b>	<b>10,123</b>		<b>214.774</b>	<b>164.469</b>	<b>6.099</b>	<b>121.646</b>

<sup>a</sup> Refer to Table 14.

<sup>b</sup> Data source: North Carolina Employment Security Commission.

<sup>c</sup> Data source: 1993 North Carolina Poultry Industry Survey.

tion. Measures of indirect and induced impacts are restricted to what is purchased within the region. Therefore, imports do not generate indirect and induced effects.

Total economic impacts of poultry production and poultry processing are reported separately in Tables 16 and 17 respectively. The linear technology assumption imbedded in input/output analysis results in the impact magnitude being the same in absolute value regardless of whether the change in final demand was positive or negative. Using this result, the economic impacts were calculated separately for production and processing by adjusting the final demand downward until the total industry

output (TIO) was completely exhausted. The total economic impact for the entire poultry industry was obtained by adding up individual impacts of poultry production and processing.

Total industry output, value added, and employment impacts associated with poultry farm production (Table 16) are generated by changing final demand for poultry and egg products such that the total impact on TIO in poultry and egg production equals \$1,477.46 million. Total economic impacts include \$796 million in statewide income and 26,918 jobs. The same table also provides information on the distribution of impacts across other state economic sectors. The biggest beneficiary of poultry production

*Impact of the Poultry Industry on the Economy of North Carolina*

**Table 15. 1993 summary of poultry production and processing.**

	Farm production		Poultry processing	
	mil \$	% TIO	mil \$	% TIO
Value of production (TIO) <sup>a</sup>	1,477.5	—	2,102.2	—
Allocation of TIO to consumption, export, and further processing <sup>a</sup>				
Consumed	44.1	3.0		
Exported	262.0	17.7		
Processed in NC	1,171.4	79.3		
Allocation of TIO to input purchases and value-added components <sup>b</sup>				
Inputs from NC firms	398.9	27.0	1,303.4	62.0
Inputs imported	744.0	50.4	338.5	16.1
Value added				
Wages	164.5	11.1	259.7	12.4
Property tax paid	6.1	0.4	1.4	0.1
Rental income	121.6	8.2	61.0	2.9
Profits	43.1	2.9	138.2	6.5
Total value added	334.6	22.6	460.3	21.9
Employment (number of FTEs) <sup>c</sup>		10,123		15,146

Source:

<sup>a</sup> 1993 North Carolina Poultry Industry Survey.

<sup>b</sup> IMPLAN.

<sup>c</sup> 1993 North Carolina Poultry Industry Survey, and Table 13.

is the trade sector. Wholesale and retail establishments gain over 5,300 jobs and almost \$130 million of income indirectly from poultry production. Including the agricultural service sector, over 5,600 jobs in service industries are indirectly associated with the poultry production. The collective income effects realized in service industries were \$72 million. The indirect impacts on financial industries (banking, insurance, and real estate sectors) are \$103 million of income and employment of 1,566 people. The combined impacts on the state's manufacturing sector were \$44.7 million in income and 1,179 in employment.

Table 17 offers similar information about the poultry processing sector. Total industry output,

value added, and employment impacts are generated by changing final demand for processed poultry products such that the total impact on TIO in the poultry processing sector equals \$2,102.30 million. Total economic impacts are \$789 million in income and 25,062 in employment. Again, wholesale and retail firms receive the largest share of indirect income and employment effects. The service and financial sectors are two other major beneficiaries of income and employment impacts associated with poultry processing.

An estimated total economic impact of the North Carolina poultry industry is determined by summing the impacts described in Tables 16 and 17. As shown in Table 18, the 1993 poultry industry supported

**Table 16. Total economic impacts from poultry production at the farm gate.**

<b>Industry sector</b>	<b>Total industry output (mil \$)</b>	<b>Value added (mil \$)</b>	<b>Employment (FTEs)</b>
Agriculture			
Livestock	6.725	4.074	148
<b>Poultry and eggs</b>	<b>1,477.464</b>	<b>335.321</b>	<b>10,123</b>
Crops	64.665	17.022	646
Agricultural services	74.091	12.438	2,918
Mining	2.581	1.272	6
Construction	32.828	19.756	891
Manufacturing			
Meat processing	11.243	1.134	36
<b>Poultry processing</b>	<b>0</b>	<b>0</b>	<b>0</b>
Food processing	13.023	3.946	76
Feed processing	94.505	4.226	191
Cigarettes	3.568	2.162	7
Textiles	16.403	5.981	319
Wood and paper	9.797	3.762	135
Chemical	42.370	14.799	204
Equipment	22.475	8.732	211
Transportation	52.266	30.882	899
Utilities	56.467	33.868	272
Trade	153.279	129.014	5,342
Financial			
Banking	24.196	13.743	458
Insurance	17.441	8.549	267
Real estate	102.368	81.004	841
Services			
Business	23.939	12.582	743
Professional	67.121	36.931	1,733
Government	19.495	10.033	249
Miscellaneous accounts	3.706	1.898	202
<b>Total</b>	<b>2,392.707</b>	<b>796.566</b>	<b>26,918</b>

Source: IMPLAN modified with 1993 North Carolina Poultry Industry Survey data.

