ERS 477

Vertical and Horizontal Integration in the Market Egg Industry 1955-69

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ABSTRACT

A method is described for developing a combined quantitative measure of vertical and horizontal integration in the market egg industry. Comparisons show that regions where egg production decreased during 1955-69 had a less than average rate of development in integration. In contrast, regions where production increased had above average rates of development. The overall growth in integration has also helped reduce egg-marketing margins.

Keywords: egg industry, integration, market eggs, quantification of integration, structure

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SUMMARY

A new model procedure to measure integration in the egg market industry indicates lower egg production in regions where the rate of integration lags and higher production where it has been more vigorous. Moreover, overall growth in integration reduces egg-marketing margins.

This conceptual method of quantifying vertical and horizontal integration involves data series on owner-integration, contract production, and cooperative marketing, which are weighted together to develop an index of integration for regions and for the United States.

During 1955-59, owner-integration and contract production increased in importance in the market egg industry; contracting became more precisely defined; and cooperative marketing changed less in total than in quality. Marketing agreements or contracts have been more widely used, especially by cooperatives.

The share of total egg surplus coming from the West North Central, East North Central, and North Atlantic regions, which showed less than average rates of development of integration, decreased during 1955-69. On the other hand, the Western, South Central, and South Atlantic regions, which exhibited above average rates of development in integration, provided increasing shares of total egg supplies.

Marketing margins have fallen as the U.S. egg industry became more integrated. The farm to retailer price spread for Grade A large eggs, adjusted for costs of marketing inputs, dropped about 50 percent from 1955 to 1969. The index of integration was 2.5-3.0 times greater in 1969 than in 1955.

The market egg industry is expected to become more highly integrated during the 1970's. However, differences between regions will become less pronounced and integration will have far less effect in explaining regional shares of output than during 1955-59.

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By

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INTRODUCTION

Interest in the extent and nature of integration or coordination in the poultry and egg industries remains strong. Within these industries, discussion focuses on the growth, relative importance, and impact of alternative forms of integration or coordination. Other industries are interested because the poultry and egg sectors have led in this kind of structural change. Examination of poultry and egg industry experiences can provide object lessons and a basis for predicting changes for other industries. 1/

Several USDA studies in the late 1950's and early 1960's attempted to appraise the extent of integration or coordination in various agricultural industries (1, 3, 9). 2/ Since then, other studies have dealt with integration in the egg industry, mainly for single years in particular States or regions. Census of Agriculture figures and USDA studies provide additional indicators. However, data available to quantify the extent of integration or coordination are fragmentary at best.

"Increased coordination of production, input-supplying, and marketing functions" was also one of the forces enumerated in a recent study as being related to interregional shifts in egg production (8, p. v). In terms of interregional competition, this suggests that those regions which developed further and faster toward a higher degree of integration or coordination would be likely to enjoy a competitive advantage, other things being equal.

1/ However, caution must be exercised when using this study for such purposes. First, there are probable estimating errors in the series. Second, the egg industry has followed a somewhat different course of development than the broiler or turkey industries. Third, studies of integration or coordination had best be approached with a considerable background in the history, institutions, product characteristics, etc. of the particular industry selected.

2/ Underscored numbers in parentheses refer to items in the Literature Cited, p. 27.

However, no studies have yet been published that make quantitative estimates available on a continuing and regional basis. Thus, such a variable could not be used in statistical analyses.

The purposes of this study are to: develop estimates of the extent of various forms of coordination or integration, by regions, for 1955-69; aggregate these forms into a single index series; and make preliminary comparisons using these series, interregional shifts in output, and industry efficiency.

QUALITATIVE DIMENSIONS

The terms "coordination" and "integration" are often used interchangeably in articles and conversation about the egg and poultry industries. In economic literature, integration is often differentiated into vertical, horizontal, and conglomerate types. Vertical integration refers to the linking through ownership or control of two or more stages of production, processing, or marketing, including the provision of major production inputs such as chicks or feed. Horizontal integration, in its simplest context, refers to the ownership or management of multiple units at a particular stage. Conglomerate refers to ownership of units in two or more industries. In the egg and poultry industries, it is typified by firms in nonagricultural industries that acquire egg or poultry firms.

Whether conglomerate integration has made any major contribution to internal efficiencies of the egg or poultry firm is highly doubtful. It may, of course, provide such aid as wider access to capital or economies in sales operations. For this analysis, it is assumed that conglomerate integration can be subsumed under vertical and horizontal dimensions.

A semantic problem must also be recognized with respect to certain terms used in discussions of vertical integration or data sources. A prime example is "contracting" or "contract production." Many earlier studies did not clearly distinguish between various kinds of financing arrangements, contract production where the contractor furnishes major production inputs, or marketing agreements (or contracts). Financing arrangements of some type have existed almost since the beginning of commercial production for the market. Traditional lenders or input suppliers have extended lines of credit to producers. Particularly in the last two decades, they have often made additional services available to borrowers or written-in additional requirements on input acquisition or production practices. Marketing agreements, where the producer agrees to sell to a given buyer, sometimes with the addition of specified production and quality-control practices to be followed, emerged prominently in the last two decades. Cooperatives have made wider but not exclusive use of this approach.

However, the most significant innovations of the 1950's and 1960's have been risk-sharing and the furnishing of production inputs by a contractor. It is to these practices that the term "contract production" is now more generally applied. It is in this sense that the term is used in this analysis.

Consideration of coordination or integration in a time dimension involves some evolution in the characteristics and terms of integrating devices. Moreover, during the stages of structural evolution through which the egg industry has passed, various forms of integration have also changed in relative importance. In the early days of the egg industry, many poultry farms were vertically integrated to some degree. The poultryman performed additional input-supplying and marketing operations as much from necessity as from choice, since the industry was composed mainly of small, decentralized units. In the next stage of structural evolution, off-farm specialization in nonproduction functions became more characteristic. With this shift, external financing and cooperative marketing rose in importance. In the present stage of structural evolution, reintegration of various functions - vertically and horizontally - under an overall management has become more characteristic. This has resulted in heavy emphasis on contract production and large-scale owner-integrated enterprises. Technological advances and growing awareness of inherent economies of scale have resulted in units of larger average size. Owner-integrated operations, except where oriented to local areas and direct marketing, have thus tended--overtime--to become economically feasible with increasing size. Individual contract flocks have gradually become larger, although not as rapidly as owner-integrator flocks.

If one were to estimate the extent of vertical and horizontal integration over a time period longer than the one employed in this study, qualitative dimensions would be even more problematical and would increase the need for breaking down estimates into more subcategories.

EXPERIMENTAL METHODOLOGY

The first step in approaching quantification of the extent of integration was to develop a conceptual matrix with vertical and horizontal dimensions (table 1). On the vertical axis, various degrees of vertical coordination were arrayed in six rows according to degree--from the lightest to the lowest. On the horizontal axis, six columns were arranged in a similar way. A modification of the usual concept of horizontal integration was employed. The keys to these categories are spatial competitive dimensions, direct versus indirect marketing channels (for example, selling to retailers versus wholesalers), and single firm versus

group marketing. The categories are assumed to reflect ascending bargaining or market power for industry units.

Obviously, the conceptual matrix in table 1 does not include all possible combinations and is therefore itself a simplification. But it does include most observable types of arrangements that have been common at various times and places in the egg industry in the last two decades, or that seem likely in the near future.

