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Changes in ERS Broiler Production and Marketing Cost Series to Reflect Product Forms in the 12-City Composite Price Report

William L. Henson

CHANGES IN ERS BROILER PRODUCTION AND MARKETING COST SERIES TO REFLECT PRODUCT FORMS IN THE 12-CITY COMPOSITE PRICE REPORT. By William L. Henson, National Economics Division, Economic Research Service, U.S. Department of Agriculture, Washington, D.C. December 1984. ERS Staff Report No. AGES840825.

ABSTRACT

The Economic Research Service reports a series of estimated costs and returns for broilers. The series was for basic whole bird carcass, ice-packed broilers. Returns were nine-city average broiler prices reported by the Agricultural Marketing Service. Costs were estimated by use of computerized formulas. In May 1983, the Agricultural Marketing Service replaced the nine-city price report with a 12-city composite price report. The new price report extends market coverage to include additional consumer areas and new product forms of broilers marketed. This report includes descriptions of the two price series and changes in cost estimation equations used for the cost-returns series to account for the product mix represented by the new price series.

Keywords: Broiler cost, returns, and price reporting.

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SUMMARY

The ERS broiler cost-returns series uses prices reported by the Agricultural Marketing Service as a basis for estimating returns. In May 1983, the nine-city price report used in the series was replaced by a 12-city composite price report. The new price report covers three additional consumer areas and three additional product forms of broilers marketed. Use of the 12-city composite price in the ERS broiler cost-returns series required modification of the equations used to estimate production and marketing costs to account for a different product mix.

The basic equations estimate national average production and marketing costs, including long distance hauling for whole broilers ice- or CO_2-packed. The addition of new reporting areas required no change in the basic equations. In early 1983, costs for about 57 percent of the loads of broilers reported in the 12-city composite price could be estimated by use of the basic formulas. However, estimation of costs for the new product forms did require some changes.

Branded products represented about 7 percent of the loads reported in the 12-city composite price in early 1983. Production costs for these broilers usually include an allowance for pigmentation additives in the feed ration. Marketing costs include expenditures for advertising. Additional costs of producing and marketing branded products were estimated at about 1.6 cents per RTC (ready-to-cook) pound. The estimated average premium for branded products was 3.1 cents per RTC pound.

WOGS (whole birds without giblets) represented about 19 percent of the loads reported in the 12-city composite price in early 1983. Most WOGS are slaughtered at an average liveweight about 10 percent less than that of broilers represented by the basic formulas. Production costs include less feed use and increased chick cost per pound of broiler produced. Marketing costs include increased processing cost per pound of broiler and loss of income from giblets and necks sold at parts prices. Additional cost of producing and selling WOGS was estimated at about 2.8 cents per RTC pound. The average premium for WOGS was 6.5 cents per RTC pound.

Chill-pack broilers represented about 16 percent of the loads reported in the 12-city composite price in early 1983. For these broilers, the percentage yield used to convert production costs from live to RTC basis is lower than that in the basic formulas. Chill-pack broilers are likely to have less than average moisture pickup during chilling. There is also a net decrease in marketing cost accounted for by extra processing plant cost for a chilling system, offset by decreased costs for ice and product delivery. Additional cost of producing and marketing chill-pack broilers was estimated at about 0.1 cent per RTC pound. The estimated average premium for chill-pack broilers was 7.6 cents per RTC pound.

The average 12-city composite price in early 1983 was about 2.5 cents per RTC pound of broiler higher than the average nine-city price. Average cost of the product mix reported in the 12-city composite price was estimated as 0.7 cent higher than the previous average cost. Composite costs and 12-city composite prices in the ERS cost-returns series provide a more accurate barometer of economic conditions in the broiler industry than did costs and returns estimated on the basis of the nine-city price.

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INTRODUCTION

The Economic Research Service (ERS) cost-returns series for broilers provides a barometer of the economic health of the broiler industry. If the series is to provide an accurate reflection of economic conditions in the industry, broiler prices and estimated costs of producing and marketing broilers should be for the same mix of products. In 1983, procedures used to calculate average prices reported for broilers were modified. In this report, the changes will be examined and complementary changes made in estimation procedures for costs of producing and marketing broilers will be described.

THE ERS COST-RETURNS SERIES 1/

The ERS cost-returns series for broilers is currently reported in the Livestock and Poultry Outlook and Situation (32). 2/ From 1975 to 1982, it was reported in the now discontinued Poultry and Egg Situation (32). The historical series dates back to 1955.

Cost estimates reported in the ERS cost-returns series for broilers have been calculated on a monthly basis by use of computerized formulas since 1967. The formulas were derived from various production and marketing cost studies and surveys. They are updated periodically to account for changes in data available and technical coefficients.

Broiler prices used in the ERS cost-returns series for broilers from 1964 through early 1983 were based on nine-city weighted average (nine-city) prices reported by the Agricultural Marketing Service (AMS). Broiler prices currently used in the series are based on 12-city composite prices, also reported by AMS.

