4-1-1963

Marketing New England poultry, Station Bulletin, no.476

Rogers, George B.

Bardwell, Edwin T.

New Hampshire Agricultural Experiment Station

ION BULLETIN 476 APRIL 1963

Marketing New England Poultry

4. Structure and Performance of the Assembly System

By George B. Rogers and Edwin T. Bardwell

AGRICULTURAL EXPERIMENT STATION
UNIVERSITY OF NEW HAMPSHIRE
DURHAM, NEW HAMPSHIRE

in cooperation with

Agricultural Experiment Station, University of Massachusetts
and Marketing Economics Division, Economic Research Service,
United States Department of Agriculture

ION BULLETIN 476 APRIL 1963

Marketing New England Poultry

4. Structure and Performance of the Assembly System

By George B. Rogers and Edwin T. Bardwell

AGRICULTURAL EXPERIMENT STATION
UNIVERSITY OF NEW HAMPSHIRE
DURHAM, NEW HAMPSHIRE

in cooperation with

Agricultural Experiment Station, University of Massachusetts
and Marketing Economics Division, Economic Research Service,
United States Department of Agriculture

This study was completed as part of a Northeast Regional Project, NEM-21, "The Effect of Marketing Changes Upon Marketing Costs and Upon Demand and Consumption of Poultry Products," a cooperative study involving Agricultural Experiment Stations in the Northeastern Region and supported in part by regional funds from the Economic Research Service (formerly Agricultural Marketing Service), United States Department of Agriculture.

Preface and Acknowledgements

This bulletin is the fourth in a new series to be issued by Agricultural Experiment Stations in the New England States and involves, in most instances, direct cooperation with the Economic Research Service, (formerly Agricultural Marketing Service) U.S.D.A. The series deals with various aspects of poultry marketing in New England. This publication describes the main features of the assembly system, based largely upon a stratified random sample of 75 firms, and analyzes the possibilities for reducing costs of the assembly function alone and in combination with processing.

The authors appreciate the cooperation of the assemblers of live poultry who furnished data on practices, costs and input-output relationships. Much valuable information was also obtained from the State departments of agriculture in New England who maintain records incident to the licensing and bonding of assembly firms. The authors wish especially to acknowledge the assistance and critical appraisal received from W. F. Henry, of the Agricultural Economics Department of the University of New Hampshire; A. A. Brown, of the University of Massachusetts; and from Norris T. Pritchard, Marketing Economics Division, Economic Research Service, U. S. Department of Agriculture. Harold B. Jones aided materially in the collection and analysis of the data. John Payne and Frank M. Conley aided materially in the analysis of data.

TABLE OF CONTENTS

Summary

Declining demand for live birds at the retail level, the movement of processing toward large-scale country plants, the advent of contract growing, and dwindling numbers of producers and small processors have caused a substantial decline in numbers of live assemblers in recent years and changes in the characteristics of the remaining firms. During 1951-57 the number of firms licensed by State departments of agriculture to haul live poultry in New England declined 55 percent. The number of poultry trucks licensed declined 47 percent.

The present assembly system in New England is a mixture of the old and the new. The older system is characterized by decreasing operations as numbers of small slaughterers, live-poultry stores, buyers of live poultry, terminal market live-poultry receivers, and city dressing plants dwindle. Newer types of firms, such as large processing plants, contract haulers, and contractors, have made tremendous gains at the expense of the older types and through extensive use of contract production.

The size of the supply area for most firms has been shrinking. At the same time volume per firm has increased. As farm unit sizes have increased and the number of small firms has declined, itinerant live buying has virtually disappeared. Commercial meat chicken production now greatly exceeds the volume of fowl in most areas. The increasing importance of contract growing, particularly as firm size increases, has contributed to producing larger lots and enabled better scheduling of plant operations.

The decline in the number of firms engaged in assembly, the changes in the types of assembly firms and in their practices, and the dominance of commercial meat chickens in total output have narrowed assembly margins and reduced resources devoted to that function. Nevertheless, the present assembly system is characterized by a sustantial excess of capacity and by duplication of travel and expense. Possibilities exist for further sizeable cost savings through enhanced firm and structural efficiencies.

The individual firm can increase efficiency and lower costs per pound in assembly by: (1) Capacity operation of a minimum number of trucks and optimum pickup crew organization; (2) increasing total volume to obtain any inherent economies of scale; and (3) increasing the volume of poultry per mile of truck travel. As volume increases, from quite small sizes, decreasing per pound costs result in part from the ability of the firm to handle flocks of larger average size with the least-cost combination of resources.

On the basis of an analysis of cost data from 75 assemblers of live poultry in New England, unit costs in assembly declined from 0.90 cent per pound for one million pounds to 0.47 cent per pound at 50 million pounds when poultry was available at the rate of 100 pounds per mile of truck travel. Increasing the pounds per mile of truck travel to 1,000 lowered unit costs to 0.60 cent per pound for one million pounds and 0.35 cent per pound at 50 million pounds.

Increased density in the supply area can be achieved by establishment of exclusive supply areas for individual firms and/or a more active

role by assemblers in determining the location and size of producing units. In an environment where independent farm units predominate, such units are likely to be located without reference to any one assembly firm. Where contract production is involved some discretion exists as to farm location. But this feature has not been fully exploited because of the heavy reliance upon the use or conversion of existing resources rather than on new investment. Cost savings available from increased volume and increased density would enable assemblers to offer incentives to maximize the size of nearby farm units.

About 330 firms assembled 470 million pounds of poultry in 1957 at a cost of $4.6 million. If these firms doubled the volume hauled per mile of truck travel, assembly costs could be reduced to $3.9 million. Further developments to create exclusive supply areas, plus a reduction of 60 percent in firm numbers to enable operation at 100 percent of capacity, could have reduced costs to $2.9 million.

Combining the assembly and processing functions under one management can effect cost savings. In 1957, 70 percent of the 470 million pounds of poultry assembled was handled by combined-function firms. The combination of assembly and processing under one management further increases the competitive advantage of large plants. However, the savings in assembly costs are relatively small compared to those in processing. In the short-run, larger firms can secure additional volume by increasing the size of their supply area and offset increased costs per pound in assembly by savings obtained by processing the larger volume. But in the long-run, efforts to reduce assembly costs by decreasing the size of the supply area and increasing its density will most enhance the competitive position of the firm.

In 1957 the combined costs for assembling and processing New England poultry totalled $23.8 million. If the volume leaving the area in live form and sold live and processed through the older marketing channels remained constant, substantial savings could be obtained by reducing numbers of combined-function firms handling one million pounds or more annually and by creating exclusive supply areas. The additional savings in assembly and processing would total $8.0 million. Economic pressures are likely to force a continued reduction in plant numbers, but the extent to which maximum cost savings are realized will depend upon changes in institutional arrangements and developments in the distributing function.

Marketing New England Poultry

4. Structure and Efficiency of the Assembly System

By George B. Rogers and Edwin T. Bardwell*

1. Background of Study

Marked changes have taken place in the poultry industry in New England and in the United States in the last two decades. Technological advances in production, assembly, processing and packaging, transportation, and distribution have enabled the industry to reduce costs and to furnish consumers with larger quantities of higher quality poultry at lower prices.

Previous reports in this series on the marketing of New England poultry have dealt with (1) the characteristics of the processing industry, and (2) the costs and economies of scale in chicken processing. The first report was concerned primarily with description of poultry producing areas and plants in New England, including problems of plant organization and equipment, buying and selling practices, and assembling and distributing methods. The second report presented detailed analyses of the costs and economies of scale in the processing of broilers and fowl. This report, the fourth, summarizes the changing characteristics of the assembly system, describes the techniques and practices used, and the costs involved. However, the value of the report is not expected to be limited to the New England poultry industry. Assemblers in other regions of the United States are confronted with many of the same problems and physical and economic conditions that New England live assemblers currently face.