If the approaches followed in this analysis are used for another industry, a conceptual matrix specific to that particular industry would have to be developed. However, inclusion of both the vertical and horizontal dimensions is probably necessary, both for making internal (interregional) and external (interindustry) comparisons.

Numerical values were assigned to each block of the matrix. Subjective weightings have been employed before in studies of contractual arrangements on broilers (5, p. 5-7) and of contract characteristics (2, p. 74-99). Exact values are indeed debatable, but perhaps not crucial in view of uniform application and data limitations discussed later. There is no compelling reason why the weightings must reflect an exact row-column balance. Indeed, a particular line of reasoning may well suggest some unbalanced set of weights. However, an alternative set of weights tested in this analysis made little difference in relative values derived from aggregations based on estimates for the limited number of categories available for use.

Knowledge of the egg industry is still grossly inadequate to fully differentiate all 36 combinations in the conceptual matrix. Following the development of a limited number of time series from available data, the matrix was collapsed into four categories (figure 1). Weightings represent arithmetic averages for the blocks included in each category. These simplified weightings were applied to the derived time series values to develop aggregate values by years, regions, and for the United States in total. Hopefully, if more detailed data became available, some disaggregation of measureable categories could occur, and aggregate values be made more sensitive and accurate.

As previously noted, by using all available sources of data, it was possible to estimate only three data series. Hence, only four weightings are used, the fourth being a residual percentage.

Table 1.--Conceptual matrix for types of vertical and horizontal integration in the market egg industry

Vertical integration	Horizontal integration					
	Direct marketing, mostly multiple units, multiple area, high group marketing potential	Indirect marketing, mostly multiple units, multiple area, high group marketing potential	Direct marketing mostly single units, single area, modest group marketing potential	Indirect marketing, mostly single units, single area, modest group marketing potential	Direct marketing, single units, local area, low group marketing potential	Indirect marketing, single units, local area, low group marketing potential
Total ownership/control of all production, processing input-supply functions	Fully coordinated mostly large firms	Fully coordinated, mostly large firms	Fully coordinated, mostly medium sized firms	Fully coordinated, mostly medium sized firms	Fully coordinated, mostly small firms	Fully coordinated, mostly small firms
Contract production, ownership/control of processing, input-supplying functions	Integrated contractors, mostly large firms	Integrated contractors, mostly large firms	Integrated contractors, mostly medium sized firms	Integrated contractors, mostly medium sized firms	Integrated contractors, mostly small firms	Integrated contractors, mostly small firms
Some contracting plus production financing, and loose input-supplying arrangements, with marketing agreements	Multiple unit packers, with input and production arrangements	Mostly multiple unit packers, with input and production arrangements	Mostly single unit packers, mostly medium sized	Mostly single unit packers, mostly medium sized	Single local packers, mostly small	Single local packers, mostly small
Some contracting plus production financing or loose input-supplying arrangements, with marketing agreements	Multiple unit packers, with input or production arrangements	Mostly multiple unit packers, with input or production arrangements	Mostly single unit packers, mostly medium sized	Mostly single unit packers, mostly medium sized	Single local packers, mostly small	Single local packers, mostly small
Loose input-supplying arrangements, no other production arrangements, without marketing agreements	Multiple unit packers, with some input arrangements	Mostly multiple unit packers, with some input arrangements	Mostly small and medium sized single unit packers, with some input arrangements	Mostly small and medium sized single unit packers, with some input arrangements	Single producer, producing some inputs, selling retail	Single producer, producing some inputs, selling wholesale
No input-supplying or production arrangements, without marketing agreements	Multiple unit packers	Mostly multiple unit packers	Mostly small and medium sized single unit packers	Mostly small and medium sized single unit packers	Single producer, buying inputs, selling retail	Single producer, buying inputs, selling wholesale

Figure 1.--Schematic system for collapsing conceptual matrix on integration in the market egg industry

Row	Score	Column 1	2	3	4	5	6
		6	5	4	3	2	1
1	6	36	30	24	18	12	6
2	5	30	25	20	15	10	5
3	4	24	20	16	12	8	4
4	3	18	15	12	9	6	3
5	2	12	10	8	6	4	2
6	1	6	5	4	3	2	1

Owner-integrated = $\sum$(row 1, columns 1-6)
= 21

Contract production = $\sum$(rows 2-3, columns 1-6)
= 15.75

Cooperatives = $\sum$(row 4, columns 1-6,
rows 5-6, columns 1-4)
= 8.357

Residual = $\sum$(rows 5-6, columns 5-6)
= 2.25

Sample calculation, United States, 1969:

Percent of market eggs from owner-integrated operations	19.2
Percent of market eggs from contract production	19.0
Percent of market eggs handled by cooperatives	15.3
Subtotal	53.5
Residual percent	46.5
Total	100.0

19.2 times 21.000 = 4.03
19.0 times 15.750 = 2.99
15.3 times 8.357 = 1.28
46.5 times 2.250 = 1.05

Estimated index of integration = 9.35

OWNER-INTEGRATED OPERATIONS

The series of owner-integrated percentages recognizes that a tremendous increase in average flock size occurred during 1955-69. Moreover, technology and economies of scale probably mean that owner-integration is economically feasible only with larger and larger production units. Hence, Census data for 1954, 1959, and 1964 on bird distributions in various flock-size categories were used to derive regional and U.S. estimates. 3/ Values for other years were interpolated from graphical analyses.

In 1954, it was assumed that the percentages of flocks with 20,000 or more layers would furnish such estimates. In 1959, 100 percent of the birds in flocks of 50,000 or over and 50 percent of the birds in flocks of 20,000-49,999 were used to develop estimates. In 1964, 100 percent of the 100,000 and over interval and 50 percent of the 50,000-99,999 interval were used. An informal survey by ERS field and State agricultural experiment station employees suggested that the number of flocks of 100,000 and over had increased substantially by 1969, probably about doubling from 1964 to 1969. Therefore, a precise estimate of 1969 values would probably be based on only 100 percent of the birds in flocks of 100,000 and over. Such a correction could be made when the 1969 Census results become available. The formulas used do not imply that owner-integration occurs only with the prescribed unit sizes, but are merely a mechanistic assumption to derive relative proportions.

Development of owner-integrated operations, associated to a considerable extent with larger flocks, has been most pronounced in regions where egg production has expanded (West, South Atlantic, South Central). In those regions, rate of growth in both average flock size and in the relative number of very large flocks has outdistanced that in other regions. Moreover, owner-integration is more important in the North Atlantic region than in the Midwest. Flocks in the North Atlantic region were historically much larger than average. Although this advantage had been lost by the mid-1950's, large flocks are still numerous enough to support a reasonably high degree of owner-integration (table 2).

CONTRACT PRODUCTION

Data for estimating the proportions of production produced under contract are available in part from various USDA and State studies, some of which have been repeated at irregular intervals so that individual State or aggregate U.S. changes can be deduced. The report of the National Commission on Food Marketing on the

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3/ National Commission on Food Marketing data (4, p. 9) provided guidelines, based on a sample of firms, of year-to-year changes for the United States.