1/ This discussion is based on the author's personal observations and a scan of the reports mentioned.

2/ Underscored numbers in parentheses refer to references at the end of this report.

Estimated Broiler Costs 3/

The ERS cost-returns series for broilers includes estimates of feed costs and total production costs in cents per liveweight pound. It also includes estimated market costs at the wholesale level in cents per ready-to-cook (RTC) pound. Basic formulas are used to calculate costs as follows:

Feed costs are estimated.

1. Monthly average prices for corn (yellow, No. 2, Chicago market) and soybean meal (49-50 percent protein, Decatur), including charges for delivery to producing areas, are calculated in dollars per ton of ingredient.

2. Ingredient cost per ton of ration is calculated as a weighted average of corn and soybean meal prices per ton multiplied by an adjustment factor to account for costs of other ingredients. The weights applied to corn and soybean meal are their respective proportions in broiler grower rations.

3. Total costs per ton of ration are calculated by adding estimated milling charges per ton to ingredient cost per ton.

4. Feed cost per liveweight pound of broiler is calculated by multiplying the feed conversion rate (pounds of feed per pound of broiler produced) times feed cost per pound of ration.

Total production cost per liveweight pound of broiler is calculated by adding estimated nonfeed cost per pound of broiler to feed cost per pound of broiler. To calculate market costs, one converts total production cost from liveweight basis to RTC basis by dividing production costs by the dressing percentage expressed as a decimal.

Total market cost at the wholesale level, RTC basis, is calculated by adding estimated farm to wholesale marketing costs per RTC pound of broiler to total production cost per RTC pound of broiler. Net returns are calculated at the wholesale market level since this is the market level at which the first change of ownership occurs for most broilers produced.

Broiler Prices 4/

Broiler prices used to calculate the ERS cost-returns series for the period 1964-83 were monthly average AMS nine-city prices. The AMS price reporting system includes offices with reporters under Federal administration and State offices which collect poultry market news under cooperative agreements with AMS. The prices reported are based on summarization of prices provided voluntarily on negotiated sales only. Negotiated sales represent "a change of ownership at a specific price determined at the time of the trade." Prices

3/ See reference (18) for more detail.
4/ The discussion on price reporting is abstracted from (28, 10-16).

reported to AMS are subject to verification by random sampling of the respondent's trading partners. The USDA's (AMS) Poultry Market News Report provides national market coverage and is released by the largest of the poultry price reporting organizations.

The nine-city price is a weighted average price for U.S. Grade A and Plant Grade trucklot sales of RTC ice-packed and CO_2-packed whole broilers to be delivered to first receivers in nine cities. (CO_2-packs were added to the report beginning April 12, 1973.) The cities are Chicago, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, and San Francisco. The nine-city price is "computed by weighting by loads the U.S. Grade A and Plant Grade sales for each of the nine cities ... and weighting the city average(s) by their metropolitan area population" (31, Vol. 30, No. 28, Mar. 7, 1983).

On March 7, 1983, AMS introduced a new, broader based broiler price report, the 12-city composite weighted average (12-city composite) price. This price includes prices for products and market areas in the nine-city report. However, the 12-city composite extended market coverage to three additional metropolitan areas: Boston/New England, Cincinnati, and Denver. Product forms included in the report were also increased. The 12-city composite is calculated by use of procedures similar to those used to calculate the nine-city price. "The (City) composite weighted average is computed by weighting by loads the sales (prices) of whole carcass product in the following categories: U.S. Grade A and Plant Grade Ice- or CO_2-packed, Branded Product, Chill-pack product, and whole birds without giblets (WOGS). The composite 12-city average is then computed by weighting (City composite prices) by populations within the regional marketing area(s)" (31, Vol. 30, No. 28, Mar. 7, 1983). Prices included in the 12-city composite are also prices negotiated for trucklot sales of RTC broilers to be delivered to first receivers in major market areas.

NINE-CITY PRICES COMPARED WITH 12-CITY COMPOSITE PRICES

For the 9-week period March 7, 1983, through May 2, 1983, both nine-city and 12-city composite prices were reported (table 1). During this period, the weekly average number of loads included in the nine-city report was 518.2 compared with 1,023.7 for the 12-city composite report. Market coverage for the 12-city composite report was about double the coverage for the nine-city report.

During the 9-week period, the average of weekly average prices weighted by number of loads per week was 41.6 cents per pound for the nine-city report compared with 44.1 cents per pound for the 12-city composite report. Part of the 2.5 cents difference was accounted for by the addition of three new cities to the coverage. Part of the difference was due to the addition of value added products to the basic commodity whole carcass, ice-packed broilers covered by the report.

Weekly average prices during the 9-week period weighted by loads per city and regional population were calculated for:

1. U.S. Grade A; 9 city, 3 city, 12 city.
2. Plant Grade; 9 city, 3 city, 12 city.
3. U.S. Grade A including branded; 9 city, 3 city, 12 city.
4. WOGS, 12 city.
5. Chill-pack, 12 city.