The advent of contract growing, increased specialization of certain areas in commercial meat chicken production, and larger producing and marketing units have facilitated volume handling of live birds. In addition, the shift of poultry processing toward large-scale country plants has enabled the assembly function to become more localized. Hence, the number of assembly firms has declined sharply, their characteristics have changed and assembly has become more closely-integrated with growing and processing.[1]

---

* Mr. Rogers is Agricultural Economist, Marketing Economics Division, Economic Research Service, U.S.D.A. Mr. Bardwell is Cooperative Agent, New Hampshire and Massachusetts Agricultural Experiment Stations and Economic Research Service, U.S.D.A. stationed at the University of New Hampshire.

[1] Rogers, G. B., E. T. Bardwell and D. L. Deoss, *Declining Numbers of Live Poultry Dealers in New England; Causes and Effects.* Agr. Exp. Sta. Univ. of New Hamp. Agricultural Economics Research Mimeograph No. 16, Dec. 1957.

Structure of the Present Assembly System

The present assembly system in New England is a mixture of the old and the new. The older system is characterized by decreasing operations and a pessimistic outlook as numbers of small slaughterers, live-poultry stores, live-poultry buyers, terminal market live-poultry receivers, and city dressing plants dwindle. The newer types of firms have gained at the expense of the older types as well as through extensive use of contract production. The forces which have produced the changes in the assembly system are still operating, but the question of predominance has long since been decided.

Most meat chickens now are produced under contract arrangements with large processors, feed companies, hatcheries, and independent contractors. This development has increased control of these firms over production and sales practices. Large processors, the contract haulers they employ, and contractors who also haul live poultry have become more important in recent years as assemblers of live poultry. Many large processors and contractors formerly were buyers of live poultry and other former independent live-poultry buyers have affiliated with specific processing plants as contract haulers.

The small poultry farms of the past, largely selling fowl, were serviced mainly by small-volume assemblers. But the substantial decline in the number of poultry farms and an increase in their average size have reduced supplies available to the small assembler. Such firms usually are unable to handle large lots and larger assembly firms have evolved. Average size per lot acquired rises substantially with increasing firm size. This occurs in part because of the decline in lots per farm as emphasis shifts from fowl and related classes[2] toward broilers and other commercial meat chickens.[3] Many egg producers practice periodic culling, selling frequent small lots plus one large lot when the balance of the flock is liquidated. In contrast, meat chickens are grown on a regular schedule, with several large lots per year per farm.

Yet small firms are important in gathering such small and scattered lots of poultry which remain, particularly in non-commercial poultry producing areas. In addition, the older types of assembly firms such as live-poultry buyers, live-poultry stores, and small slaughterers are still important in supplying customers who prefer to examine live birds at the point of slaughter.

Figure 1 diagrams the channels through which New England live poultry moves during the assembly process.

Types of Assemblers Defined

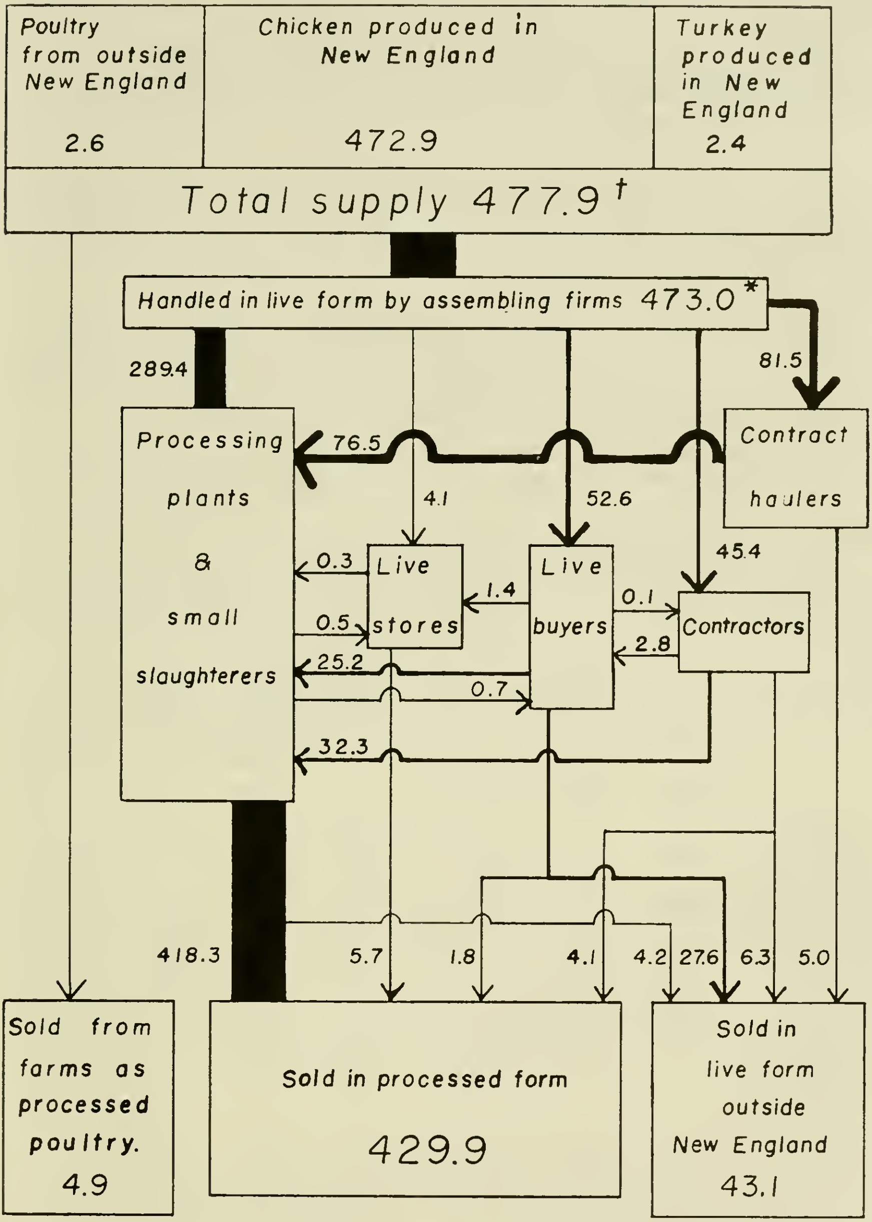
Most assemblers carry on several marketing functions in addition to hauling poultry. These may include buying and selling, contracting, growing, processing, and distributing. However, for each type of firm

---

[2] Included in this group are hens culled during or sold at the end of the egg-laying period, roosters, cull pullets, and some young chickens, mainly surplus cockerels from egg strains of birds. Since fowl account for the major share of volume, this group is hereafter referred to in this report as "fowl."

[3] Included in this group are broilers, fryers, roasters, caponettes, capons and pullets grown strictly for meat purposes. Since broilers account for the major share of volume, this group is hereafter referred to in this report as "broilers."

Figure 1. Channels Involved in Live Poultry Assembly, New England 1957



* Includes 3.4 million (lbs.) delivered to assemblers by producers.
† All figures — million (lbs.)

one function is clearly primary to its existence, organization, and operation. The major features of each type of assembler of live poultry are listed below:

Processing plants slaughter and eviscerate poultry for sale to volume buyers. Other functions are contributory in nature. Most plants are located at country points.

Contract haulers truck poultry mainly for processing plants at a fixed contract rate per pound. They seldom take title to any poultry. Contract haulers are of two types: (1) Those who haul the entire volume for particular plants or a share of it on a regular basis; and, (2) those who haul only during periods of peak receipts for plants which own their own trucks.

Contractors finance growing operations. They obtain the bulk of their volume from contract growers to whom they extend financing for cash items. They commit some lots in advance to specific plants and negotiate sales of other lots when birds reach market size.

Live-poultry buyers purchase small and mixed lots of poultry from scattered, independent producers and resell them in live form.