Table 2.--Estimated proportion of market eggs supply from owner-integrated operations, 1955-69

Year	Region						
	North Atlantic	East North Central	West North Central	South Atlantic	South Central	West	United States
	Percent						
1955	1.3	0.6	0.1	1.9	1.4	4.7	1.3
1956	2.1	0.8	0.2	3.0	2.4	6.6	2.0
1957	2.9	1.1	0.2	4.2	3.5	8.5	2.8
1958	3.7	1.4	0.3	5.4	4.6	10.5	3.6
1959	4.5	1.7	0.4	6.6	5.7	12.6	4.4
1960	5.0	2.0	0.6	7.2	8.0	15.7	5.4
1961	5.5	2.3	0.8	7.8	10.4	18.9	6.5
1962	6.1	2.7	1.0	8.4	12.9	22.2	7.8
1963	6.7	3.1	1.2	9.0	15.5	25.6	9.2
1964	7.3	3.6	1.5	9.7	18.2	29.1	10.7
1965	8.0	4.2	1.8	11.0	22.0	32.0	12.4
1966	8.7	5.0	2.4	12.8	22.5	34.0	14.0
1967	9.3	5.8	3.0	15.0	28.0	36.0	15.6
1968	10.3	6.8	3.8	17.0	30.5	37.5	17.2
1969	11.5	8.0	4.7	19.2	32.3	39.0	19.2

poultry and egg industries contained the results of a survey of industry firms for 1959-64 (4, p. 8-9). These data were published for the United States only, but are indicative of the timing of the development of contract production, even though the nature of the firms included probably overstates the actual proportions involved for the industry as a whole. The 1959 Census contained a U.S. estimate of the proportion of contract production. However, this value included hatching as well as market eggs, and probably marketing agreements and loose financing arrangements as well as actual contract production. Hence, the estimate was not directly comparable with other observations.

The 1964 Census attempted a State-by-State enumeration of the extent of contract production. While the individual State figures were not all published because Census did not have full confidence in the quantity and quality of responses, the overall U.S. average seems reasonable. In constructing estimates in this analysis, adjustments were made by regions, based on other studies, to achieve greater comparability and accuracy. In general, estimates were keyed around adjusted 1964 Census estimates, and projected backward to earlier years and forward to later years by using other studies.

Contract production first emerged as a major influence in the South Atlantic and South Central regions in the mid-1950's. By 1963, it accounted for over 30 percent of volume in the two regions. Contract production declined somewhat in relative importance in the two regions since the mid-1960's as large owner-integrated operations have become more important. Contract production has assumed increasing importance since the early 1960's in the North Atlantic, Western, and East North Central regions, but this development is heavily concentrated in a few States in each region. The West North Central region has evidenced slow growth in contract production, despite some early efforts with contracts and tight financing arrangements there and in the East North Central region in the mid-1950's (table 3).

COOPERATIVE MARKETING

The Farmer Cooperative Service and its predecessor agencies have published the annual dollar sales of poultry and eggs by cooperatives for many years. However, the sales data are not separated by individual commodities. Using slaughter data for plants under Federal inspection since the early 1960's, market price series, and other studies, poultry items were subtracted out. The remainder for eggs was converted to quantities by utilizing market price series. Egg volumes were then compared with volumes sold off farms (SRS) to derive percentages handled regionally by cooperatives.

Table 3.--Estimated proportion of market egg supply from contract production, 1955-69

Year	Region						
	North Atlantic	East North Central	West North Central	South Atlantic	South Central	West	United States
	Percent						
1955	1/	1/	1/	4.0	1.0	1/	0.5
1956	0.5	0.5	0.5	5.0	1.0	0.5	1.0
1957	1.0	2.0	2.0	10.0	5.0	2.0	3.0
1958	1.5	2.5	2.5	18.0	9.0	3.5	5.0
1959	2.0	3.0	2.5	20.0	11.0	4.0	6.0
1960	3.0	4.0	2.7	21.0	11.8	5.0	7.0
1961	4.0	5.0	2.9	22.0	12.6	6.0	8.0
1962	6.0	6.0	3.1	23.0	18.8	8.0	10.2
1963	12.0	9.0	3.7	28.0	35.0	11.0	16.2
1964	12.5	9.3	3.9	28.4	37.1	11.7	17.4
1965	13.4	9.7	4.2	27.9	37.0	12.2	18.0
1966	14.0	10.2	4.6	26.9	36.6	12.6	18.5
1967	14.7	10.7	5.0	26.1	35.7	13.1	18.9
1968	15.8	11.0	5.3	25.2	34.6	13.5	19.0
1969	16.8	11.5	5.6	24.1	33.5	13.7	19.0

1/ Negligible.

Egg cooperatives, mainly individual units, historically performed such operating functions as assembling, packing, and distributing eggs. During the 1950's and 1960's they became increasingly concerned with quality control programs and volume stability. In the latter instance, marketing agreements were widely developed with producer-members, the objective being to secure commitments from producers to deliver all or a major share of their output to the cooperative. In some cases, notably on the West Coast, some arrangements assumed the status of yearly contracts. Thus, marketing agreements and contracts were often confused with production contracts. Although some cooperatives have engaged in production contracting and loose input-supplying and financing arrangements, these have not been typical practices. Moreover, some producer-members have become owner-integrators insofar as production, input-supplying, and packing are involved. In these instances, cooperatives have been used as packers and sales agents. Thus, cooperative volume may include some duplication of that covered under the owner-integrated and contract production categories. On the other hand, some private firms have also used marketing agreements, contracts, loose input-supplying, and financing arrangements. The proportion handled by cooperatives is assumed in this analysis to be representative (in a relative sense) of various arrangements between full owner-integration or contract production and completely separate units performing each production, input-supplying, and marketing function.

Traditional functions of egg cooperatives have undergone a partial transformation, particularly in recent years. Since 1953, a central cooperative sales agency (North American Poultry Cooperative Association, Inc.) has operated in New York City. Member cooperatives are located in the Northeast, the South, and the Midwest. This agency formerly traded on the New York Mercantile Exchange to represent producers in the price-determining process. In addition, it developed regular institutional outlets. But the volume of eggs handled has been only slightly more than one-fourth of 1 percent of U.S. volume, and therefore not large enough for differential treatment in this analysis. The National Egg Company, organized in 1966, soon accounted for 24 percent of eggs sold for purposes other than hatching; its activities were mainly in compiling and exchanging information and in price-determination. The New England Egg Marketing Association, Inc., organized in 1967, shortly represented one-fourth of New England's table egg production or 1.1 percent of U.S. eggs sold for purposes other than hatching; its activities were in information and price stabilization. The Southwest Egg Producers (SWEP) was organized as a bargaining cooperative in 1958, but really only became highly active by 1966. SWEP--operating a two-price system--had exclusive contracts not only with producers but also with dealer-members. By 1966, it accounted for 70-75 percent of the eggs produced in Southern California and Arizona, or less than one-third of the California-Arizona volume sold for purposes other

than hatching, or 3.5 percent of the U.S. market egg volume. In 1968-69, these organizations, plus others, federated into the United Egg Producers, Inc. (UEP), the main activities of which are in information and price-determination. By 1969-70, UEP represented about 40 percent of egg producers and over 50 percent of the volume. With national membership, it might become increasingly difficult to identify regional differences regardless of whether the objectives were changed in future years. SWEP, whose activities have extended geographically since 1966, represents the only major group marketing effort to date and is the only one which might have been recognized in this analysis.

In some areas of the country, private firms and some cooperatives have operated localized clearinghouse arrangements like those carried out by the National Egg Company. While these have some beneficial effects on short-run price stabilization, they do not meet the standards for group marketing assumed in this analysis.