Table 1--Nine-city weighted average and 12-city composite weighted average prices for trucklot sales of ready-to-cook whole broilers, March 7, 1983-May 2, 1983

Date	9-city		12-city composite	
	Price	Loads	Price	Loads
	Cents/lb.	Number	Cents/lb.	Number
3-7	42.25	551	44.54	1,006
3-14	41.99	515	44.33	1,009
3-21	43.61	496	46.01	971
3-28	39.58	494	42.38	958
4-4	40.84	456	43.56	1,020
4-11	40.57	510	43.20	981
4-18	40.70	519	43.36	1,061
4-25	41.65	572	43.94	1,156
5-2	42.95	551	45.28	1,051
Average	41.60	518.22	44.07	1,023.66

Source: (31, various Monday issues).

Averages of the weekly average prices, weighted by number of loads per week, provide a basis for distribution of the difference between nine-city and 12-city composite prices among sources (tables 2 and 3).

The average of weekly average prices for U.S. Grade A and Plant Grade broilers for the nine cities was 41.2 cents per pound compared with 41.6 cents for the 12 cities (table 2). About 0.4 cent of the difference between the average nine-city price and the average 12-city composite price was accounted for by the extension of coverage to the additional three areas. This extension also accounted for an increase in weekly average number of loads reported of about 80 loads. The weekly average number of loads of U.S. Grade A and Plant Grade broilers reported by city for nine cities was 504.7 (some loads reported in the nine-city average were not reported by city).

The 12-city average of weekly average prices for U.S. Grade A including branded products and Plant Grade broilers was 42 cents per pound compared with 41.6 cents per pound when branded products were excluded (table 2). The extension of the product line to include branded products accounted for about

0.4 cent of the difference between the average nine-city price and the average 12-city composite price. Extension of coverage to include branded products also accounted for an increase in weekly average number of loads reported of about 77 loads. The estimated average price for branded products was 44.7 cents per RTC pound.

Addition of WOGS to the 12-city average of weekly average prices resulted in a 1.4 cents per pound increase in the average price to 43.4 cents per pound (table 2). This additional coverage also accounted for an increase in weekly average number of loads reported of about 196 loads.

The increase in the number of cities reporting and extension of product forms to include branded products and WOGS accounted for about 2.1 cents of the 2.5 cents difference between the average nine-city price and the average 12-city composite price for broilers. These additions also accounted for about 352 loads of broilers per week. The weekly average number of loads of broilers reported in the 12-city composite price was 166.8 more than the 856.9 average number of loads accounted for above. Most of the difference was accounted for by loads of chill-packed broilers. Extension of the product forms reported to include chill-packed broilers accounted for the approximately 0.4 cent remaining difference between average nine-city prices and average 12-city composite prices. Prices for chill-pack broilers were not reported as a separate item. However, the difference between the average total value of loads priced at the 12-city composite price and the average value of loads accounted for above provided an estimate of the average total value of loads of chill-pack broilers. Dividing this value by the number of loads of chill-pack broilers yielded an estimate of the average price for broilers in this product form, 47.8 cents per RTC pound.

COSTS FOR BROILERS REPORTED IN THE 12-CITY COMPOSITE PRICE

A recent report on the ERS cost-returns series for broilers demonstrated that the distribution of broilers produced among product forms marketed has changed dramatically in the past 20 years (18). Only whole carcass broilers, ice- or CO_2-packed were accounted for in both estimated costs and returns through February 1983. In 1962, results of a survey of broiler processors showed that 83 percent of their sales volume was whole birds, uncut in ice- or CO_2-pack (24). Results of a followup survey in 1981 showed only 27.1 percent of the processors' volume was whole, uncut, with neck and giblets in ice- or CO_2-pack. This change eroded the market base covered by the cost-returns series. The extension of product forms to include whole birds sold as branded product, WOGS, and chill-pack increased the market base covered by the price report by over 13 percent of the total volume of broilers marketed. This extension plus the addition of three market areas to the original nine cities resulted in about twice as many loads of broilers being included in the weekly broiler price report which is the base for calculating estimated returns in the cost-returns series. However, the new price series represents a modified market base. Calculation of estimated costs was also adjusted to account for the modified market base.