Table 1. Poultry Assembly Firms: Type, Number, Volume, and Market Classes of Poultry Assembled, New England, 1957

Type of Firm	Firms	Total Volume Handled	Volume Hauled From Farms[1]	Type of Poultry Hauled: Broilers	Heavy Young Chickens	Other[2]	Total
	number	million pounds	million pounds	percent	percent	percent	percent
Processing plants	35	422.9	285.6	75.8	15.1	9.1	100.0
Contract haulers	10	81.5	81.5	84.7	5.9	9.4	100.0
Contractors[3]	22	45.5	45.4	60.4	35.7	3.9	100.0
Live-poultry buyers	125	56.1	52.6	11.4	50.6	38.0	100.0
Live-poultry stores	90	6.0	3.9	41.1	41.0	17.9	100.0
Small slaughterers	50	0.8	0.6	17.0	34.0	50.0	100.0
Inactive and transitional units	18[4]	[5]	[6]	—	—	—	—
Total or average	350	612.8	469.6	68.3	19.7	12.0	100.0

[1] Excludes off-farm deliveries by producers to assemblers, but includes acquisitions at cooperative live-poultry auctions.
[2] Mostly fowl and roosters; includes minor quantity of turkeys.
[3] Includes only firms which haul.
[4] Including 7 formerly engaged in processing.
[5] Not available.
[6] Insignificant.

Live-poultry stores sell to the Kosher trade and to other customers wishing to purchase, or select, live birds at the point of slaughter. They are part-time slaughterers. Usually they are located in heavily populated areas.

Small slaughterers combine local assembly with processing, sales, and delivery to nearby retail outlets and consumers. Volume per plant is usually less than 30,000 pounds a year and operations generally are on a part-time basis.

Importance of Various Types of Assemblers

Of 350 potential assemblers of live poultry in New England in 1957, fewer than 20 percent were processing plants, contractors, and contract haulers (Table 1), but these 67 firms hauled nearly 88 percent of the volume available from farms. The remainder was hauled by 265 buyers of live poultry, live-poultry stores, and small slaughterers. About 5 percent of the 350 firms were inactive or in the process of transition to wholesale distributing or retailing operations.

Assemblers delivered to other types of assembly firms almost 30 percent of the 470 million pounds of live poultry they hauled from farms. The pre-dominant movement between types of firms was from contract haulers, contractors, and live-poultry buyers to processing plants. In addition, firms of like type (such as processors) sometimes exchanged poultry with each other. This exchange helped to equate supplies of individual market classes on hand with customers' requirements.

The older (and smaller) assembly firms haul a higher percentage of fowl than the newer firms. However, most assembly firms now handle a larger volume of broilers than of fowl. Although most of New England's turkey output is produced, processed, and sold by specialized units, all types of assembly firms acquire a few turkeys, mostly surplus young birds and breeders.

Supply Sources and Market Outlets

Almost two-thirds of the 470 million pounds of live poultry hauled by New England assembly firms in 1957 was from farms under contract to, or owned by, the hauler or his employer (Table 2). About two-thirds of the volume that processors hauled was from contract sources; for contractors, the proportion was more than 95 percent; and for contract haulers, 83 percent. In contrast, more than 93 percent of the volume hauled by live-poultry buyers and almost 100 percent of that hauled by live-poultry stores and small slaughterers was from independent sources.

Fowl came largely from independent farms since integration had not developed to the same extent in New England in egg-producing enterprises as in broiler enterprises. But almost three-fourths of the broiler volume was from farms under contract to assemblers of live poultry and their affiliates. About 4 percent of the total supply of live poultry in 1957 originated on farms owned by assembly or processing firms.

Of the total volume of 473 million pounds of live poultry handled by assembly firms and sold by producers in 1957, nearly 91 percent was

Table 2. **Receipts and Disposition of Live Poultry, by Type of Assembler and by Source and Outlet, New England, 1957**

Sources and outlets	Type of assembler						
	Processing Plants	Contract Haulers	Contractors	Live-Poultry Buyers	Live-Poultry Stores	Small Slaughterers	Total
	(million pounds)						
Receipts obtained from:							
Deliveries by producers	3.1	—	—	—	0.2	0.1	3.4[1]
Assembler collections from:							
Assembler-owned farms	5.6	0.4	9.5	1.4	—	0.1	17.0
Own contract producers	170.6	—	32.1	—	—	—	202.7
Other contract producers	13.5	67.3	1.7	2.1	—	—	84.6
Independent producers[2]	95.9	13.8	2.1	49.1	3.9	0.5	165.3
Total	285.6	81.5	45.4	52.6	3.9	0.6	469.6
Other assemblers	134.2	—	0.1	3.5	1.9	0.1	139.8
Total	422.9	81.5	45.5	56.1	6.0	0.8	612.8[1]
Disposition:							
Other assemblers	1.2	76.5	35.1	26.7	0.3	—	139.8
Sold outside New England	4.2	5.0	6.3	27.6	—	—	43.1
Slaughtered	417.5	—	4.1	1.8	5.7	0.8	429.9

[1] Does not include 4.9 million pounds (live basis) of poultry sold from farms as processed poultry.
[2] Includes cooperative live auctions.

slaughtered within New England and 43.1 million pounds, or about 9 percent, left the region alive. Movement of live poultry into New England was relatively small, about 2.6 million pounds. Live-poultry buyers accounted for the bulk of the out-movement which has declined sharply in the last decade.

Producers delivered about 3.4 million pounds of live poultry to various assemblers in 1957 and sold about 4.9 million pounds (live basis) as processed poultry. The five New England cooperative live-poultry auctions still functioning in 1957 handled only about 2.5 million pounds of poultry. The principal buyers on these auctions were live-poultry stores, processing plants, and live-poultry buyers — in that order.

Area Differences in Assembly Systems

The nature of the assembly system in particular areas is determined by the characteristics of the areas: (1) surplus-deficit status; (2) degree of commercialization of production; (3) human population density; (4) distance to principal consuming centers; (5) relative importance of commercial meat chicken production to egg production; and (6) institutional considerations, particularly the degree of control exercised by marketing firms over production units.

Assembly firm numbers are largest, and average firm size smallest in heavily populated areas such as western Connecticut, Massachusetts and Rhode Island where live buyers, live stores, and direct marketing by producers are important. Where concentrations of commercial processing have developed, as in southern Maine, eastern Connecticut, and southern New Hampshire, there are fewer, but larger firms. Firm numbers and average firm size are small in sparsely-populated non-commercial poultry areas such as Vermont, and northern Maine and New Hampshire. In such areas live buyers face less competition from large processors and producers and small local firms are important in servicing local demand.

Maine. Broiler production is paramount. The area is surplus, sparsely-populated and remote from markets. There are few assembly firms in relation to volume. In southern Maine, large-scale commercial processors have a substantial share of volume under direct contract. Northern Maine is non-commercial. Few Maine firms pick up poultry outside the State. Few out-of-state buyers operate in Maine. Newer types of assemblers account for 98 percent of volume.

New Hampshire. Fowl are almost as important as broilers. The area is surplus, sparsely-populated, and intermediate in distance from markets. Northern New Hampshire is non-commercial. But in southern New Hampshire, commercial processors stress fowl and many buy live poultry in two or more states. New Hampshire attracts a large number of out-of-state buyers, particularly from northeastern Massachusetts. Over 85 percent of volume is hauled by newer types of firms.

Vermont. Poultry production is small and strongly oriented toward market eggs. The State is deficit and sparsely-populated. Direct marketing by producers and older types of assembly firms are relatively more important than in other sections remote from markets but whose poultry production is more commercialized. A few Vermont dealers buy outside the State, but their purchases are more than offset by the operations of dealers from Massachusetts and New Hampshire who buy in Vermont. The number of assemblers operating in the State is small.

Rhode Island. Although poultry production is small, and strongly oriented toward market eggs, the State is deficit, and heavily-populated. The number of assemblers is larger in relation to volume than in Vermont. This results in a relatively greater role for the older types of firms. A few out-of-state firms buy in Rhode Island, and most Rhode Island firms also assemble poultry in other States.