Egg cooperatives were relatively more important in the North Atlantic and Western regions in the mid-1950's than in other regions; they remain so to the present time. In the East North Central region, egg cooperatives have gained in relative importance since the mid-1950's. In the South Atlantic region, relative gains were achieved in the late 1950's and early 1960's, but recent growth in volume has not been as great among cooperatives. The relative position of the South Atlantic region has since declined. Although cooperative volume is relatively limited in the West North Central and South Central regions, some gains have occurred in the latter (table 4).

INDEX OF INTEGRATION

Using procedures described under the earlier section on methodology and data from tables 2-4, the index series in table 5 were derived.

By 1969, the market egg industry had become almost three times as integrated as in 1955. But in the scale of reference employed in this study, the industry is only slightly over a fourth of the way between a situation of completely atomistic competition (many independent local units, and no coordination of various functions) and complete owner-integration by large multiple unit firms operating over wide geographical areas and engaging in direct and group marketing. Much of the growth in integration since 1955 has occurred in the vertical dimension. To data, the horizontal dimensions have developed somewhat less. Further growth in both vertical and horizontal dimensions is likely during the 1970's.

Table 4.--Estimated proportion of market egg supply handled by cooperatives, 1955-69

Year	Region						
	North Atlantic	East North Central	West North Central	South Atlantic	South Central	West	United States
	Percent						
1955	23.8	8.0	8.1	11.3	2.7	20.9	12.5
1956	23.1	8.3	8.3	11.8	2.8	20.9	12.5
1957	23.2	9.4	9.0	12.6	2.5	23.1	13.2
1958	20.7	9.2	8.2	13.8	3.1	22.0	12.5
1959	24.3	10.6	8.7	22.3	6.2	26.5	15.5
1960	20.2	8.5	5.8	22.7	7.4	21.4	13.4
1961	22.2	11.8	9.1	24.7	6.8	22.4	15.5
1962	20.6	13.3	9.9	21.9	6.9	22.9	15.5
1963	17.3	13.6	12.2	14.8	6.0	20.5	13.9
1964	18.6	14.6	13.3	17.4	9.4	19.1	15.3
1965	21.8	16.1	8.1	11.8	10.0	14.2	13.4
1966	19.9	12.6	3.4	10.4	6.3	20.4	11.8
1967	25.0	12.2	4.3	13.1	6.8	38.8	16.1
1968	19.2	10.3	4.5	9.9	7.8	40.9	15.2
1969 1/	19.2	10.8	4.8	9.3	8.0	41.0	15.3

1/ Preliminary.

Table 5.--Market eggs: Estimated index of integration, 1955-69

Year	Region						
	North Atlantic	East North Central	West North Central	South Atlantic	South Central	West	United States
	Percent						
1955	3.95	2.85	2.76	3.84	2.81	4.41	3.32
1956	4.12	2.97	2.86	4.21	3.01	4.83	3.52
1957	4.35	3.30	3.11	5.13	3.73	5.52	3.99
1958	4.41	3.41	3.14	6.54	4.52	6.03	4.36
1959	4.85	3.62	3.19	7.55	5.18	6.78	4.83
1960	4.83	3.68	3.08	7.82	5.79	7.18	5.03
1961	5.18	4.08	3.35	8.19	6.32	7.99	5.50
1962	5.46	4.38	3.46	8.27	7.63	8.62	6.04
1963	5.76	4.88	3.72	8.62	10.25	9.79	7.01
1964	6.44	5.07	3.87	8.97	11.22	10.45	7.54
1965	6.89	5.33	3.65	8.80	11.98	10.76	7.82
1966	6.99	5.33	3.53	8.92	12.36	11.57	8.09
1967	7.50	5.53	3.75	9.39	12.73	13.14	8.71
1968	7.48	5.64	3.95	9.44	13.12	13.60	8.97
1969	7.85	5.96	4.18	9.67	13.32	13.92	9.35

In 1955, some differences--much less substantial than in 1969--existed between regions in the total degree of integration. All regions showed some development over the 15-year period. The largest relative and absolute changes were in the West and South; the West North Central region showed the least development. Intermediate rates of change characterized the East North Central and the North Atlantic regions.

The Western, South Central, and South Atlantic regions have expanded their shares of U.S. egg production since 1955. The other three regions have decreased in relative importance, with the West North Central region showing the greatest relative decline.

MARKET EGG SUPPLY

Total egg production statistics, as reported by the Statistical Reporting Service, USDA, include eggs produced for hatching as well as for human consumption. By far the largest component of eggs produced for hatching goes into commercial production of broilers, including other meat chickens. Such eggs are produced according to decisions made in the broiler industry and only the excess production enters shell egg markets. Other eggs for hatching are for laying flock replacements and are thus directly related to the commercial shell egg industry. Here again, only excess production directly enters shell egg markets. Figure 2 shows the components of the market egg supply.

To derive market egg supply, an adjustment was made from total egg production statistics to remove eggs used for hatching chicks. Revised figures on regional shares of U.S. market egg supply reflect this adjustment (table 6). The removal of eggs used for hatching does not result in major changes for most regions, however. Primarily because of the importance of broiler hatching eggs in the hatching egg total, the relative importance of the South Atlantic region dropped several percentage points by 1969. A lesser drop occurred for the South Central region. The Western region's share rose the most, and the other three regions somewhat less. Table 8 shows the unadjusted regional shares.

INTEGRATION AND INTERREGIONAL SHIFTS

A relationship appears to exist between the rate of development of integration and region's share of U.S. market egg supply (figs. 3 and 4). During 1955-69, the market egg industry in all regions became more integrated, although the rate of development varied by region. Thus, the West North Central, East North Central, and North Atlantic regions, which have