Ice- and Co_2-Pack

Calculation of estimated broiler production and marketing costs by use of the previous basic formulas resulted in estimated costs mostly for whole carcass

Table 2--Average of prices reported for trucklot sales of ready-to-cook whole broilers, by product, March 7, 1983-May 2, 1983 1/

Date	Unit 2/	U.S. Grade A 3/		Plant grade 3/		U.S. Grade A incl. branded 3/ 4/		WOGS 5/	Chill-pack 6/
		9-city	12-city	9-city	12-city	9-city	12-city	12-city	12-city
3-7	cents	42.98	43.61	40.17	40.20	43.88	44.18	49.03	46.98
	loads	302	364	209	220	413	475	179	132
3-14	cents	42.48	43.09	40.16	40.21	42.92	43.33	48.78	46.72
	loads	258	322	212	237	308	372	190	210
3-21	cents	44.12	44.64	42.13	42.19	44.35	44.80	49.67	49.33
	loads	301	363	189	208	330	400	215	148
3-28	cents	40.47	40.96	37.25	37.38	40.82	41.15	46.38	47.66
	loads	304	357	181	204	364	417	192	145
4-4	cents	41.56	42.03	38.90	39.00	42.24	42.24	47.35	48.27
	loads	261	314	189	208	395	448	190	174
4-11	cents	41.16	41.69	38.94	38.98	41.05	42.01	47.07	47.67
	loads	311	374	195	220	354	417	189	155
4-18	cents	40.97	41.44	39.18	39.20	42.06	42.26	46.81	48.09
	loads	322	378	196	216	427	487	203	155
4-25	cents	41.99	42.41	40.19	40.23	42.74	42.94	47.94	46.58
	loads	368	437	198	218	463	532	197	209
5-2	cents	43.54	43.78	41.13	41.18	43.78	43.97	49.35	49.17
	loads	333	388	213	230	382	440	208	173
Average	cents	42.14	42.63	39.82	39.86	42.64	42.98	48.06	47.77
	loads	306.67	366.33	198.00	217.89	381.78	443.11	195.89	166.78

1/ Calculated from price reports in (31, various Monday issues). Nine-city averages are for the cities included in the nine-city weighted average reports. Twelve-city averages are for the cities included in the 12-city composite weighted average report. 2/ Cents per pound and number of loads reported. 3/ Prices are averages of city prices weighted by numbers of loads reported and regional population. 4/ Average price calculated for branded products was 44.65 cents per RTC pound. 5/ WOGS are whole birds without giblets. Prices are averages of regional prices weighted by numbers of loads reported and regional population. 6/ Calculated from 12-city composite weighted average prices by subtracting the contributions of 12-city average prices for U.S. Grade A, including branded, plant grade, and WOGS.

Table 3--Composition of the difference between averages of nine-city weighted average prices and 12-city composite weighted average prices for trucklot sales of ready-to-cook whole broilers, March 7, 1983-May 2, 1983 1/

Factor added to nine-city base product	Increase in average price	Increase in loads reported weekly
	Cents/lb.	Number
3 cities	0.37	79.55
Branded product	.35	76.78
WOGS	1.40	195.89
Chill-pack	.35	166.77
Total	2.47	2/518.99

1/ Calculated from data in table 2. 2/ Includes an average 13.55 loads reported in the nine-city weighted average but not identified by city because there were too few loads to report for some cities in some reporting periods.

birds, ice-packed, with CO_2-packed whole birds. However, results of surveys of broiler processors show that CO_2/dry ice-pack broilers, whole carcass, uncut which accounted for 22.2 percent of the volume sold in 1970 accounted for only 5.1 percent in 1978 (24). By 1981, the proportion of CO_2/dry ice-pack had decreased to the point that sales in these packs were included in wet ice categories. This would suggest there is no longer any need to account for CO_2/dry ice-pack in calculating broiler costs for the cost-returns series and that costs generated from the basic formulas can be interpreted as costs for whole carcass, uncut, ice-pack broilers.

New Markets Reporting

The addition of new marketing areas to the report could affect production and marketing costs through changes in product mix marketed or in product distribution costs. Any effects of changes in product mix are accounted for when costs for the products included in the composite price are weighted. Distribution costs estimated by use of the basic formulas include long distance hauling from production areas to consumer markets. The estimates are for national average distribution costs and the three new consumer marketing areas are part of the national market for broilers. There did not appear to be a need to modify the basic formulas for broiler costs to account for the added marketing areas.

Branded Product

Calculation of added costs of broiler production and marketing associated with sales of branded products is a difficult problem. A firm is likely to attempt to differentiate broilers sold with its brand identification from

nonbranded products it sells and from all products sold by other firms. An individual firm may even differentiate within its own branded sales and sell under more than one label. Differentiation can be based on quality of the broilers produced. Quality differences in broilers can be achieved through selectivity among strains of chicks, production techniques, feed ingredients and medicants, and processing techniques (see, for example, 11, 13, 15, 25, 26, and 33). The firm could also attempt to differentiate based on how its product is packaged. There is substantial variation among firms in techniques used to differentiate their products. Information on these practices is usually considered proprietary. Thus, for most practices used for broiler product differentiation there is no solid basis for calculation of an industry average cost. However, during the 9-week period discussed earlier, 85.7 percent of the loads of branded products reported was for New York. Cities in the Northeast (New York, Pittsburgh, Philadelphia, and Boston/New England) accounted for 96.1 percent of the loads of branded products reported.