Connecticut. Although poultry production is highly-commercialized and broilers predominate, the State is heavily-populated. The role of older types of assembly firms and producers engaged in direct marketing is large. Since the State is surplus, it attracts many out-of-state buyers. A small proportion of buyers resident to Connecticut seek supplies outside the State. The number of assembly firms in Connecticut is large, but more than 75 percent of the volume in the State is hauled by a limited number of newer types of firms.

Massachusetts. The assembly system in Massachusetts is somewhat parallel to that in Connecticut, with newer types of assembly firms handling more than three-fourths of the output. Since Massachusetts is deficit, many of the large number of resident firms seek supplies in adjacent States. Despite a substantial production of poultry meat, with supplies of broilers exceeding those of fowl, relatively few out-of-state firms buy in Massachusetts.

The Effect of Declining Resources in the Assembly System

During 1951-57 the number of firms licensed by State departments of agriculture to haul live poultry in New England declined 55 percent. The number of poultry trucks similarly licensed declined 47 percent. The number of one-truck firms declined 58 percent; firms with 2 to 6 trucks, 53 percent. Firms with 7 or more trucks increased in number, and the average number of trucks per firm increased.

Output of poultry meat in New England increased about one-third from 1951 to 1957. Hence, over the 6-year period, average volume of poultry hauled per licensed firm almost tripled and average volume per licensed truck increased 2½ times. These increases in volume per firm and per truck helped reduce assembly costs. Higher labor efficiency resulted from handling fewer but larger lots of poultry and from the use of larger crews. Travel time was reduced through localization of the assembly function. Furthermore, contract production permitted economies through better truck-route organization and location of producing units, but full exploitation of these possibilities has not yet been achieved.

II. Performance and Costs in the Present System of Live Poultry Assembly

In New England in 1957, the average volume of poultry hauled per truck year, per mile of travel, and per man-hour generally increased with the size of assembly firms. The rate of utilization of truck capacity was also higher for larger firms. Increased efficiency with size of firm may be the result, in part, of a close relation between the size and type of firm, as well as the result of cost savings as size of firm increases. Table 3 summarizes measures of performance efficiency, by type of firm, for 75 live poultry assemblers.

The decline in the number of assembly firms and changes in their characteristics have increased the overall efficiency of the assembly system. Newer types of assembly firms have realized substantial economies through expanded volume and increased control over it. But the efficiency of assembly operations may still receive little attention from older-types of firms, particularly live stores and small slaughterers, because of the wider margin these firms obtain from processing and/or retailing.

Labor Performance

Rising labor productivity in response to change in type of firms from the old to the new results from the following factors: increased crew

Figure 2. Relationship Between Pounds Handled per Man Hour of Total Time of Labor and Annual Volume, 75 New England Live Poultry Assemblers, 1957

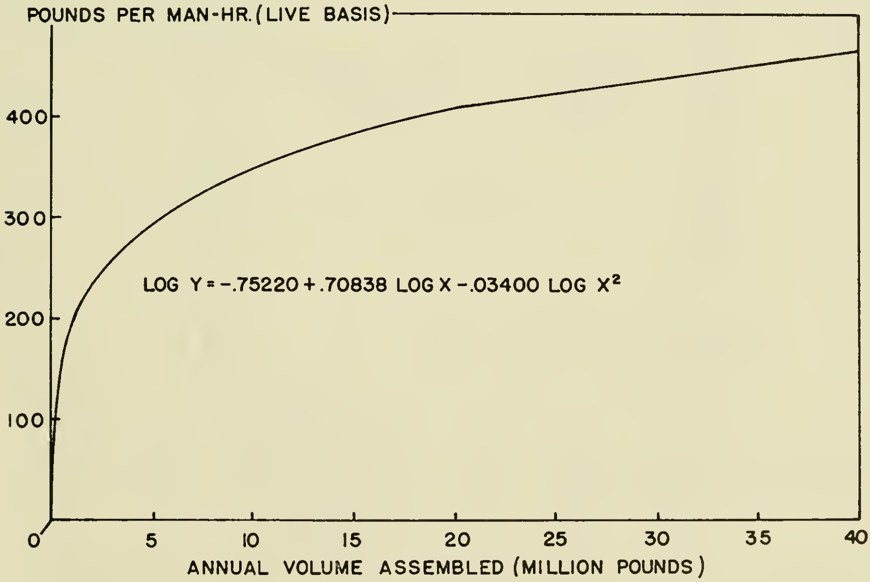


Table 3. Measures of Performance for Firms Assembling Live Poultry, New England, 1957[1]

Type of Firm	Annual Volume Hauled per Firm	Annual Miles Travelled per Firm	Annual Man-Hours Used per Firm	Trucks per Firm	Percentage of Truck Capacity Used Annually[2]	Annual Miles Travelled per Truck	Average Volume of Live Poultry Picked Up: Per Truck Year	Per Truck Mile Travelled	Per Man-Hour of Labor
	1,000 pounds	number	number	number	percent	1,000 miles	1,000 pounds	pounds	pounds
Processing plants	14,802	217,250	37,466	7.4	40.0	29.6	2,014	67.8	387
Contract haulers	11,936	155,083	34,927	5.5	38.0	28.2	2,170	77.0	342
Contractors	3,226	76,000	10,245	3.9	19.0	19.5	829	42.4	315
Live-poultry buyers	629	26,104	3,560	1.3	18.5	19.6	473	24.1	177
Live-poultry stores	64	6,615	757	1.0	9.5	6.6	64	9.6	84
Small slaughterers	11	3,706	298	1.0	7.0	3.7	11	3.1	38

[1] Based upon a stratified random sample of 75 firms.

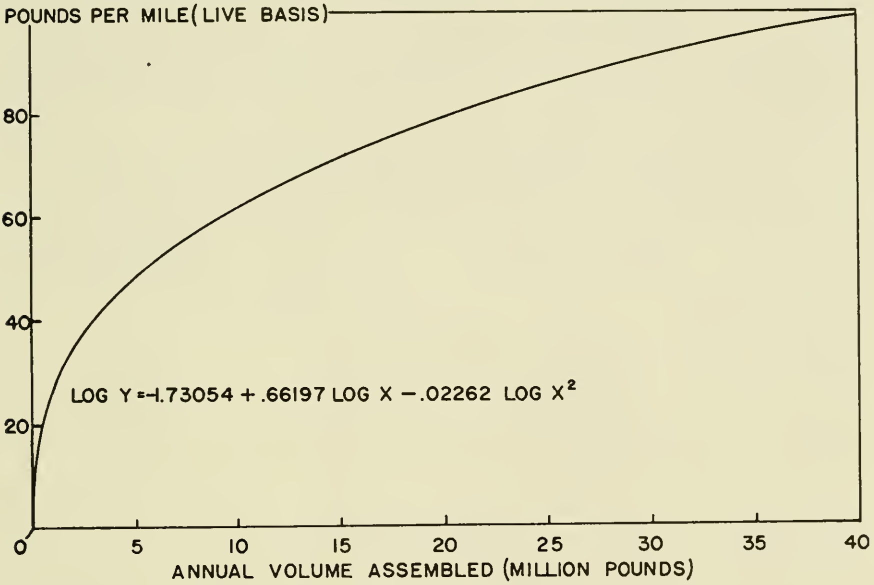
[2] Annual capacity equals crate capacity of each truck times average weight per full crate of birds times two trips per day for 247 operating days.

size and specialization, larger average flock size[4], and a higher ratio of work time to travel time because of increased density of production. Figure 2 shows the relationship, calculated from survey results, between output per man hour of total time of labor and annual volume.

At the farm a major share of time is involved with catching birds and loading crates. Other jobs performed include: positioning trucks, handling empty crates, tying and untying loads, covering loads during inclement weather, weighing, making out purchase slips and paying. In some instances, only part of the crew is fully occupied at these tasks.