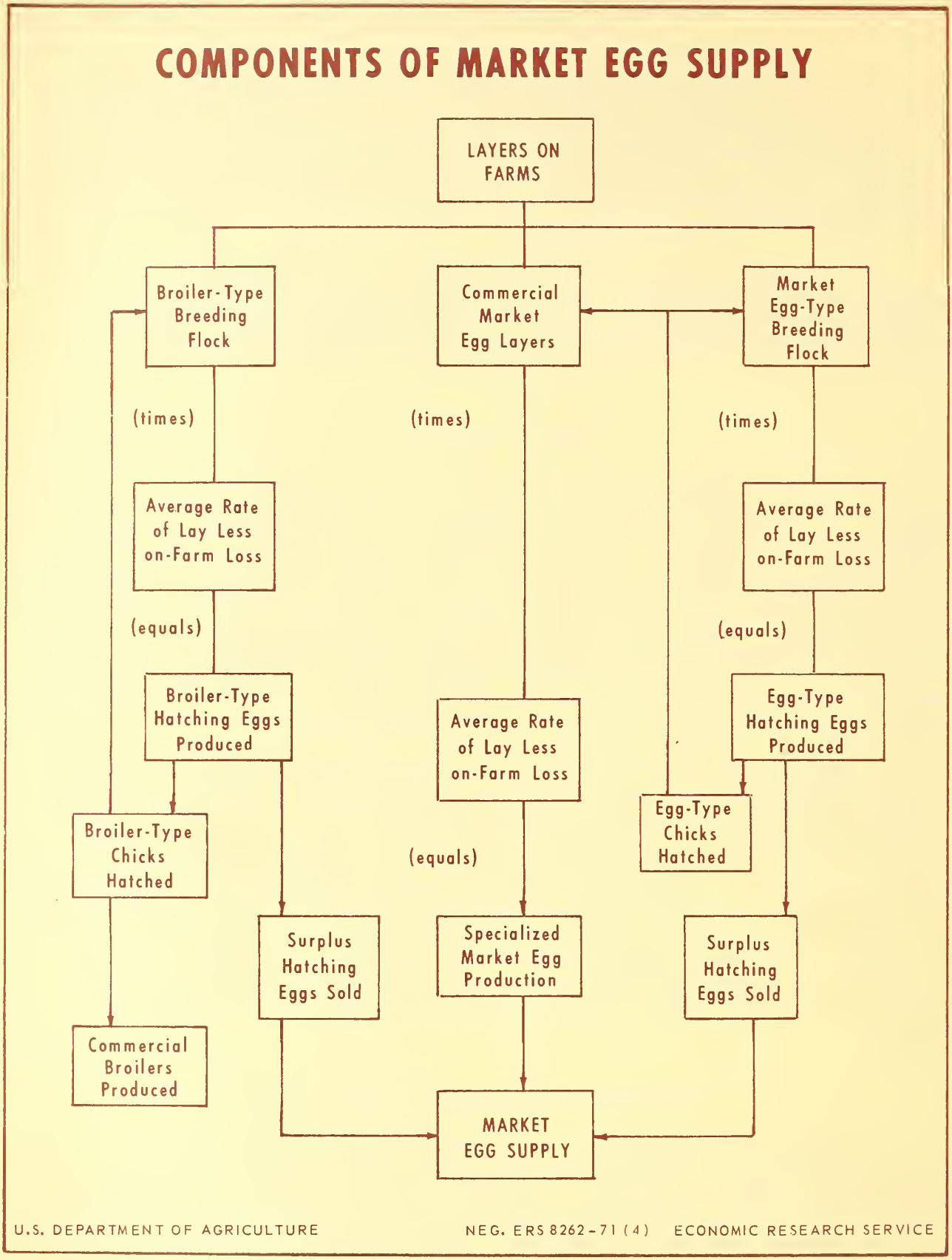
COMPONENTS OF MARKET EGG SUPPLY
LAYERS ON FARMS
Broiler-Type Breeding Flock
Commercial Market Egg Layers
Market Egg-Type Breeding Flock
(times)
(times)
(times)
Average Rate of Lay Less on-Farm Loss
Average Rate of Lay Less on-Farm Loss
(equals)
(equals)
Broiler-Type Hatching Eggs Produced
Average Rate of Lay Less on-Farm Loss
Egg-Type Hatching Eggs Produced
Egg-Type Chicks Hatched
Broiler-Type Chicks Hatched
(equals)
Surplus Hatching Eggs Sold
Specialized Market Egg Production
Surplus Hatching Eggs Sold
Commercial Broilers Produced
MARKET EGG SUPPLY
U.S. DEPARTMENT OF AGRICULTURE
NEG. ERS 8262-71 (4) ECONOMIC RESEARCH SERVICE

Figure 2

Table 6.--Proportion of U.S. market egg supply, by regions, 1955-69 1/

Year	Region						
	North Atlantic	East North Central	West North Central	South Atlantic	South Central	West	United States
	Percent						
1955	18.0	19.9	28.3	8.6	12.3	12.7	100.0
1956	18.2	19.8	27.4	9.0	12.9	12.7	100.0
1957	17.9	19.1	27.7	9.4	13.0	12.8	100.0
1958	17.5	19.1	27.3	9.7	13.1	13.3	100.0
1959	17.0	18.3	26.1	10.9	14.0	13.7	100.0
1960	16.4	17.9	25.3	11.8	14.0	14.6	100.0
1961	15.9	17.1	24.5	12.4	14.9	15.2	100.0
1962	15.4	17.0	23.1	13.0	15.7	15.7	100.0
1963	15.7	16.3	20.8	14.6	16.6	16.1	100.0
1964	15.5	15.5	19.8	15.1	17.7	16.4	100.0
1965	15.6	15.4	18.9	15.5	18.3	16.5	100.0
1966	15.1	14.9	17.6	16.3	19.2	16.8	100.0
1967	14.5	14.7	16.8	17.1	20.0	16.8	100.0
1968	14.5	14.8	15.3	17.5	20.6	17.4	100.0
1969	14.7	14.2	14.5	18.8	20.2	17.6	100.0

1/ Excludes broiler-type and egg-type hatching eggs used for hatching.

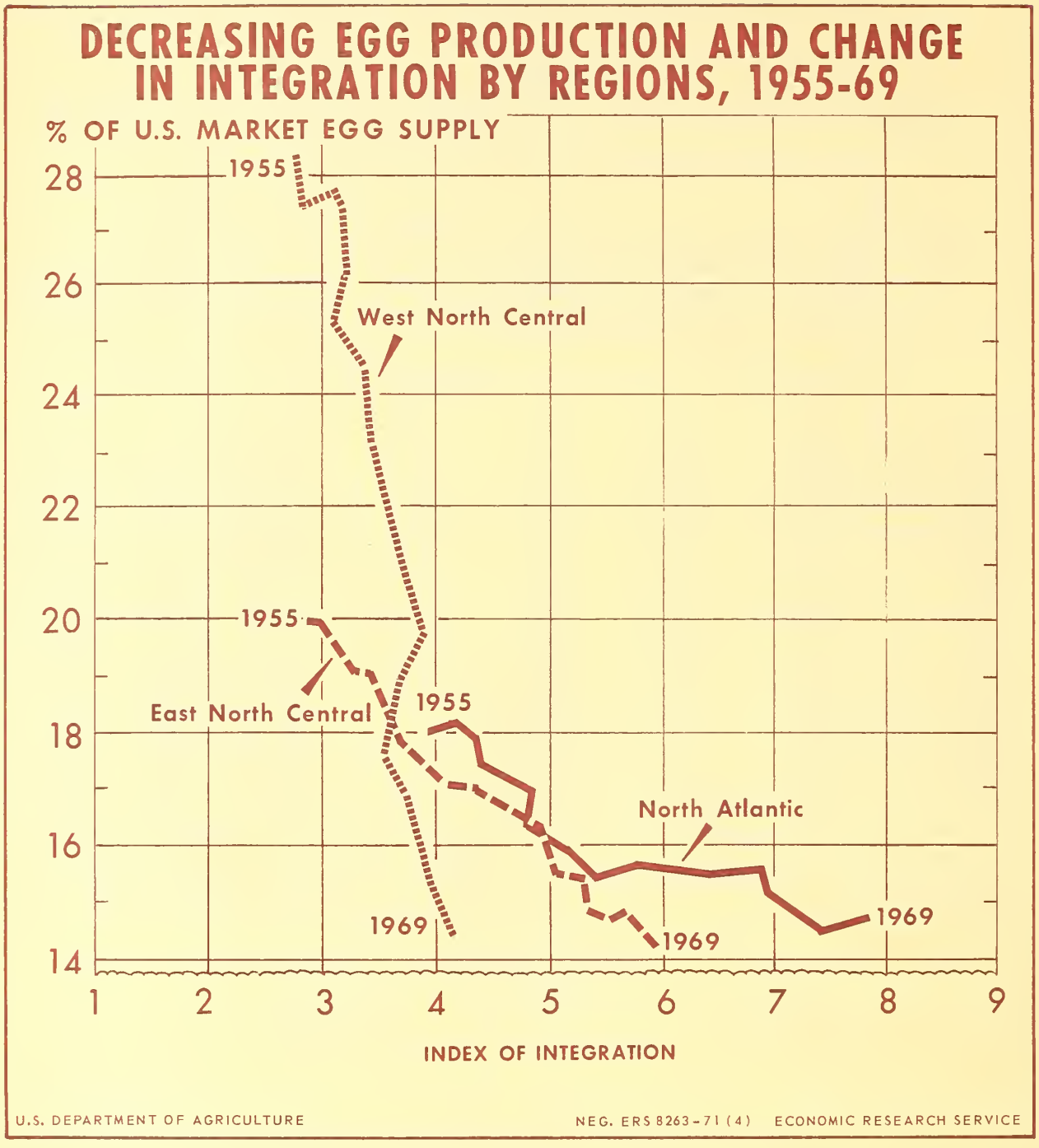
DECREASING EGG PRODUCTION AND CHANGE IN INTEGRATION BY REGIONS, 1955-69
% OF U.S. MARKET EGG SUPPLY
28
26
24
22
20
18
16
14
1955
West North Central
1955
East North Central
1955
North Atlantic
1969
1969
1969
1
2
3
4
5
6
7
8
9
INDEX OF INTEGRATION
U.S. DEPARTMENT OF AGRICULTURE
NEG. ERS 8263-71 (4) ECONOMIC RESEARCH SERVICE