*Impact of the Poultry Industry on the Economy of North Carolina*

**Table 17. Total economic impacts from the North Carolina poultry processing in 1993.**

<b>Industry sector</b>	<b>Total industry output (mil \$ )</b>	<b>Value added (mil \$ )</b>	<b>Employment (mil \$ )</b>
<b>Agriculture</b>			
Livestock	2,653	1,374	48
<b>Poultry and eggs</b>	<b>0</b>	<b>0</b>	<b>0</b>
Crops	1,372	0,320	15
Agricultural services	2,001	0,796	50
<b>Mining</b>	<b>1,989</b>	<b>1,011</b>	<b>5</b>
<b>Construction</b>	<b>17,501</b>	<b>10,222</b>	<b>431</b>
<b>Manufacturing</b>			
Meat processing	4,781	0,508	15
<b>Poultry processing</b>	<b>2,102,301</b>	<b>460,380</b>	<b>15,146</b>
Food processing	9,601	3,368	61
Feed processing	0,390	0,026	1
Cigarettes	3,608	2,195	7
Textiles	15,526	5,718	279
Wood and paper	47,327	16,934	419
Chemical	19,644	7,428	91
Equipment	12,518	4,932	109
<b>Transportation</b>	<b>20,970</b>	<b>12,412</b>	<b>334</b>
<b>Utilities</b>	<b>51,041</b>	<b>29,460</b>	<b>226</b>
<b>Trade</b>	<b>116,545</b>	<b>91,954</b>	<b>4,204</b>
<b>Financial</b>			
Banking	19,572	11,342	334
Insurance	15,919	7,803	225
Real estate	81,322	64,477	509
<b>Services</b>			
Business	18,547	8,822	600
Professional	64,458	35,817	1,553
Government	18,566	9,651	224
<b>Miscellaneous accounts</b>	<b>3,594</b>	<b>2,043</b>	<b>257</b>
<b>Total</b>	<b>2,651,745</b>	<b>788,994</b>	<b>25,062</b>

Source: IMPLAN modified with 1993 North Carolina Poultry Industry Survey data.

almost 52,000 jobs and helped generate almost \$1.6 billion of state income. Poultry production and processing sectors contributed equally to the estimated total economic impacts.

### *Multipliers*

Total economic impacts developed in the previous section are obtained by artificially removing the poultry industry from the rest of the economy. An alternative way of assessing economic impacts is to allow the industry to expand and note the changes in income (value added) and employment. A total effects coefficient will predict changes in regional income and employment for a given change in an industry's final demand. For example, a total effects income coefficient of 0.66 says that for a one dollar increase in final demand for processed poultry products, income in the region increases by 66 cents. The total effects coefficient is a summation of direct, indirect, and induced effects; hence, an income total effect coefficient of \$0.66 is comprised of a \$0.22 direct effect, a \$0.23 indirect effect, and a \$0.21 induced effect.

To clarify the presentation even further, assume an increase in the final demand for processed poultry products of 10% over 1993 levels, generating a \$210 million increase in sales. Because prices are assumed fixed, the increase in sales is matched by an increase in output. Table 19 presents the income and employment effects associated with an increase in poultry processing sales of \$210 million. Total income and employment impacts were 138 million<sup>7</sup> and 4,148 FTE jobs. The impacts were equally distributed across direct, indirect, and induced components. Approximately 18% of total income and employment impacts generated by a change in poultry processing sales accrued to poultry farms.

Multipliers are a convenient way to summarize economic impacts. Multipliers are calculated by dividing total effects by direct effects. The income multiplier associated with poultry processing was

<sup>7</sup>The income total effect coefficient of \$0.66 was calculated as the ratio between total impact (\$138.30 million) and 10% increase in final demand (\$210 million).

