

SOME EFFECTS OF EGG PRODUCTS ON
EGG PRICING^{1/}, ^{2/}

Introduction

The purpose of this article is to review some of the relationships between shell eggs and breaking eggs or egg products. This includes both production and price relationships.

Several rather basic descriptive studies have been done of the egg products industry. None of these studies had as their objective the study of specific price making forces for the major raw material of the egg products industries--breaking eggs, (4, 5, 6, 7, 8).

Therefore, studies of relationships between shell and breaking egg markets were conducted (1, 2). Those studies were basically analytical. The more specific purposes of this report are to describe the place of breaking eggs in the total egg industry, some changes in the egg products industry, competitive and complementary relations between shell and breaking eggs and price effects of these relationships. Another descriptive study has recently been published but it differs considerably from the present report (3).

The Place of Egg Products in Total U.S. Egg
Production and Changing Relationships

Between 1960 and 1969, U.S. egg production as reported by the U.S. Department of Agriculture ranged from slightly more than 61 billion to

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^{2/} Occasional Paper E50-28 of the Department of Agricultural Economics and Rural Sociology.

70 billion eggs. However, from 3.4 billion to 4.7 billion of these eggs were used per year for hatching purposes. Therefore, the number of eggs available for food use varied from approximately 58 billion in 1960 to about 66 billion in 1967. The trend was upward for total eggs produced, the number used for hatching and the number of eggs for food use from 1960 to 1969, Table 1.

Increases from 1960 to 1969 were as follows: total eggs produced, 7.5 billion; number of eggs used for hatching purposes, 1.3 billion; number of eggs for food use, 6.1 billion.

The quantity of eggs stored is low compared to total production. Therefore, the number of eggs consumed or available for consumption in any year is roughly equal to the total number of food eggs produced. However, there are storage variations from year to year which have important price effects.

The U.S. Department of Agriculture does not estimate the storage stocks of egg solids. Hence, it was necessary to develop a method of estimating these data to get the real effect of the net number of eggs used from storage stocks. This was done by assuming levels of consumption per month and then further assuming the additions to or subtractions from storage stocks equalled the differences between the estimated consumption and estimated production. Results of the data used for this purpose are in Table 5.

As is shown in Table 2, the apparent utilization of eggs for food purposes varies somewhat from the number available for food use. However, the estimates for the inventory of egg solids were made only for 1965 to 1969 because of the difficulties of projecting estimates backward. From 1965 through 1969, storage movement varied from a net into storage movement of

980 million eggs moving in 1967 to a low of 74 million eggs moving out of storage in 1965. Interestingly enough, in only one of the five years between 1965 and 1969, was there a net into storage movement of eggs. In the five previous years in which egg solids inventories were not estimated, a net into storage movement occurred in two years and net out of storage in three years. The movements were considerably larger from 1966 through 1969 than in the immediately preceding years.

In the high production year of 1967, nearly five more food eggs were produced per capita in the U.S. than were consumed. Nearly all of these additional eggs were stored in the frozen or solids form. If the U.S. Department of Agriculture estimates of egg production and storage of frozen and shell eggs and the author's estimates of storage stocks of egg solids are correct, there was little difference in the total number of eggs used for food in 1967, 1968 or 1969.

Further if one subtracts the estimated purchases of eggs by U.S. Department of Agriculture of 85 million in 1967, 301 million in 1968 and 270 million in 1969 and the net exports of eggs as estimated from U.S. Department of Agriculture data of 612 million in 1967, 480 million in 1968 and 384 million in 1969, the numbers of eggs used for food purposes in the United States becomes slightly more than 64 billion in each of 1967, 1968 and 1969. Obviously, if these data are correct, egg price differences were due to factors other than the number of eggs used for food in the United States in each of the three years.

The number of U.S. eggs available for food purposes can be further broken down into those used for egg products and those used for table eggs or as shell eggs, Table 3. From 1960 to 1963, the number of U.S. eggs used as egg

products ranged from 5.6 billion in 1960 to 6.6 billion in 1968. In seven of the ten years, the numbers used were above 6 billion. These data do not refer to the number of eggs broken, but to the number of eggs actually used as egg products. Storage stocks are added to or subtracted from these totals. Data on estimated numbers of eggs broken in each year are shown in Tables 6 and 7. The numbers of eggs used for products could be estimated better if actual data were available on egg solids storage stocks. The estimates from 1965 through 1969 less the estimated number of eggs purchased by the U.S. Department of Agriculture implies that commercial use of egg products varied less from 1965 to 1969 than data in Table 3 indicate. In each of 1965, 1966, and 1969, numbers used were just over 6 billion, while in 1967 and 1968, they were 6.4 billion and 6.3 billion, respectively.