Figure 3

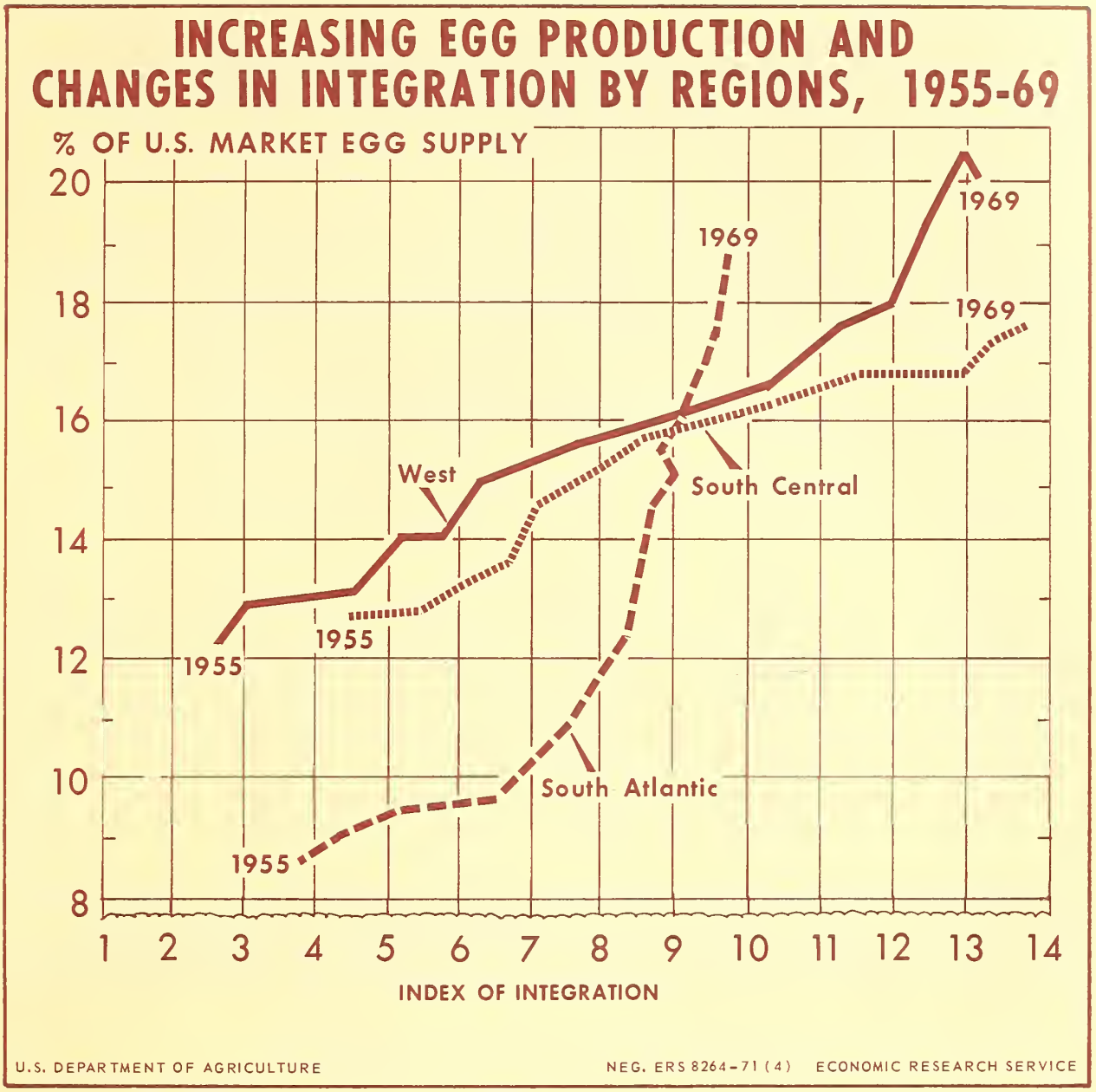
INCREASING EGG PRODUCTION AND CHANGES IN INTEGRATION BY REGIONS, 1955-69
% OF U.S. MARKET EGG SUPPLY
20
18
16
14
12
10
8
1969
1969
1969
West
South Central
1955
1955
South Atlantic
1955
1 2 3 4 5 6 7 8 9 10 11 12 13 14
INDEX OF INTEGRATION
U.S. DEPARTMENT OF AGRICULTURE
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Figure 4

experienced declines in their share of U.S. market egg supply, show a less than average rate of development in integration. In contrast, the Western, South Central, and South Atlantic regions, which have experienced increases in their share of U.S. market egg supply, show an above average rate of development in integration.

To attribute all of the changes in the relative regional shares of U.S. output to differential rates of growth in integration would be unrealistic. The integration variable was developed for use in multiple-variable analysis where integration should receive its proper weight as an influence in each region. Indeed, the importance of other factors is suggested by the positions and slopes of the regional relationships in figures 3 and 4. Also, use of an integration variable can be hazardous if used in a linear relationship for projection. The apparent value of the integration variable in explaining the differential rate of development of the egg industry during 1955-69 may not hold in future periods.

In tables 9 and 10, for example, there is evidence that the relationships between regions and the U.S. average may be changing. Conceptually, one might well expect: (1) a period of continued development of integration in the market egg industry in the 1970's; and (2) faster relative rates of development in the Midwest and Northeast. Thus, other things remaining equal, relationships of the general nature of:

$$Y = \frac{1}{a + bx + cx^2} \quad \text{or} \quad Y = a + bx + cx^2,$$

might be more appropriate for projective purposes than are linear projections. This implies that relationships during 1955-69 might be reversible, and/or that the integration variable could be far less important in the 1970's in interregional analysis.

INTEGRATION AND MARKETING MARGINS

Aggregatively, it can be hypothesized that an industry which becomes more highly integrated - vertically and horizontally - could become more efficient. In major cities, farm to retailer price spreads for Grade A large eggs declined during 1955-69 by 3.5 - 4.0 cents per dozen. 4/ However, since substantial increases in costs of inputs used in marketing occurred during this period, the relative decline is much greater. Adjusted spreads show about a 9.0 cent per dozen decline, or about 50 percent (table 7).

4/ Farm to retailer price spreads or their components are not necessarily always equal to marketing costs. If margins go below functional costs, large scale integrated firms may better withstand these because of superior capital positions or returns from other activities.