A substantial segment of total time elapses during travel between plant and farm units and only the driver can be considered as productively employed. As volume increases, crew organization shifts from one man per truck to one or two men riding with the driver of each vehicle. A further shift, with additional volume, is to foremen and crews who remain in the field and load vehicles which ferry back and forth to the plant. The crew moves from farm to farm in passenger vehicles. This type of operation reduces travel time for the crew and contributes materially to enhanced productivity.

Figure 3. Relationship Between Pounds Hauled per Mile of Truck Travel and Annual Volume, 75 New England Live Poultry Assemblers, 1957



Truck Operating Performance

The number of pounds of live poultry handled per mile of truck travel increases as volume increases (Figure 3). This is due in part to the use of larger trucks[5] and a higher rate of utilization of truck capacity.

---

[4] Appendix Figure III shows the relationships of crew size to annual volume, and Appendix Table IV contains detailed data from four actual plants, showing the increase in average lot size which occurred with increasing plant size.

[5] Appendix Tables V and VI show the distribution of truck sizes and inventory value for vehicles registered by assemblers of live poultry in New England in 1957.

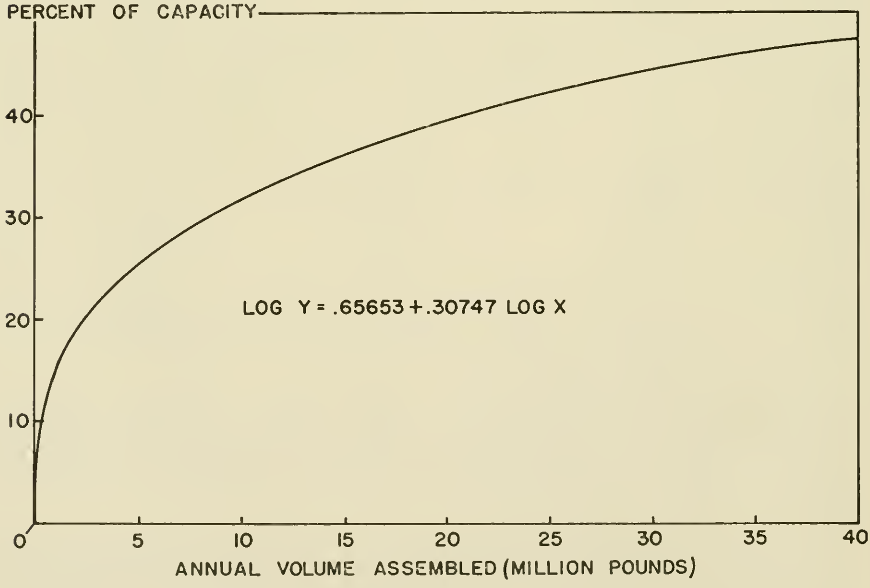
Moreover, the largest firms are oriented toward large flocks and assemble poultry in the most-commercialized areas. On the other hand, the orientation of small firms is toward small flocks and non-commercial areas. Although influenced by the nature of local production, emphasis also shifts from fowl to broilers as firm size increases (Appendix Table VII). This substantially increases the poultry available per stop and per mile.

In New England in 1957, three-fourths of the assembly firms operating one vehicle utilized trucks of 1½ tons rated capacity or less. In contrast, for firms operating 7 or more vehicles, three-fourths of the trucks were of 2½ tons rated capacity or larger (Appendix Table V).

Nevertheless, many firms have trucks of larger capacity than the current volume they handle would require, and there is a wide distribution of ages of trucks registered by poultry handlers (Appendix Table VIII). This is because: (1) The volume of business of many smaller firms is declining; and (2) secondhand trucks are widely used by smaller firms to help reduce costs. Truck depreciation is not a major item in the total costs of the assembly firm, and obsolescence is a minor consideration. Furthermore, trade-in allowances and secondhand values are not proportionate to truck capacity. Hence, in the present system, decisions on vehicle replacement can be made solely on the basis of repair bills vs. annual depreciation.

Trailers are owned by many large firms because of their substantial capacity and assumed efficiencies. However, many firms do not use them regularly and are replacing them with large trucks because the trailers

Figure 4. Relationship Between Percent of Annual Trucking Capacity* Used and Annual Volume, 75 New England Live Poultry Assemblers, 1957



* Crate capacity of each truck times average weight per full crate of birds times two trips per day for 247 operating days.

are difficult to maneuver into position for loading at the farms and too hard to handle on many back roads. Improvement of buildings, yard lay-outs, and secondary roads to enhance pickup efficiency has received too little attention.

Factors which influence the rate of utilization of a firm's total truck capacity, are: (1) The number of days of operation per week; (2) the typical load compared with vehicle capacity; (3) the number of vehicles on hand and the regularity of their use; and (4) the use of trucks for purposes other than hauling poultry. Figure 4 shows the relationship between percentage of annual truck capacity used and size of firm.

Most small slaughterers and live-poultry stores pick up poultry only one or two days per week. Most live-poultry buyers operate 3-5 days per week, and contractors, contract haulers, and processing plants generally 5 days per week. On the average, the smaller the firm, the greater the seasonal variation in volume it experiences. Hence, the percentage of excess capacity may be relatively larger for smaller firms than the comparison of operating days per week would suggest.

Present Costs of Live Poultry Assembly

Total costs per pound for assembling live poultry decline as firm size increases (Table 4). This is also true for the two main variable cost items, labor and truck operation costs, as well as for fixed costs such

Table 4. Average Costs for Typical Sizes and Types of Firms Assembling Live Poultry, New England, 1957-58[1]

Typical Firm Size: Total Pounds Hauled per Year	Estimated Total Costs	Typical Firm Size: Total Pounds Hauled per Year	Estimated Total Costs
	(cents per pound)		(cents per pound)
50,000	4.10	2,500,000	1.40
100,000	3.25	5,000,000	1.25
200,000	2.75	10,000,000	1.00
300,000	2.52	15,000,000	0.75
400,000	2.27	20,000,000	0.65
500,000	2.10	30,000,000	0.55
1,000,000	1.60	40,000,000	0.50

Type of Firm	Labor Cost	Other Costs	Total Costs	Range in Total Costs
		(cents per pound)		
Processing plants	0.43	0.36	0.79	0.50–1.00
Contract haulers	0.47	0.38	0.85	0.70–1.00
Contractors	0.49	0.95	1.44	0.80–1.75
Live-poultry buyers	0.70	1.00	1.70	1.45–10.00[2]
Live-poultry stores	1.52	1.98[2]	3.50[2]	
Small slaughterers	3.30	4.20[2]	7.50[2]	

[1] For input-output data on the same firms, see Table 3. Based on a stratified random sample of 75 firms.

[2] These cost levels appear excessive, and may include charges assignable to other activities.

as the ownership of equipment. However, the cost reductions with increasing firm size suggested by examination of average costs of actual firms may differ from those obtained by the synthetic method. This difference occurs because of short-run considerations which will be nullified by the eventual replacement of resources, further structural adjustments, and by differences in basic assumptions and methods of analysis.

Smaller firms, whose costs on any standardized basis seem excessive, are able to survive in the present environment by:

(1) Using "unpaid" family labor to reduce out-of-pocket costs;
(2) Paying lower factor prices;
(3) Acquiring and using secondhand vehicles;
(4) Combining labor and vehicle used for poultry pickup with use for farming operations, egg hauling, distributing poultry and eggs, or hauling other items;
(5) Absorbing any "loss" on pickup operations in other operations; and
(6) Confining operations to areas of "non-commercial" poultry production which may be by-passed by large firms, and sometimes by paying lower prices.

In a marketing system composed of a mixture of integrated organizations and independent firms carrying out successive single functions, some higher-cost firms selling to volume outlets are afforded short-run protection by marketing margins established on a bulk-line basis.[6] But with continued progress toward higher operating efficiency as a major weapon of competition, the assembly margin will be progressively narrowed over time and its impact more apparent for all sizes of firms.