Based on the author's observations and informal contacts with marketing specialists in the region, the dominant sources of broiler product differentiation used in Northeastern markets are pigmentation and chilling techniques. In 1980, one firm was estimated to "have as high as 80 percent of the branded (chicken) market" in the greater New York area (4). This firm advertises that its chickens have not been exposed to freezing temperatures. This suggests it does not use deep chilling technology. Thus, it was assumed that chilling costs for branded products included in the price report did not substantially differ from costs for ice-pack broilers. Broiler pigmentation can be enhanced in various ways (see, for example, 11, 14, 17, and 20). The most frequently used technique is the addition of pigment enhancers to the feed ration. The amount, source, and cost of enhancer used vary among firms. Based on a private conversation with a poultry nutrition specialist with a leading broiler production and feed milling firm, the extra cost of pigment enhancers in a high pigment ration is about $1.50 to $2.00 per ton of ration. At $1.75 per ton of ration, the cost of pigment enhancers to produce highly pigmented broilers would increase feed cost about 0.25 cent per RTC pound.

Branded broilers are also more likely to be advertised by the selling firm than are nonbranded ones. The firm mentioned above as having most of the New York market for branded chicken is also a leader in advertising branded broilers. In 1982, it was reported that this firm allocated 1 cent per RTC pound of chicken sold for advertising (3). There is considerable variation among firms in expenditures per unit of sales for advertising and the industry average is probably less than 1 cent per pound. However, since this firm had most of the market where almost all branded sales were reported, it was assumed that expenditures for advertising by firms selling branded chicken included in the price report was 1 cent per pound of chicken sold.

Compared with costs represented by the basic formulas, sale of branded chickens would likely be associated with an increase in feed ration ingredient costs of about $1.75 per ton and an increase in marketing cost of about 1 cent per RTC pound of chicken sold. Firms which sell branded chickens do not sell all of their output branded. Some output may not meet their standards for their brand. There may also be periods when the product is diverted from the potential supply of branded products to protect brand premium prices. Results of a recent survey of broiler processors with branding programs showed that 44 percent of their 1981 output was marketed with consumer branding (24). The percentage is likely to be considerably higher for the firm mentioned above since that firm has a very aggressive promotional program. It was assumed

that the proportion was 75 percent for firms with loads of branded chickens reported in the composite price. Extra costs per pound associated with selling branded chicken were multiplied by 1.33 to account for the fact that those firms sell 25 percent of the output as nonbranded.

WOGS

Results of a recent consumer survey showed that about 50 percent of the respondents were interested in purchasing chicken without giblets (9). About the same proportion of those who purchased chickens with necks and giblets used these parts for pet food or discarded them. About one-third of the respondents were willing to pay premiums averaging about 6 cents per pound of chicken for chicken without giblets. However, WOGS sales reported in the composite price were whole birds mostly by buyers who serviced the fast-food industry. These buyers emphasize uniformity of broiler size and the average size broiler they want is smaller than the average size of all broilers slaughtered.

Cost differences associated with the sale of WOGS are accounted for in part by differences in chick, feed, and processing costs due to differences in average weight of broilers marketed. There is also loss of income when necks and giblets are sold at parts prices rather than at whole bird prices. The average liveweight of broilers slaughtered between March 7 and May 2, 1983, was 4.18 pounds (31). The most frequently reported size of WOGS was 2.50 to 2.75 RTC pounds. Adding in 10 percent for the neck and giblets, most WOGS were slaughtered at average liveweight of about 3.62 to 3.98 pounds. The average liveweight of WOGS was about 10 percent less than that of all broilers slaughtered during the period.

Estimated chick cost for producing WOGS would be about 10 percent greater than the estimate included in the basic broiler production cost formula. This increased estimated nonfeed production cost about 0.4 cent per liveweight pound. Feed conversion for WOGS, feed per pound of meat, would be about 0.12 pounds less than the estimate included in the basic feed cost formula (23). Processing cost per pound of WOGS would be about 10 percent greater than the estimate included in the basic marketing cost formula. Hourly costs for processing plant operation are mostly fixed. The number of broilers processed per hour is also mostly independent of the size of the broiler. However, volume of output per hour is directly related to average bird size. Processing cost for WOGS would be about 1 cent per RTC pound greater than the estimate in the basic marketing cost formula. Proportions of broiler carcasses represented by their component parts vary depending on type of cut, size, or sex of broilers and other factors. Based on results of several studies (9, 16, and 22), it was assumed broilers processed as WOGS were made up as follows:

	Percent	RTC pounds
WOG shell	89.5	2.60
Neck	6.0	.17
Liver	2.5	.07
Gizzard	1.5	.04
Heart	.5	.01
Total	100.0	2.90

During the March 7 through May 2, 1983, period the average of prices for U.S. Grade A broilers reported for New York was 41.39 cents per RTC pound (31). New York prices were used because parts prices were reported for this market. Averages of parts prices in cents per RTC pound, ice-packed, delivered to first receivers included: backs and necks, 10 cents; livers, 23.61 cents; gizzards, 32.78 cents. The value of a 2.9 RTC pound broiler at 41.39 cents per pound is $1.20. The contribution of the neck and giblets to this value is 0.29 RTC pound at 41.39 cents per pound for 12 cents. If the neck and giblets were priced at parts prices, their value would be 5 cents. [(0.17 x 10.00¢) + (.07 x 23.61¢) + (.05 x 32.78¢) = 4.99¢.] (The heart was valued at the gizzard price since no heart prices were reported.) Marketing cost for sale of the 2.6 RTC pound WOG shell would be 7 cents greater than that estimated on the basic product. This accounts for the lower value of necks and giblets when sold separately from the whole bird. The extra cost for marketing WOGS associated with loss of value of necks and giblets was about 2.7 cents per RTC pound. The magnitude of this cost changes as differences between whole bird and parts prices change.