Table 7.--Farm to retailer price spreads, Grade A large eggs, 12 major cities, unadjusted and adjusted, 1955-69

Year	Farm to retailer price spreads unadjusted	Cost 1/ index	Farm to retailer price spreads adjusted for costs	Total civilian disappearance as percentage of preceding year	Farm to retailer price spreads adjusted for volume
	Cents per dozen	1957-59 = 100	Cents per dozen	Percent	Cents per dozen
1955	16.0	89	18.0	100.7	18.1
1956	15.8	94	16.8	101.3	17.0
1957	15.5	98	15.8	99.8	15.8
1958	15.2	100	15.2	99.7	15.2
1959	15.0	102	14.7	101.2	14.9
1960	14.6	106	13.8	96.9	13.4
1961	14.4	108	13.3	99.8	13.3
1962	14.2	110	12.9	100.8	13.0
1963	13.8	112	12.3	98.8	12.2
1964	13.4	115	11.7	101.6	11.9
1965	13.0	117	11.1	100.0	11.1
1966	13.4	121	11.1	100.9	11.2
1967	13.1	126	10.4	104.2	10.8
1968	12.1	132	9.2	100.1	9.2
1969	12.5	139	9.0	99.6	9.0

1/ Costs of containers, packaging materials, fuel, light, power, services, and wages of food-marketing employees.

Figure 5 compares adjusted price spreads with the index of integration for the U.S. market egg industry. Changes in price spreads reflect more direct and orderly marketing plus shifts in supply areas. A linear relationship could be used to measure the association of the two series. However, logic would suggest another kind of relationship, such as:

$$\log Y = a + b (\log x),$$

implying that a continued rate of development in integration will have less and less effect on reducing price spreads in marketing. While further development toward a more highly integrated industry could have some cost-reducing effects, much of the potential saving has already been realized. Future changes in the industry, possibly reflecting horizontal integration to a greater extent than vertical, may show up increasingly in the areas of bargaining power (price level and division of returns) than in cost reduction.

APPLICATIONS AND REFINEMENTS OF METHOD

The method described in this report could be applied to various agricultural industries, thus making possible more meaningful interindustry comparisons of the degree of integration or coordination. This is sometimes done now by separately estimating the proportions of output in such categories as: contract production, vertically-integrated firms (synonomous with owner-integrated operations as used in this report), and contract marketing. But the method outlined above has the added advantage of differentially weighting the importance of various degrees of vertical and horizontal integration.

Interindustry comparisons would be difficult if conceptual matrices differed in size or scoring systems. This could be avoided by converting index numbers to percents; the percents are obtained by dividing index numbers by the maximum score in the conceptual matrix for each specific industry.

It may generally be easier to estimate components for an index of integration for a particular industry on a national basis than for geographic subdivisions, such as regions. Thus, there may be more immediate applications in terms of total industry levels in systems analysis. However, if detailed data were available for several key States, such comparisons might have value both in themselves or as proxy indicators involving larger areas.

The process of averaging rows in conceptual matrix scoring (fig. 1) arbitrarily assumed fixed midpoint weights for the horizontal dimension. Use of such data series as changes in the proportions marketed through more versus less direct marketing channels, or numbers, sizes, and costs of processing and other input

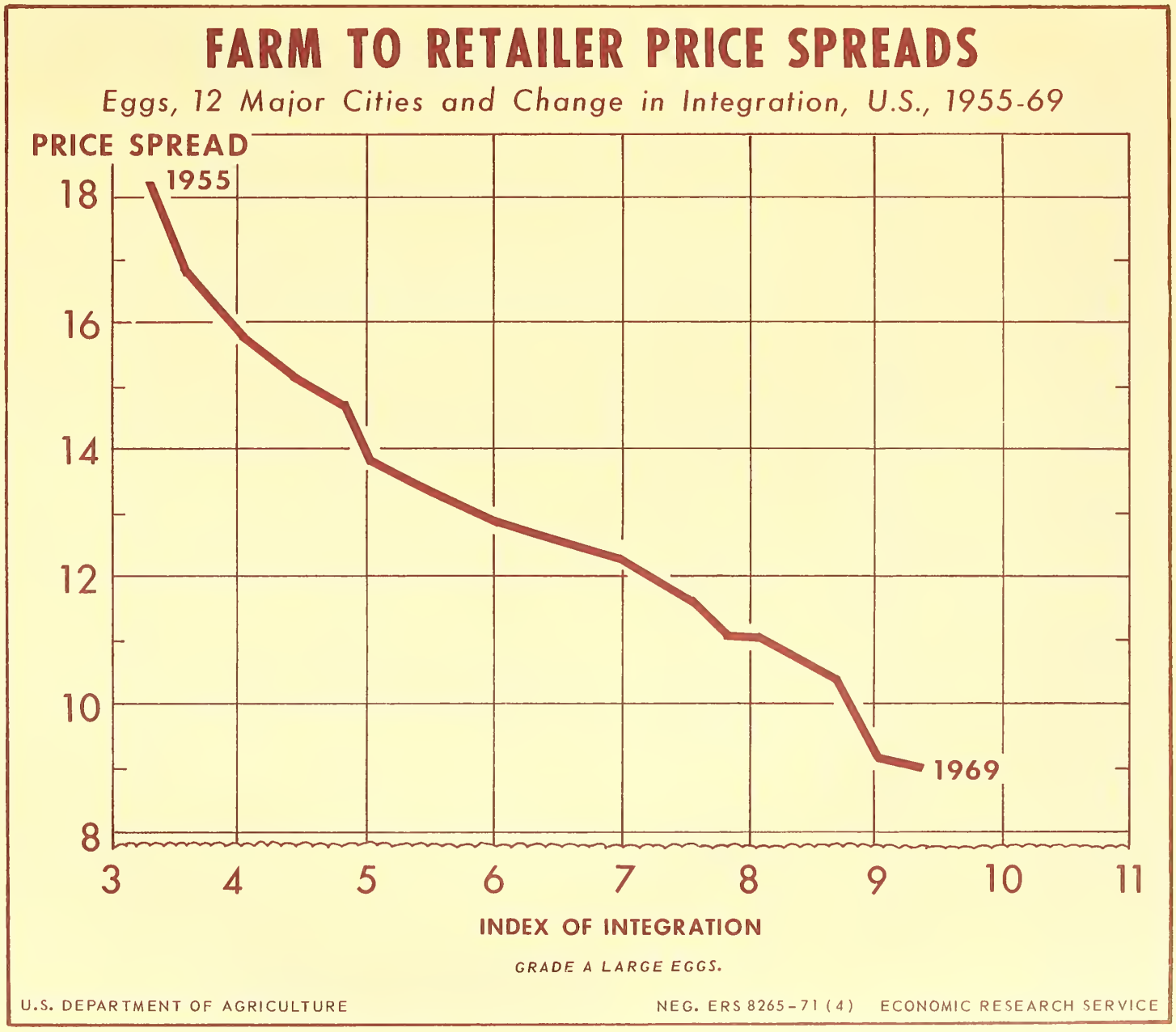
FARM TO RETAILER PRICE SPREADS
Eggs, 12 Major Cities and Change in Integration, U.S., 1955-69
PRICE SPREAD
1955
1969
18
16
14
12
10
8
3
4
5
6
7
8
9
10
11
INDEX OF INTEGRATION
GRADE A LARGE EGGS.
U.S. DEPARTMENT OF AGRICULTURE
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Figure 5

and marketing firms, would be helpful in improving accuracy. In effect, the result would probably be to accentuate changes over time by widening the range of index values. But at the time of preparation of this report, the above types of series had not been adequately delineated for the market egg industry.