Despite the association of increasing volume and declining costs, variations from the average may be substantial for any one firm size (or volume level). These differences reflect: locational and institutional considerations; market-class composition of supplies; and, managerial competence.

While a substantial number of assembly firms may operate in most sections, the supply areas of two or more individual firms rarely coincide. Thus, the supply area of each firm exerts a unique effect on costs.

The rapid changes in the industry in recent years have disrupted established procurement patterns. Some assembly firms have successfully adjusted to these forces by establishing closer tie-ins with producers or contractors and between the assembly and processing functions. For others, particularly older firms, with committed resources and long-established relationships which curtailed adjustment prospects, the result has been distortion of the size and shape of the supply area and excessive assembly costs.

Costs per pound for assembling fowl are generally higher than for broilers. Both average flock size and density of volume are likely to be lower with fowl. Heavier weight per bird is usually not sufficient to offset these factors.

In an environment where independent farmers predominate, producing units are likely to be located without reference to any one assembly firm. Where contract production is involved some discretion exists as to farm size and location. But the cost reduction possibilities inherent

[6] A bulk-line margin is wide enough to cover a major share of the volume needed.

in size and location of producing units have not been fully achieved as yet because of the heavy reliance upon use of or conversion of existing resources rather than on new investment.

Management has not yet assumed its full role in increasing efficiency and lowering costs of assembling poultry. Moreover, it is difficult to ascertain from cost data from actual firms the degree of success management has achieved in minimizing costs. This is because of the variations in levels of operation, equipment, practices, market classes and weights, prices of inputs, density of the supply area[7] and the extent of integration of production and marketing functions. The following chapters examine the effect of standardization of some of these factors on the level of assembly costs. They also suggest some of the forces which have resulted in declining assembly costs and some of the changes by which present firms can further reduce costs.

III. Reducing Costs of Live Poultry Assembly

Methodology and Assumptions

Average costs for groups of firms are derived from a mixture of varying situations and circumstances. A substantial number of factors influence the assembly costs of the individual firm. Some factors are primarily geographically-oriented. Examples are: The proportions of various market classes available; the volume obtainable per square mile and per road mile; and the rate at which truck travel may be accomplished. Other factors are primarily institutionally-oriented. Some of these are: The number, size, and age of trucks; the level of factor prices; the number and type of firms competing in a supply area; crew size and organization; labor input-output relationships; and the number, type and location of farm units.

The original data, taken at a particular point in time, provides a cross-section of an industry in transition. Historical series cited, and case studies of individual firms, give further evidence of the speed and direction of changes. Chapters I and II describe the present industry and its practices and costs. This chapter translates the present industry, by standardizing size and some other factors, into a set of simplified models representing completed stages rather than a mixture of firms in all stages of transition. This is done to facilitate the study of the effects of a continued movement toward fewer, larger, and more highly integrated firms.

By standardizing many of these diverse factors, more precise and meaningful relationships can be synthesized. These provide helpful guidelines for assemblers of live poultry by: (1) Suggesting the results they can expect by imitating their more successful (and sometimes

[7] In synthesizing assembly costs, one can project the size and density of supply areas well beyond levels which may exist in practice. Processing plants studied in 1955-56 obtained more than three-fourths of their volume within 50 miles of the plant. This held true even for the largest plants, though the size of the supply area increased with plant size. In the aggregate, the size of the supply areas for most firms has continued to shrink in recent years. Hence, a 40 mile mean radius would now appear to constitute a reasonable limitation to the supply area of most individual firms or groups of reasonably homogeneous firms. See Appendix Table IX for a distribution of firms by average lengths of haul in 1957.

larger) competitors; (2) by explaining the reasons for the present cost structure.

However, the cost levels in this chapter are not necessarily "pure costs," as derived from a rigorous study of the relationship of size of firm to average costs, and the level of costs might be reduced somewhat by a more microscopic approach, particularly in terms of labor input-output relationships. These differences occur because the assumptions one would make under a rigorous size-cost study would not be identical with the procedure employed in the analysis in this chapter. Yet, the use of observed relationships as a basis of projecting what a firm might experience seems realistic and appropriate. In other words, while this analysis does standardize some factors, some heterogeniety remains. For example, this analysis does standardize firm size, as would be done in selecting model firms for a synthetic cost study. In contrast, flock size and crew size are allowed to increase with increasing firm size, as they were found to do among existing firms. In a more restricted analysis flock size and crew size might be standardized for all firm sizes. However, the use of these looser assumptions is believed to be more typical of the conditions which firms have and would still encounter in increasing volume from given levels. Thus, the objectives of this analysis are distinctly different from those of a more rigorous study and the assumptions used are varied accordingly.

The resulting analysis is expressed first in terms of the relationship between firm size and costs per unit of product for selected average lengths of haul. Other factors are varied with size, on the basis of observed practices and relationships. These include: truck size, crew size, labor input-output functions, flock size, and the percentages of broilers and fowl handled. Because of the aggregative nature of the original data, it is impossible to separate out the precise effects of each of these factors on costs.

Secondly, since the assumptions of given volumes, given truck sizes, and given lengths of haul result in sets of observations where volume per mile of truck travel may vary, the best levels of performance were selected for each of several levels of volume per mile of truck travel in order to standardize this factor. These relationships are then used to examine the effects of: (a) Holding volume constant, but obtaining it from shorter or longer average lengths of haul; (b) increasing volume while holding average length of haul constant; and, (c) changing both volume and average length of haul.

The results from making adjustments relating primarily to total volume and volume per mile of truck travel may be viewed in two ways. First, given a supply of specified quality, quantity, and geographical location, how could assembly costs be minimized if a number of firms of discreet sizes and types constituted the alternatives? Secondly, if a firm of particular size and type was able to overcome institutionalized restrictions and change to another size and type, what would the results be in terms of costs?

Data were adjusted to standardize levels of operation, prices of inputs, weights per bird, volume of poultry per mile of truck travel, travel time for specific lengths of haul, and equipment and practices. The results of the survey of 75 firms assembling live poultry in New England were used to determine progressive changes, with increasing firm size, in crew sizes, labor input-output relationships in handling poultry at the farm, flock size, and the proportion of broilers and fowl handled.

Some of the principal assumptions and techniques on which this analysis is based are:

(1) Ten sizes of assembly firms were selected. These were capable of handling the poultry required by processing plants with capacities of 150; 300; 600; 1,200; 1,800; 2,400; 3,600; 5,000; 7,500; and 10,000 broilers per hour, as established in a previous study.[8]

(2) Initial cost budgets were prepared for 12 selected truck sizes found in use by New England poultry assemblers. These were capable of carrying 2, 5, 10, 20, 30, 60, 100, 130, 160, 190, 220, and 320 crates each. This selection served to establish the nature and extent of cost relationships without considering an almost unlimited number of truck combinations.

(3) Firm capacity was increased by adding additional trucks of the same size as in the initial budget. Costs at 100 percent of capacity were determined with annual mileage traveled per truck at 2,500; 5,000; 6,250; 10,000; 12,500; 25,000; and 50,000. For each firm capacity and mileage level, costs were then determined at 10, 40, 70, and 130 percent of capacity. The mileage levels used were equivalent to two trips per day (for 247 operating days) of the following average round-trip lengths in miles: 5, 10, 12.5, 20, 25, 50, and 100.

(4) Truck travel time was basically determined by using average rates of speed which increased with distance (see Appendix Figure I).[9] Where passenger vehicles were required to transport pickup crews between farms, additions to travel time were made at a rate which decreased per man added to the crew.

(5) Statistically-computed curves were used to establish labor input-output relationships for work performed at the farms. Output per man-hour was determined by removing travel time from the data used for Figure 2 (see Appendix Figure II). Crew size was determined from Appendix Figure III.

(6) Flock size was progressively increased with annual volume hauled as indicated in the survey. Appendix Table VII shows the increase from an average of 3,000 pounds per lot per farm at one million pounds annually to an average of 30,000 pounds per lot per farm at 40 million pounds and above annually.