Chill Pack

Dry chilling technology for processing broilers has been in use since the sixties (30). There was a period of high interest in this technology in the early seventies in response to a European Economic Community announcement of plans to ban immersion chilling of poultry by 1977 (21). The objective was to decrease the probability of bacterial cross contamination of poultry carcasses during chilling. Results of comparisons of bacterial counts on broiler carcasses chilled wet versus dry have not all been in agreement (see, for example, 19, 21, 29, and 30). The most important sources of variation among studies in the results obtained were differences in strains of bacteria counted, chilling technology used, and sanitation conditions in wet chill vats. Conventional wet chilling involves immersion of broilers in ice slush. The ice slush step can be preceded by prechilling with cold water spray or immersion. Dry chilling is usually by use of sub-freezing air blast on carcasses hanging from shackles. The air blast step can also be preceded by prechilling with cold water spray or immersion.

Conflicting results of economic evaluations of immersion, spray, and dry chilling of broilers have been reported (30). The problem is that there is no single, accepted, "best" technique for any individual method. Based on the information available, compared to conventional ice slush chilled, ice-pack broilers, dry chilling and packing can:

1. Decrease ice use per pound of RTC broiler about 0.4 pound for chilling (30) and about 0.25 pound for packing (1). Assuming the cost of ice is 0.5 cent per pound, this represents a marketing cost saving of about 0.33 cent per RTC pound of broiler.

2. Increase delivery truck payloads about 25 percent (1) for an additional marketing cost saving of about 0.5 cent per RTC pound of broiler based on distribution costs estimated in the basic formulas.

Cost disadvantages associated with dry chilling and packing of broilers relative to conventional ice chilling and packing are possible lower yields due to less moisture pickup, more drip line moisture loss during chilling, and high initial investment for deep chilling systems. Wet chilling of broilers can yield up to 12-percent weight gain by moisture uptake during immersion while dry chill can cause up to 8-percent weight loss (30). Wet chilling of broilers has caused a 7.4-percent weight gain during chilling while dry chilling has caused a carcass weight loss of about 1.2 percent (29). In 1982, a prototype of a tunnel freezing system was described which could "be adjusted to give up to 2 percent added moisture (liveweight basis) or 8 percent added yield vs. 6 percent for standard deep-chill" (8). The variation among reported results is probably accounted for by differences in chilling procedures used especially for dry chilling. Broiler carcasses can go directly from the final washers to drip lines and into blast freezers for chilling. This procedure is likely to produce the most moisture loss. Dry chilling preceded by prechilling by spray or immersion or including intermittent spraying could promote moisture uptake. The prototype system mentioned above included a prechill in refrigerated water with time in the prechiller monitored to allow the birds to pick up the recommended percentage of moisture. With this system, moisture uptake during chilling would be about the same percentage of broiler weight as it would before a conventional ice chilling system. However, the 6-percent added yield for "standard deep chill" is about 2 percentage points less than that for conventional ice chilling. To estimate this added cost for deep chilling, one must decrease the estimate of percentage yield used to convert basic broiler production costs from liveweight to RTC basis by 2 percentage points.

Investment cost, the primary added cost to using deep chilling systems, varies considerably among plants. There is little information available on cost of the different systems. The estimated cost for the prototype system mentioned above was $500,000 for an 8,400 birds per hour plant (8). This is probably representative of the upper limit for investment required since it is for a complete system using up-to-date technology. A loan to finance this investment, amortized over 7 years at 14-percent interest, would require repayment of about $116,000 per year (23). If the system were used at full capacity for 40 hours per week, 50 weeks per year for broilers averaging 3.2 RTC pounds each, the system would produce about 53.8 million RTC pounds per year. Added processing cost per RTC pound of deep chilled broiler would be about 0.22 cent. Over 80 percent of the plants responding to a national survey of broiler processers in 1981 produced sufficient volume to use this system at full capacity (24). However, it is not likely that a plant which markets deep chilled broilers will sell its total output in this product form. It was assumed that the deep chilling system was used at about 60 percent of capacity and added processing cost for deep chill broilers was about 0.4 cent per RTC pound.