Data in Table 3 also imply that the numbers of U.S. eggs used as egg products changed less from 1960 to 1969 than those used as shell eggs.

The number of eggs used in egg products increased from approximately 5.9 billion in each of 1960-62 and 1963-65 to approximately 6.5 billion in 1967-1969. In 1960-62, slightly more than 53 billion were used in the shell form. This number increased to 55 billion in 1963-65 and to slightly more than 58 billion in 1967-69. The percentages by which the egg products use and shell egg use increased were almost identical, but the number increase in shell egg use was more than eight times that of egg products use.

The number of eggs used for shell purposes averaged roughly nine times that of eggs used as egg products in each year from 1960 to 1969. Year to year proportions are shown in Table 4.

Forms of Egg Products--The total numbers of eggs broken vary considerably from the numbers used or consumed within any given year. In the low-price year of 1967, an estimated 20.7 million cases of eggs were broken. This was nearly

4 million cases more than were broken in any other year in 1964-69, Table 6.

This means that the extra eggs broken in 1967 were the equivalent to nearly seven eggs per capita. As a result of the heavy breaking operations in 1967, fewer eggs were broken in each of 1968 and 1969 than were used during those years.

The number of frozen eggs broken has been nearly constant for the ten years, 1960-69. The smallest quantity was broken in 1969 and the largest quantity in 1967, Table 7.

Both egg solids and liquid egg for immediate consumption have increased since 1960-62. The quantity of egg solids moved up substantially with the event of pasteurization requirements in the mid-1960's. Liquid egg for immediate consumption reached a peak in 1964 and then dropped off in 1965 and 1966, but since 1966 has been increasing. The quantity broken for immediate consumption in 1967-69 was the largest of any three-year period in the last ten years. The average for the three years was about 18 million pounds above the average for 1960-62.

In 1960-62, 590 million pounds of liquid egg were produced for egg solids and in 1967-69, this quantity amounted to 784 million pounds. The average quantity of eggs broken for solids increased 65 million pounds from 1960-62 to 1967-69. The averages for 1968-70 for both frozen eggs and egg solids was likely below those of 1967-69 because of the extremely high production in 1967. But the trend is upward for both egg solids and liquid eggs for immediate consumption.

The three-year total quantity of eggs broken was 1,854 million pounds in 1960-62 and 2,119 million pounds in 1967-69 or an increase from 618 million pounds per year to 706 million pounds per year.

Data in Table 11 indicate that changes in egg prices are associated with factors other than quantity of shell egg production, as one would expect.

This applies to both the shell egg price and the breaking egg price. The table also implies a low elasticity of demand for shell eggs and a seasonal difference in demand. These areas are part of the two more analytical studies (1, 2).

Storage of Eggs and Egg Products

As earlier indicated there are no official U.S. Department of Agriculture data on storage stocks of egg solids. Estimates indicate that at the beginning of 1967 there were approximately 1.3 million pounds of solids in storage. By January 1, 1968 this quantity had risen to an estimated 15.5 million pounds or more than 3 months normal utilization. These estimates declined to 7.8 million pounds on January 1, 1969 and to 1.4 million pounds by January 1, 1970. These relatively large inventories at the end of 1967 at least partly explain the decline in production of egg solids for commercial use (U.S. Department of Agriculture purchases subtracted) in 1968 and 1969 compared to 1967.

Part of the reason for the relatively large storage stocks is the shelf life or storability of egg solids compared to shell eggs.

Frozen eggs are also more storable than shell eggs and in the low egg price year of 1967 there was a net into storage movement of 53 million pounds, nearly two months normal utilization of frozen eggs. The lower production of frozen eggs in 1968 and 1969 was partly a result of these extra stocks at the end of 1967. In both 1968 and 1969 there was a net out-of-storage movement of frozen eggs. The out movement quantities were about 18 million pounds in 1968 and 30 million pounds in 1969.