Table 8.--Proportion of total U.S. egg production, by regions, 1955-69 1/

Year	Region						
	North Atlantic	East North Central	West North Central	South Atlantic	South Central	West	United States
	Percent						
1955	18.5	19.6	27.9	9.3	12.3	12.4	100.0
1956	18.5	19.6	27.0	9.8	12.8	12.3	100.0
1957	18.2	18.8	27.1	10.4	13.1	12.4	100.0
1958	17.7	18.8	26.6	10.8	13.3	12.8	100.0
1959	17.0	18.0	25.6	12.0	14.2	13.2	100.0
1960	16.3	17.6	24.6	13.1	14.3	14.1	100.0
1961	15.8	16.7	23.8	13.8	15.3	14.6	100.0
1962	15.3	16.5	22.4	14.6	16.1	15.1	100.0
1963	15.5	15.7	20.1	16.1	17.2	15.4	100.0
1964	15.3	15.0	19.1	16.8	18.2	15.6	100.0
1965	15.2	14.8	18.1	17.3	18.9	15.7	100.0
1966	14.7	14.3	16.8	18.4	19.9	15.9	100.0
1967	14.1	14.1	16.1	19.0	20.7	16.0	100.0
1968	13.9	14.1	14.7	19.6	21.2	16.5	100.0
1969	14.2	13.5	13.8	21.0	20.9	16.6	100.0

1/ Includes market eggs and eggs used for hatching.

Table 9.--Regional index of integration in the market egg industry, compared with U.S. average, 1955-69

Year	Region					
	North Atlantic	East North Central	West North Central	South Atlantic	South Central	West
	Deviation from U.S. average					
1955	+ 0.63	+ 0.47	- 0.56	+ 0.52	- 0.51	+ 1.09
1956	+ 0.60	- 0.35	- 0.66	+ 0.69	- 0.51	+ 1.31
1957	+ 0.36	- 0.69	- 0.88	+ 1.14	- 0.26	+ 1.53
1958	+ 0.05	- 0.95	- 1.22	+ 2.18	+ 0.16	+ 1.67
1959	+ 0.02	- 1.21	- 1.64	+ 2.72	+ 0.35	+ 1.95
1960	- 0.20	- 1.35	- 1.95	+ 2.79	+ 0.76	+ 2.15
1961	- 0.32	- 1.42	- 2.15	+ 2.69	+ 0.82	+ 2.49
1962	- 0.58	- 1.66	- 2.58	+ 2.23	+ 1.59	+ 2.58
1963	- 1.25	- 2.13	- 3.29	+ 1.61	+ 3.24	+ 2.78
1964	- 1.10	- 2.47	- 3.67	+ 1.43	+ 3.68	+ 2.91
1965	- 0.93	- 2.49	- 4.17	+ 0.98	+ 4.16	+ 2.94
1966	- 1.10	- 2.76	- 4.56	+ 0.83	+ 4.27	+ 3.48
1967	- 1.21	- 3.18	- 4.96	+ 0.68	+ 4.02	+ 4.43
1968	- 1.49	- 3.33	- 5.02	+ 0.47	+ 4.15	+ 4.63
1969	- 1.50	- 3.31	- 5.17	+ 0.32	+ 3.97	+ 4.57
	Percent of U.S. average					
1955	119.6	85.9	83.7	116.3	84.8	132.6
1956	116.3	83.7	80.6	119.4	85.7	136.7
1957	109.0	82.9	77.5	127.9	93.7	137.8
1958	100.8	78.5	71.9	150.4	104.1	138.0
1959	100.7	75.4	66.4	156.7	107.5	140.3
1960	95.7	72.9	61.4	155.0	115.0	142.1
1961	94.1	73.9	60.8	148.4	115.0	145.1
1962	90.5	72.6	57.1	136.9	126.2	142.3
1963	82.1	69.7	52.8	122.6	146.2	139.5
1964	85.6	67.5	51.2	119.1	149.3	138.8
1965	88.0	68.2	46.5	112.4	153.5	137.8
1966	86.2	65.8	43.6	110.2	152.4	142.7
1967	86.0	63.6	43.0	107.8	146.3	150.8
1968	83.5	63.1	44.2	105.2	146.2	151.8
1969	83.8	63.8	44.6	103.5	142.3	148.8

Table 10.--Regional index of integration in the market egg industry, compared with West North Central region, 1955-69

Year	Region					
	North Atlantic	East North Central	South Atlantic	South Central	West	United States
	Deviation from West North Central average					
1955	+ 1.19	+ 0.09	+ 1.08	+ 0.05	+ 1.65	+ 0.56
1956	+ 1.26	+ 0.11	+ 2.35	+ 0.15	+ 1.97	+ 0.66
1957	+ 1.24	+ 0.19	+ 2.02	+ 0.62	+ 2.41	+ .88
1958	+ 1.27	+ 0.27	+ 3.40	+ 1.38	+ 2.89	+ 1.22
1959	+ 1.66	+ 0.41	+ 4.36	+ 1.99	+ 3.59	+ 1.64
1960	+ 1.75	+ 0.60	+ 4.74	+ 2.71	+ 4.10	+ 1.95
1961	+ 1.83	+ 0.73	+ 4.84	+ 2.97	+ 4.64	+ 2.15
1962	+ 2.00	+ 0.92	+ 4.81	+ 4.17	+ 5.16	+ 2.58
1963	+ 2.04	+ 1.16	+ 4.90	+ 6.53	+ 6.07	+ 3.29
1964	+ 2.57	+ 1.20	+ 5.10	+ 7.35	+ 6.58	+ 3.67
1965	+ 3.24	+ 1.68	+ 5.15	+ 8.63	+ 7.11	+ 4.17
1966	+ 3.46	+ 1.80	+ 5.39	+ 8.83	+ 8.04	+ 4.56
1967	+ 3.75	+ 1.78	+ 5.64	+ 8.98	+ 9.39	+ 4.96
1968	+ 3.53	+ 1.69	+ 5.49	+ 9.17	+ 9.65	+ 5.06
1969	+ 3.67	+ 1.78	+ 5.49	+ 9.14	+ 9.74	+ 5.17
	Percent of West North Central average					
1955	143.1	103.3	139.1	101.8	159.8	120.3
1956	144.1	103.8	147.2	105.2	168.9	123.1
1957	139.9	106.1	165.0	119.9	177.5	128.3
1958	140.4	108.6	208.3	143.9	192.0	138.9
1959	152.0	113.5	236.7	162.4	212.5	151.4
1960	156.8	119.5	253.9	188.0	233.1	163.3
1961	154.6	121.8	244.5	188.7	238.5	164.2
1962	157.8	126.6	239.0	220.5	249.1	174.6
1963	154.8	131.2	231.7	275.5	263.2	188.4
1964	166.4	131.0	231.8	289.9	270.0	194.8
1965	188.8	146.0	241.1	328.2	294.8	214.2
1966	198.0	151.0	252.7	350.1	327.8	229.2
1967	200.0	147.5	250.4	339.5	350.4	232.3
1968	189.4	142.8	239.0	332.2	344.3	227.1
1969	187.8	142.6	231.3	318.7	333.0	223.7

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