(7) The percentage of broilers was progressively increased with annual volume hauled. The proportions of broilers ranged from 50 percent for small assembly firms to 98 percent at 70 million pounds annually. Appendix Table VII shows the proportions used at selected volume levels.

(8) Since the cost projections resulting from the preceding assumptions were made with mileage per truck held constant, volume per mile of truck travel varied. This occurred because of the increase in the

---

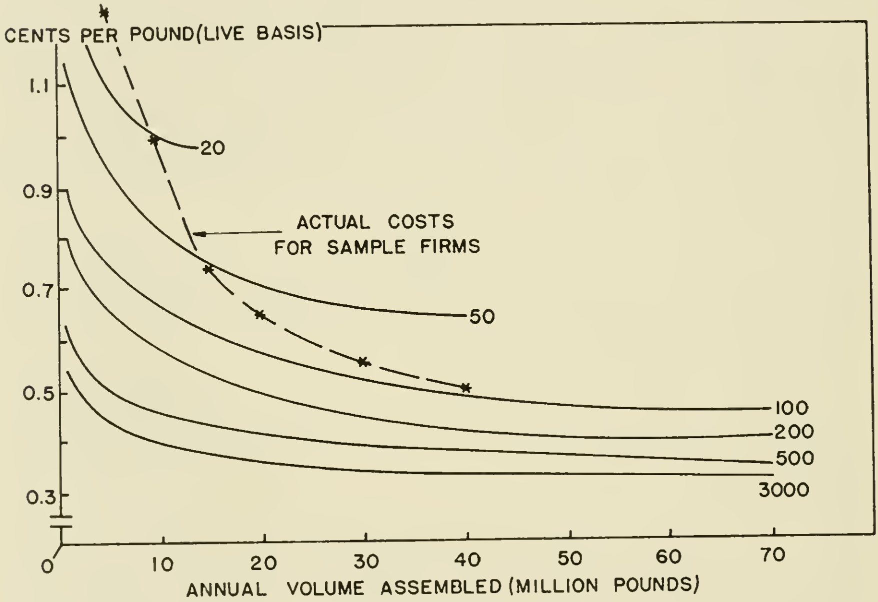
[8] Rogers, G. B. and E. T. Bardwell, *Marketing New England Poultry. 2. Economies of Scale in Chicken Processing.* N. Hamp. Agr. Expt. Sta. Bul. No. 459. April 1959.

[9] Based on truck mileage and time relationships in: Rogers, G. B. and H. C. Woodworth, *Distributing and Handling Grain-Feeds in New Hampshire. II. Problems in Retail Distribution.* N. Hamp. Agr. Expt. Sta. Bul. 427, July 1956. Fig. 9, p. 37.

sizes and number of trucks. Least cost-combinations of trucks, labor and other resources were chosen to derive cost curves for specified volumes of poultry per mile of truck travel, as illustrated in Figure 5.

(9) The shrinkage in live weight which occurs in hauling was not included as a cost item in this report. Shrinkage is less for short than for long hauls. Thus, reducing the length of haul would result in cost reductions in addition to those shown in this report. In practice, shrinkages resulting from different lengths of haul are averaged out in paying prices or transfer values of live birds. Moreover, there is a definite need for a new study of the precise relationship between shrinkage and length of haul under present conditions and with the modern type of broiler.

Figure 5. Poultry Assembly Costs Related to Annual Volume and Pounds per Mile of Truck Travel



(The number on each solid lined curve indicates the pounds of poultry obtained per mile of truck travel)

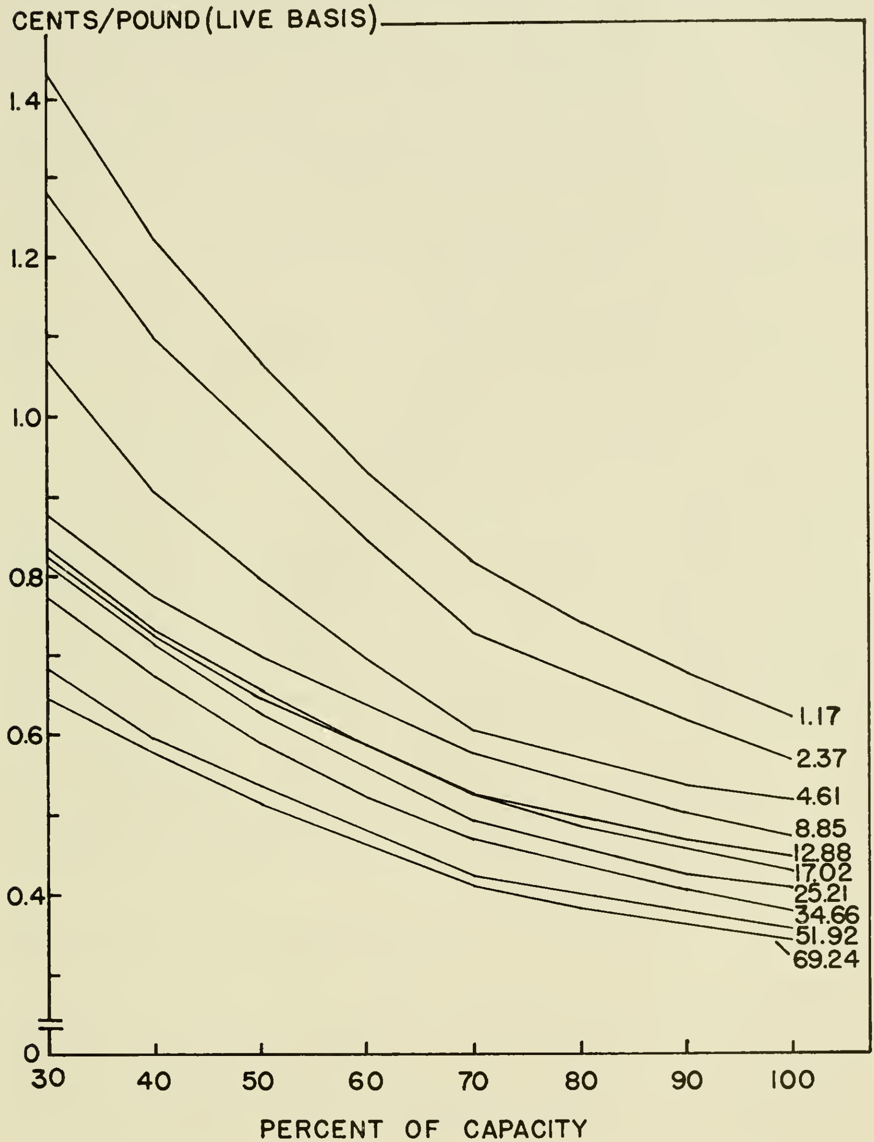
Effect of Firm Size on Costs of Live Poultry Assembly

Using the assumptions and methodology previously described, costs of assembling live poultry are hereafter analyzed in terms of a set of 10 model firms. Net differences in the unit costs provide a measurement of the savings or increased revenues which the firm with the less efficient operations must accomplish by other means if it is to remain competitive.

This analysis does suggest that costs of assembling live poultry can be reduced from present levels by increasing firm size and thus achieving the desirable characteristics of new type firms and by increasing the density of the supply area. Moreover, the cost patterns outlined help explain the reasons for the rapid concentration of poultry assembly in fewer and larger hands in recent years. Inherent in this development is the spread of vertical integration, including the selection and expansion of contract flocks.

For any size of assembly firm there is a substantial cost advantage in maintaining operations as close to capacity as possible. Figure 6 shows

Figure 6. Poultry Assembly Costs for 10 Model Plants Related to Size of Firm and Use of Capacity*



* When poultry is obtained at rate of 500 pounds per mile of truck travel.