Estimated commercial egg solids disappearance was about 54 million pounds in each of the three years. The apparent disappearance of frozen

eggs was 381 million pounds in 1967, 378 million pounds in 1968 and 365 million pounds in 1969. Thus, the disappearance of each of these types of eggs was much different from the production data shown in Tables 8 and 9.

Breaking Egg and Shell Eggs^{3/}
Have Separate But Interrelated Markets

It was found in both of the analytical studies (1, 2) that it was necessary to look at the shell egg and breaking egg markets as separate but interrelated markets. The Maryland study found it necessary to use seasonal shifters to adequately study demand for the two types of eggs. The demand for breaking eggs was highest in March, April and May. However, the seasonality pattern is shifting toward larger quantities of eggs being broken in the last half of the calendar year as money management becomes a more important ingredient in breaking egg operations.

December, January and March were high demand months for table eggs. Table or shell egg utilization has been increasing in October and November. It can be generally said that shell egg utilization is higher in cold months than in warm months. Seasonal variation in production of eggs, however, is declining. Despite the changing seasonal pattern, the dove-tailing of the utilization of eggs by the two sectors of the egg economy was an important finding of the study. The lower demand for shell eggs in the second quarter of the year tends to encourage heavier breaking egg activity in that quarter. In the Ohio study, it was learned that a daily shell or table egg utilization of 7.7 million fewer eggs in the second quarter than in the first quarter was mostly offset by an increase in breaking egg utilization of 7.4 million more eggs in the second quarter than in the first quarter.

^{3/} The words shell and table eggs are used interchangeably.

Price changes in the two quarters were similar. With other pre-determined variables held constant the New York price of table or shell eggs was 2 cents a dozen lower in the second quarter than in the first quarter while the Chicago Standards and Farm Run egg price was 50 cents a case lower under the same conditions. As can be noted in Table 6, the second quarter continues to be generally the quarter of greatest breaking egg activity. Thus, the lower demand for shell eggs in the second quarter and increased breaking egg activity coincide and occurs when both shell and breaking egg prices are seasonally lowest. This is a function of the greater storability of frozen eggs and egg solids discussed earlier.

It appears that breaking operations in the second quarter of the year, particularly, provide an outlet for eggs which become available as a result of lower shell egg demand and, therefore, act as a buffer to shell egg prices. The level of breaking egg prices is tied to that of shell eggs while breaking egg utilization for at least part of the year is a residual claimant for eggs. However, there is definite market for egg products. If users of these egg products underestimate expected Fall egg prices and do not buy stocks in advance it becomes necessary for them to pay much more than storage and money costs above Spring prices for egg products in the last quarter of the year. This situation is amply illustrated by the relatively high last quarter breaking egg prices in both 1966 and 1969.

In the last quarter of 1966, Chicago Farm Run and Standards prices averaged \$9.48 per case in the second quarter and \$11.36 per case in the fourth quarter. As can be seen in Table 6, breaking egg activity was relatively high in the fourth quarter of 1966. An even more pronounced difference occurred in 1969. Second quarter Chicago and Farm Run prices were \$8.34 per case while fourth quarter prices averaged \$12.71 per case. Price differences at country-

points were similar. Again, as can be seen in Table 6 breaking egg activity in the last quarter of 1969 was relatively high.

Prices Change for Breaking Eggs Less for One Percent
Change in Quantity Than Is True for Table Eggs

The price elasticity of demand for breaking eggs was higher than that for shell or table eggs. In table eggs, a one percent change in quantity was associated with about 2 1/2 percent change in the opposite direction in the price of eggs. However, the percentage changes in prices and quantities of breaking eggs were about equal. In other words, the price elasticity of demand for table eggs was less than -0.5. For breaking eggs, it was slightly less to somewhat more than -1.0. This is likely a result of egg breakers generally being somewhat better informed about prospective prices than consumers plus the ability of breakers to break at an earlier or later date. Consumers buy eggs for immediate use throughout the year and their purchases are not geared to changes in prices.