3.00 (\$138.3 million/\$46.0 million), meaning that for every dollar earned by the poultry processing firms, a total of three dollars are generated across the state's economy. Similarly, the employment multiplier of 2.92 (4,148 FTEs/1,423 FTEs) suggests that for every FTE hired by a poultry processing facility, FTE employment across the state increases by 2.92.

### SUMMARY AND CONCLUSIONS

The objective of this study was to quantify the impact of the poultry industry on the economy of North Carolina. An industry's contribution to the overall regional economy can be separated into three components: direct, indirect, and induced effects. Direct economic impacts are output, income, and employment from poultry farms and processing facilities. Indirect impacts result from the network of regional suppliers who sell inputs to the poultry industry. Induced impacts result when households spend their additional income on consumer goods available within the region. Indirect and induced effects are calculated using total effects coefficients and multipliers. A total effects coefficient predicts changes in regional output, income, value added, or employment for a given change in an industry's final demand. The total effects coefficient is a summation of direct, indirect, and induced effects. A multiplier is related to a total effects coefficient, but expresses impacts slightly differently. Multipliers predict changes in regional output, income, value added, or employment from a corresponding change in an industry's output, income, value added, or employment.

Poultry production and processing are important sectors of the North Carolina economy. Nationally, North Carolina ranks first in turkey production and fourth in broiler production. In 1993 the combined final-point-of-sale farm value of broilers, turkeys, and commercial eggs was \$1.477 billion, accounting for 30% of total agricultural value produced in North Carolina. Over 98% of the live broilers and turkeys grown on North Carolina farms were processed in the state, creating processed products whose value exceeded \$2 billion. The poultry industry generated almost \$800 million in income and supported 25,269



*Impact of the Poultry Industry on the Economy of North Carolina*

**Table 18. Total economic impacts from the North Carolina poultry industry (production and processing) in 1993.**

<b>Industry sector</b>	<b>Total industry output (mil \$)</b>	<b>Value added (mil \$)</b>	<b>Employment (FTEs)</b>
<b>Agriculture</b>			
Livestock	9.378	5.448	196
<b>Poultry and eggs</b>	<b>1,477.464</b>	<b>335.321</b>	<b>10,123</b>
Crops	66.037	17.342	661
Agricultural services	76.091	13.234	2,969
<b>Mining</b>	4.571	2.283	11
<b>Construction</b>	50.329	29.978	1,312
<b>Manufacturing</b>			
Meat processing	16.024	1.642	51
<b>Poultry processing</b>	<b>2,102.301</b>	<b>460.380</b>	<b>15,146</b>
Food processing	22.624	7.314	138
Feed processing	94.895	4.253	192
Cigarettes	7.176	4.357	14
Textiles	31.928	11.698	598
Wood and paper	57.124	20.695	554
Chemical	62.014	22.227	295
Equipment	34.993	13.664	370
<b>Transportation</b>	73.235	43.294	1,233
<b>Utilities</b>	107.508	63.328	498
<b>Trade</b>	269.824	220.968	9,546
<b>Financial</b>			
Banking	43.768	25.085	793
Insurance	33.359	16.353	493
Real estate	183.691	145.481	1,350
<b>Services</b>			
Business	42.485	21.404	1,343
Professional	131.579	72.748	3,286
Government	38.061	19.684	472
<b>Miscellaneous accounts</b>	7.990	4.378	381
<b>Total</b>	<b>5,044.452</b>	<b>1,585.561</b>	<b>51,983</b>

Source: IMPLAN modified with 1993 North Carolina Poultry Industry Survey data.

**Table 19. Income and employment impacts associated with a \$210 million increase in sales of poultry processing products.**

Economic measure	Income (mil \$)	Employment FTEs
Direct	46.0	1,423
Indirect	48.6	1,407
Induced	43.5	1,318
Total	138.3	4,148
Portion to farm sector	25.9	735
Multipliers	3.00	2.92

Source: IMPLAN modified with 1993 North Carolina Poultry Industry Survey data.

FTE jobs, of which 10,123 work in the production and 15,146 in the processing sector.

The economic impact of the poultry industry extends beyond the jobs and income it directly creates. Total economic impacts (direct, indirect, and induced) associated with poultry production and processing in 1993 included almost \$1.6 billion of state income and 52,000 jobs. The biggest beneficiaries of the poultry industry's economic impact were firms in the wholesale and retail sectors. The income multiplier associated with poultry processing was 3.00, meaning that for every dollar earned by the poultry processing firms, a total of three dollars are generated across the state's economy. Similarly, the employment multiplier of 2.92 suggests that for every person hired by a poultry processing facility, employment across the state increases by 2.92 people.

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