CALCULATION OF COSTS FOR THE 12-CITY PRODUCT MIX

Based on the basic formulas, estimation of the simple average of costs of producing and marketing whole bird, ice-packed broilers to the wholesale market level, March and April 1983, included the following steps (18):

1. Obtain average prices of soybean meal and corn for March and April 1983.

soybean meal = $198.05 per ton.
corn = $ 3.06 per bushel.

2. Add estimated 1983 charges for delivery of ingredients to producing areas.

soybean meal = $198.05 + $21.30 = $219.35 per ton.
corn = $3.06 + $.46 = $ 3.52 per bushel.
= ($3.52 x 35.7) = $125.66 per ton.

3. Estimate cost of soybean meal and corn per ton of ration. Weight the price per ton of each by its proportion in the ration for 1983 and sum the weighted prices.

(.30 x $219.35) + (.70 x $125.66) = $153.77 per ton of ration.

4. Adjust cost of soybean meal and corn per ton of ration to account for other higher average cost ingredients and additives in the ration (1983).

(1.089 x $153.77) = $167.45 per ton of ration.

5. Obtain total cost per ton of ration by adding estimated 1983 milling charges to ingredient costs.

$167.45 + $11.50 = $178.95 per ton of ration.
($178.95/2,000) = 8.95¢ per pound of ration.

6. Calculate feed cost per liveweight pound of broilers by multiplying 1983 feed conversion rate times feed cost per pound of ration.

(2.083 x 8.95¢) = 18.64¢ per liveweight pound of broiler.

7. Calculate total production cost per liveweight pound of broiler by adding estimated 1983 nonfeed costs per pound to feed cost per pound.

18.64¢ + 8.423¢ = 27.06¢ per liveweight pound of broiler

8. Convert total production cost from liveweight basis to RTC basis by dividing cost per liveweight pound by 1983 dressing percentage.

(27.06¢/.752) = 35.98¢ per RTC pound of broiler.

9. Calculate total cost per RTC pound of broiler at the wholesale marketing level by adding estimated farm-to-wholesale marketing costs per RTC pound of broiler to production cost per RTC pound.

35.98¢ + 14.088¢ = 50.07¢ per RTC pound of broiler.

These equations were specified to estimate broiler costs for the product mix reported in the nine-city weighted average price. Based on the earlier

discussion, these basic equations were respecified as follows to account for each market extension represented in the 12-city composite report:

A. Addition of three new reporting cities--no change.

B. Cost of branded product--steps 1-3--no change.

4. The ingredient cost adjustment factor was increased to account for pigmentation additives. The change was calculated as a proportion of the soybean meal-corn cost per ton of ration (step 3, basic equations) at $1.75 pigmentation additive cost per ton of ration. This allows the cost of pigmentation additives to vary directly with changes in costs of other feed ingredients. The change in the feed ingredient cost adjustment factor for branded product was:

   $1.75/$153.77 = 1.1-percent change, and the factor is
   1.089 + .011 = 1.100.
   Adjusted feed ration ingredient cost is:
   1.100 x $153.77 = $169.15 per ton of ration.

5. No change
   $169.15 + $11.50 = $180.65 per ton of ration.
   ($180.65/2,000) = 9.03¢ per pound of ration.

6. No change
   (2.083 x 9.03¢) = 18.81¢ per liveweight pound of broiler.

7. No change
   18.81¢ + 8.423¢ = 27.23¢ per liveweight pound of broiler.

8. No change
   (27.23¢/.752) = 36.21¢ per RTC pound of broiler.

9. The farm-to-wholesale marketing costs estimate was increased 1 cent per RTC pound for advertising. The farm-to-wholesale marketing costs estimate for branded product is:
   14.088¢ + 1.000¢ = 15.088¢ per RTC pound of broiler
   Total cost per RTC pound of broilers sold by firms using product branding is:
   36.21¢ + 15.088¢ = 51.30¢ per RTC pound of broiler.
   Cost associated with sale of branded product is:
   51.30¢ - 50.07¢ = 1.23¢ per RTC pound of broiler.
   Cost associated with sale of branded product was multiplied by 1.33 to account for 25 percent of product sold not branded:
   (1.33 x 1.23¢) = 1.64¢ per RTC pound of broiler.

   Total cost for broilers sold branded is:
   50.07¢ + 1.64¢ = 51.71¢ per RTC pound of broiler.

C. Cost of WOGS--steps 1-5--no change.

6. The feed conversion factor was decreased 0.12 pound to account for less feed use per pound of broiler. The feed conversion factor for WOGS is:
   2.083 - .12 = 1.963 pounds of feed per liveweight pound of broiler.
   (1.963 x 8.95¢) = 17.57¢ per liveweight pound of broiler.

7. Nonfeed production costs were increased 0.4 cent per liveweight pound to account for higher chick cost per pound of broiler. Nonfeed production cost is:
   8.423¢ + .4¢ = 8.823¢ per liveweight pound of broiler.
   17.57¢ + 8.823¢ = 26.39¢ per liveweight pound of broiler.