Storage Stocks Part of Visible Supply

As illustrated above, when the quantity of eggs broken in one year is above utilization, the quantity of eggs broken in succeeding years declines. This is not only a function of storage but of the ability of egg products users to rotate stocks so that they were not using eggs in 1969 that were broken only in 1969 but in early 1969 were using eggs broken in 1968 and by late 1969 were using eggs broken just a short while ahead of use.

Since storage stocks are part of the visible supply, if programs to store are initiated in one production period, fewer eggs per capita need to be produced in succeeding production periods because the per capita der

eggs is likely to decline in the succeeding periods or prices will continue to be low.

Continued Relationship Between
Egg Products and Table Eggs

It does not appear that the egg products now being sold to consumers will have a wide market. Costs of producing the products and distributing them seem to be high enough that substitution for shell eggs is not likely to be an important part of the total egg market.

Egg albumen is likely to be a highly demanded food in the years ahead but the edible portion of each egg is about 35% yolk and 65% albumen. The yolk averages 51 to 52% solids while the albumen is about 12% solids. So more than two-thirds of the solids in liquid eggs are in the yolk. Somebody has to buy the yolk if the market for the no-fat albumen is to be properly exploited. In this age of cholesterol-consciousness selling large quantities of yolk may be a problem. But if products are sold directly to consumers, the food for which egg products is most likely to substitute is other eggs.

Table 1.--Estimated Number of U.S. Eggs
Produced for Food Uses, 1960-69
(Million)

	Total Eggs Produced ^{1/}	Number Used For Hatching In U.S. ^{2/}	Number Of Eggs For Food Use
1960	61,462	3,384	58,078
1961	62,423	3,624	58,799
1962	63,569	3,636	59,933
1963	63,500	3,648	59,852
1964	65,215	3,744	61,471
1965	65,692	3,996	61,696
1966	66,484	4,380	62,104
1967	70,031	4,332	65,699
1968	69,270	4,368	64,902
1969	68,925	4,733	64,192

^{1/} Table 2, p. 10, Poultry and Egg Situation, PES-252, U.S. Department of Agriculture, June, 1968, and Table 7, p. 21, PES-261, April, 1970. Hawaii and Alaska are not included in 1960 data.

^{2/} Table 19, p. 25 and Table 11, p. 23 of above publications, converted from dozen to number. Does not include eggs exported for hatching purposes.

Table 2.--Estimated Number of U.S. Eggs Used
For Food Purposes, 1960-69
(Million)

	Number Of Eggs Available For Food Use ^{1/}	Net Number Of Eggs Used From Storage Stocks ^{2/,3/}	Number Of U.S. Eggs Used For Food Purposes
1960	58,078	178	58,256
1961	58,799	38	58,837
1962	59,933	- 27	59,906
1963	59,852	74	59,926
1964	61,471	- 23	61,448
1965	61,696	74	61,770
1966	62,104	242	62,346
1967	65,699	-980	64,719
1968	64,902	341	64,661
1969	64,192	533	64,725

1/ From Table 1.

2/ Net change in storage stocks of shell and frozen eggs from January 1 to January 1 of succeeding year. Basic data from Table 40, p. 43, Selected Statistical Series for Poultry and Eggs Through 1965, ERS-232. U.S. Department of Agriculture, May, 1966 and Poultry and Situation. Pounds of frozen eggs converted to numbers by multiplying by 9.43643. The yield of liquid eggs was based on survey of 8 large breaking plants.

3/ Assumes 31.9 eggs per estimated pound of storage stocks of egg solids. This includes a blend of egg solids as reported by U.S.D.A. and mixtures which are reported under "Other" by U.S.D.A. Solids stocks computed only for 1965-69.

Table 3.—Estimated Number of U.S. Eggs Used As Egg Products and Shell Eggs, 1960-69 (Million)

	Number Of U.S. Eggs For Food Purposes ^{1/}	Number Of U.S. Eggs Used As Egg Products ^{2/}	Number Of U.S. Food Eggs Used As Shell Eggs
1960	58,256	5,634	52,622
1961	58,837	6,016	52,821
1962	59,906	5,991	53,915
1963	59,926	5,595	54,331
1964	61,448	6,193	55,255
1965	61,770	6,000	55,770
1966	62,346	6,086	56,260
1967	64,719	6,519	58,200
1968	64,661	6,618	58,043
1969	64,725	6,313	58,412

^{1/} From Table 2.

^{2/} Total pounds of broken eggs as reported in monthly, Egg Products, Liquid, Frozen and Solids Production, U.S. Department of Agriculture, Pou 2-5 (2-61 to 2-70) converted to numbers by multiplying by 9.43643. Net changes in storage stocks subtracted or added. Does not consider stocks of egg solids held by U.S.D.A.

Table 4.--Proportions of U.S. Food Eggs Used
As Shell Eggs and as Egg Products, 1960-69

	Percent As Shell Eggs	Percent As Egg Products
1960	90.3	9.7
1961	89.8	10.2
1962	90.0	10.0
1963	90.7	9.3
1964	89.9	10.1
1965	90.3	9.7
1966	90.2	9.8
1967	89.9	10.1
1968	89.8	10.2
1969	90.2	9.8

Table 5.--Estimated Number of Months Supply of Egg Products in Storage, Average During Quarter, 1965-69

	January- March	April- June	July- September	October- December
1965	1.5	1.9	2.6	2.0
1966	0.9	0.9	1.5	1.1
1967	1.0	1.9	3.2	3.4
1968	2.9	3.4	3.8	2.8
1969	2.0	1.4	1.6	1.0

Assumes use of approximately 397,000 cases in solids form and 786,000 cases in frozen form per average month or a total of 1,183,000 cases per month.

Table 6.--Approximate Monthly Numbers of Eggs Broken
For Commercial Channel Uses by Months, 1964-69
(1,000 Cases)

	1964	1965	1966	1967	1968	1969
Jan.	729	1,214	917	1,504	1,318	917
Feb.	1,167	1,314	836	1,532	1,345	979
March	1,494	1,663	1,204	1,768	1,589	1,078
April	1,395	1,488	1,599	1,945	1,725	1,180
May	1,842	1,829	1,962	2,279	1,985	1,589
June	1,696	2,136	2,123	2,378	1,792	1,769
July	1,427	1,743	1,581	1,916	1,260	1,644
Aug.	864	1,346	1,249	1,807	1,511	1,515
Sept.	845	1,062	1,102	1,538	1,145	1,274
Oct.	787	891	1,108	1,510	1,198	1,360
Nov.	842	876	1,196	1,357	1,080	1,095
Dec.	942	825	1,359	1,182	890	1,259
Total	14,030	16,387	16,236	20,716	16,838	15,659

Source: Computed from U.S. Department of Agriculture data on quantities broken less estimated quantities used for U.S. Department of Agriculture purchase programs. Converted to case equivalents by using yields obtained from eight large breaking plants.

Table 7.--Number of Egg Products Eggs Used
 In Various Forms, 1960-69
 (Million Eggs)^{1/}

	Frozen	Egg Solids	Liquid
1960	3,557	1,662	415
1961	3,525	2,039	474
1962	3,603	1,865	523
1963	3,479	1,570	545
1964	3,576	1,975	643
1965	3,542	2,039	419
1966	3,505	2,120	380
1967	3,601	2,900 ^{2/}	561
1968	3,403	2,389 ^{2/}	594
1969	3,152	2,114	774

^{1/} See Footnote 2, Table 3.

^{2/} If corrected for estimated storage of egg solids on first of year, 1967 use of egg solids equalled 2,357 million eggs and 1968 use equalled 2,621 million eggs. The 1969 use was about 2,321 million eggs. In 1967 about 86 million eggs were purchased by the U.S. Department of Agriculture. In 1968, these purchases equalled about 302 million eggs and in 1969 there were about 270 million eggs bought by the U.S. Department of Agriculture.

Table 8.--Production of Frozen Eggs,
By Classes, 1963-69
(Million Pounds)

	Plain and Mixed Whole	Albumen	Yolk	Total
1963	176	91	96	363
1964	188	91	103	382
1965	191	80	97	368
1966	188	72	96	356
1967	248	78	109	435
1968	204	67	90	361
1969	191	63	80	334

Source: Egg Products, Statistical Reporting Service,
U.S. Department of Agriculture.