8. No change
   (26.39¢/.752) = 35.09¢ per RTC pound of broiler.

9. The farm-to-wholesale marketing cost estimate was increased 1 cent per RTC pound of broiler to account for higher cost per pound to process WOGS.

10. It was also increased by 6.3 percent of the average 12-city U.S. Grade A price per pound for ice-packed broilers (table 2) to account for loss of income from sale of giblets and necks. Use of a percentage for this calculation allows the magnitude of the loss to vary directly with the broiler price level. The farm-to-wholesale marketing cost estimate for WOGS is:
   14.088¢ + 1¢ + (.063 x 42.63¢) = 17.778¢ per RTC pound of broiler.

   Total cost per RTC pound of WOGS is:
   35.09¢ + 17.778¢ = 52.87¢ per RTC pound of broiler.

D. Cost of chill-pack--steps 1-7--no change.

8. The yield estimate was decreased 0.009 to account for less moisture pickup during chilling. The yield estimate for chill-pack broilers is:
   .752 - .009 = .743
   (27.06¢ - .743) = 36.47¢ per RTC pound of broiler.

9. The farm-to-wholesale marketing cost estimate was increased 0.4 cent per RTC pound of broilers to account for additional processing plant costs associated with use of the chilling system. It was decreased 0.33 cent per RTC pound to account for savings on ice used for chilling and packing. It was decreased an additional 0.50 cent per RTC pound to account for savings due to increased delivery truck payloads. The farm-to-wholesale marketing cost estimate for chill-pack broilers is:
   14.088¢ + .4¢ - .33¢ - .5¢ = 13.658¢ per RTC pound of broiler.

Total cost per RTC pound of chill-pack broilers is:
36.47¢ + 13.658¢ = 50.13¢ per RTC pound of chill-pack broiler.

Cost estimates for the product mix in the 12-city composite report were calculated as weighted averages of costs estimated above. The weights were obtained from table 4. U.S. Grade A and Plant Grade combined represent the product mix included in the basic cost formulas. The combined weight for these product forms is (0.358 + 0.213) = 0.571. Estimated composite costs were calculated as follows:

Feed cost, cents per liveweight pound of broiler
(.571 x 18.64¢) + (.074 x 18.81¢) + (.192 x 17.57¢) + (.163 x 18.64¢)
= 18.45¢

Production cost, cents per RTC pound of broiler
(.571 x 35.98¢) + (.074 x 36.21¢) + (.192 x 35.09¢) + (.163 x 36.47¢)
= 35.91¢

Total cost, cents per RTC pound of broiler
(.571 x 50.07¢) + (.074 x 51.71¢) + (.192 x 52.87¢) + (.163 x 50.13¢)
= 50.74¢

Table 4--Proportion of total loads reported for 12-city composite weighted average broiler prices accounted for by different grades and packs, March 7, 1983-May 2, 1983 1/

Date	U.S. Grade A	Plant grade	Branded product 1/	WOGS 2/	Chill pack 3/	Total loads
	Percent of loads					Number
3-7	36.2	21.9	11.0	17.8	13.1	1,006
3-14	31.9	23.5	5.0	18.8	20.8	1,009
3-21	37.4	21.4	3.8	22.1	15.2	971
3-28	37.3	21.3	6.3	20.0	15.1	958
4-4	30.8	20.4	13.1	18.6	17.1	1,020
4-11	38.1	22.4	4.4	19.3	15.8	981
4-18	35.6	20.4	10.3	19.1	14.6	1,061
4-25	37.8	18.9	8.2	17.0	18.1	1,156
5-2	36.9	21.9	4.9	19.8	16.5	1,051
Average	4/35.8	4/21.3	7.4	19.2	16.3	1,024

1/ U.S. Grade A (includes branded) minus U.S. Grade A. 2/ Whole birds without giblets, regional reports. 3/ Calculated as residuals. 4/ U.S. Grade A plus Plant Grade represent the product mix in the basic formulas. Their combined average proportion is 57.1 percent.

Source: Calculated from price reports in (31, various Monday issues).

CONCLUSIONS

In March and April 1983, estimated average composite total cost per RTC pound of broiler marketed was about 0.7 cent greater than average cost estimated by use of the basic formulas. Most of the difference was accounted for by differences in farm-to-wholesale costs including advertising cost for branded products, loss of income from necks and giblets for WOGS, and extra investment in processing equipment for deep chilling. The 12-city weighted average composite price was about 2.5 cents per pound more than the nine-city weighted average price during the same period. Use of 12-city composite prices with costs estimated with the basic formulas to calculate net returns for broilers would suggest a better than actual cost-returns situation. Conversely, use of nine-city average prices with basic formula cost estimates would suggest a worse than actual situation. Use of composite prices and costs provides a more accurate barometer of economic conditions, at least for that portion of the broiler industry for which prices are negotiated at the time of sale. The most important gain from use of 12-city composite prices and costs in the ERS broiler cost-returns series is the extension of broiler market coverage beyond the historically reported whole bird carcass, ice-packed product form.

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