Table 9.--Production of Egg Solids, U.S., 1963-69
(1,000 Pounds)

	Whole		Albumen	Yolk	Other		Total	Commercial
	Total	USDA			Total	USDA		
1963	14,170	8,397	8,651	12,672	9,217	-	44,710	36,313
1964	19,650	15,768	10,864	10,677	10,836	-	52,027	36,259
1965	9,795	0	13,595	13,412	13,275	-	50,077	50,077
1966	8,104	0	13,671	12,909	16,800	-	51,484	51,484
1967	13,140	2,430	19,186	19,126	19,277	-	70,729	68,299
1968	13,785	0	13,109	12,861	25,573	16,686	65,328	48,642
1969	7,467	0	10,083	11,513	32,012	15,021	61,075	46,054

Source: Computed from data from U.S. Department of Agriculture Statistical Reporting Service and Consumer and Marketing Service.

Table 10.--Production of Liquid Egg for Immediate
Consumption, by Classes, 1963-69
(Million Pounds)

	Plain and Mixed Whole	Albumen	Yolk	Total ^{1/}
1963	21	22	12	55
1964	19	39	11	68
1965	17	15	12	44
1966	19	8	14	40
1967	33	13	13	59
1968	38	12	14	63
1969	40	22	20	82

Source: Egg Products, Statistical Reporting Service,
U.S. Department of Agriculture.

^{1/} May not equal sum of the three types due to rounding.

Table 11.--Estimated Per Capita Supply, Utilization Numbers of Eggs and Price of Eggs, by Quarters 1965-69

	January- March	April- June	July - September	October- December
	<u>1965</u>			
Available for Food ^{1/}	83.5	85.6	82.4	82.6
Used as Shell Eggs ^{2/}	72.5	71.5	69.5	72.3
Used as Egg Products ^{2/}	7.5	7.7	6.7	7.1
Ending Storage ^{3/}	3.5	6.4	6.2	3.2
Shell Egg Price ^{4/}	31.9	33.2	39.8	44.6
Breaking Egg Price ^{5/}	23.4	25.1	26.5	30.8
	<u>1966</u>			
Available for Food	80.3	81.5	80.5	84.0
Used as Shell Eggs	72.0	69.5	70.2	74.7
Used as Egg Products	7.2	8.4	7.1	7.3
Ending Storage	1.1	3.6	3.2	2.0
Shell Egg Price	45.5	38.1	47.7	46.2
Breaking Egg Price	34.7	30.7	33.8	37.1
	<u>1967</u>			
Available for Food	83.8	86.8	87.1	90.7
Used as Shell Eggs	73.5	72.0	73.0	76.6
Used as Egg Products	7.6	8.0	7.2	7.1
Ending Storage	2.7	6.8	6.9	7.0
Shell Egg Price	36.4	28.7	33.9	32.0
Breaking Egg Price	27.0	23.4	23.4	20.5
	<u>1968</u>			
Available for Food	89.9	89.3	86.3	86.0
Used as Shell Eggs	75.6	72.3	71.9	73.5
Used as Egg Products	7.7	7.6	7.0	7.3
Ending Storage	6.3	9.4	6.4	5.2
Shell Egg Price	32.4	31.1	43.7	44.6
Breaking Egg Price	22.1	22.8	24.4	31.2
	<u>1969</u>			
Available for Food	83.0	82.8	81.4	81.7
Used as Shell Eggs	72.7	71.1	70.6	72.6
Used as Egg Products	7.2	8.0	7.2	7.4
Ending Storage	3.1	3.7	3.6	1.7
Shell Egg Price	46.0	36.6	46.7	57.3
Breaking Egg Price	31.0	28.3	32.3	42.8

Source: Computed from data from U.S. Department of Agriculture, U.S. Department of Commerce and private sources.

^{1/} U.S. egg production as reported by U.S. Department of Agriculture minus estimated number of eggs used domestically for hatching and government purchases plus estimated storage at beginning of period divided by total U.S. population.

Table 11.--Continued

- 2/ Does not include exports or imports.
- 3/ Includes estimates for stocks of egg solids in addition to U.S. Department of Agriculture data on frozen and shell egg stocks.
- 4/ New York Wholesale Fancy Large White as reported by U.S. Department of Agriculture, cents per dozen.
- 5/ Iowa-Nebraska breaking egg price, top of mostly as reported by U.S. Department of Agriculture, transposed to cents per dozen.

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