(The number on each curve indicates the capacity of the model firm in million pounds of poultry annually.)

derived average cost curves for 10 model firms with poultry available at the rate of 500 pounds per mile of truck travel. Similar sets of curves can be derived for other levels of volume per mile of truck travel. In assembly operations, 100 percent of capacity can be exceeded only in the short-run without adverse effects on costs. The hauling capacity of trucks (crates, birds) is an important limiting factor. Hence, in the long-run, operation above 100 percent of capacity results in a discontinuous average cost curve because additional equipment is required or other costs increase sharply.[10]

When derived average cost curves for the series of model plants are plotted in relation to percent of capacity, each successively larger plant has an advantage over the next smaller unit. This is because unit costs are successively lower, almost without exception, for each percentage level as firm size increases. Relative advantages are generally minimized at 100 percent of capacity, but widen below this level.

The Influence of Volume Per Mile of Truck Travel on Costs of Live Poultry Assembly

Declining costs per pound of poultry assembled, associated with firm size, result from changes in the number and size of vehicles, increased labor efficiency, economies in management and facilities, larger flock sizes, and a greater proportion of broilers hauled. Such factors often can more than offset the effects of increased total mileage per truck and per firm as volume increases. Moreover, these savings can be supplemented substantially by increasing the volume of poultry per mile of travel. Thus, density of supplies, as well as absolute volume, is related to the achievement of minimum costs in assembling live poultry.

The density of the supply area and the average length of haul have an important effect on costs.[11] Figure 5 compares the curves computed for selected levels of volume per mile of truck travel with actual average costs incurred by firms of various sizes under 1958-59 conditions. Because of variations in use of capacity, input prices, and performance levels as well as volume obtained per mile of truck travel, the curve connecting the actual average costs cuts across several of the curves representing costs with volume per mile of truck travel standardized. This situation shows the greater degree of success already achieved by larger assembly firms in reducing costs. Figure 5 also illustrates the opportunities which may be open to assembly firms of a given size to reduce costs through contracting the size of the supply area and reducing the average length of haul.

Present firm size seems related to the relative cost reductions which actual firms can realize through: (1) Increasing volume and adopting

[10] Costs predicated upon 130 percent of capacity do not represent a sustained level of operation. In the short run, 100 percent of capacity can be exceeded without adverse effects by additional crates, placing more birds in each crate, or handling birds of heavier wieght, if this can be accomplished without exceeding legal load limits. But the methods of projecting costs, described in the Appendix, probably do not fully reflect the increased rates of use of inputs and the added repairs which sustained heavier loading might necessitate, nor the costs of breakdowns during the operating week.

[11] For purposes of this report, density of poultry production and pounds per mile of truck travel are used interchangeably.

the techniques and practices of their larger competitors; or, (2) retaining their present size of business, techniques, and practices and increasing volume per mile of truck travel. Except for small firms picking up poultry at a low rate per mile of truck travel, a given percentage increase in volume would usually provide greater dollar savings than the same percentage increase in volume per mile of truck travel. Firms with annual volume of 2 million pounds or less and picking up poultry at a rate of less than 200 pounds per mile of truck travel can make the greatest short-run savings by increasing volume per mile of truck travel. However, once present firms attain a level of 200 pounds per mile of truck travel, their greatest gains may lie in expanding firm size.

Costs per pound for live poultry assembly will not continue to decline indefinitely as annual volume increases. With volume per mile of truck travel at 200 or below, miles per truck increase rapidly with increases in annual volume. Despite other potential savings, such as those from using larger trucks and crews, the increased time and distance is sufficient to cause an eventual upturn in costs. Hence, least cost points will be attained at smaller and smaller annual volumes as pounds per mile of truck travel declines from 200. However, in this study, continued cost reductions were indicated for levels of 500 pounds per mile of truck travel and up throughout the range of volumes studied (Table 5).

Least-Cost Combinations of Resources in Live Poultry Assembly

At most volume levels, several alternative combinations of resources and inputs will achieve the minimization of total per pound costs — within a fraction of a cent range. For most levels of volume per mile of truck travel, least-cost points for successively larger firms involve greater numbers of trucks of larger size operated at or near 100 percent of capacity. Table 6 illustrates some of the alternative combinations of resources indicated in this study for selected annual volumes and mileages per truck. Since subsequent discussions will involve minimum-cost combinations of assembly and processing, the annual volume levels selected are about equivalent to those for model processing plants developed in a previous report.

For example, if a firm assembles 25 million pounds of poultry by using at capacity five 2½ ton trucks traveling 25,000 miles each, about 55,000 man hours of labor would be required, and total costs per pound would approximate 0.475 cents. At 35 million pounds, capacity use of seven 2½ ton trucks or six 3 ton trucks, traveling 25,000 miles each, would require about 71,000 man hours of labor and cost 0.440 cents per pound of live poultry assembled.

In actual practice, some individual assembly firms own and operate trucks of various capacities. Such combinations may be indicated at some volume levels to enable the firm to develop least-cost combinations under the standardized conditions involved in this analysis. Furthermore, in applying this study to a specific situation, truck size may be further modified because of variations in average flock size from the levels assumed herein.

For example, if the volume of a firm lies between 25 and 35 million pounds annually, it might achieve its least-cost combination with five

Table 5. Average Cost Per Pound for Assembling Live Poultry, by Annual Volume Assembled and Quantity Assembled Per Mile of Truck Travel

Annual Volume	Pounds of Poultry per Mile of Travel (density)										
	5	10	20	50	100	200	500	1,000	2,000	3,000	4,500
(million pounds)					(cents per pound)						
1	3.100	2.000	1.550	1.150	0.900	0.800	0.637	0.595	0.575	0.555	0.532
2	2.820	1.750	1.325	1.075	.850	.750	.576	.535	.520	.505	.483
3	2.690	1.660	1.200	1.020	.820	.720	.543	.510	.495	.480	.458
4	2.560	1.600	1.140	.975	.790	.695	.522	.490	.475	.460	.440
5	2.500	1.560	1.100	.940	.770	.670	.506	.475	.461	.445	.425
6	[1] 2.450	1.540	1.070	.915	.745	.650	.493	.462	.448	.433	.414
9		[1] 1.460									
10	[2]	[2]	1.000	.820	.670	.584	.458	.427	.413	.399	.381
14			[1] .975								
20			[2]	.710	.574	.505	.415	.388	.376	.364	.350
30				.660	.530	.460	.391	.365	.356	.344	.333
40				[1] .640	.490	.425	.375	.352	.344	.333	.323
50				[2]	.470	.410	.364	.343	.335	.327	.316
56					[1] .464						
60					.470	.402	.354	.338	.330	.322	.312
62						[1] .400					
70					.480	.404	.347	.334	.327	.320	.310

[1] Point of lowest cost at density shown. At densities of 500 lb. or more, lowest-cost points were at volumes over 70 million lb. and beyond range of projection.

[2] Before these volumes are reached assembly costs per unit will increase or level off due to excessive travel time, mileage, and overtime wage rates, or to restriction of operations to a single load per operating day, or to use of a larger number of vehicles than at higher densities. Hence, no firms of these sizes operated with these densities.

Table 6. Alternative Combinations which Minimize Total per Pound Costs of Assembling Live Poultry at Selected Annual Volumes and Mileages per Truck

Model Processing Plants [1]			Annual Mileages per Truck		
Model Number	Annual Volume (mil. lbs.)	Items	10,000	25,000	50,000
I	1.17	Total cost per pound [2]	0.850	1.160	1.700
		Man hours per year [3]	5.3	6.8	8.5
		Number and Model of truck [4]	1F	1F	1F
II	2.37	Total cost per pound [2]	0.650	0.800	1.400
		Man hours per year [3]	7.4	9.6	12.1
		Number and Model of truck [4]	2F, 1G, 1H	2F, 1G, 1H	2F, 1G, 1H
III	4.61	Total cost per pound [2]	0.540	0.730	0.975
		Man hours per year [3]	12.3	15.5	19.5
		Number and Model of truck [4]	1J	1J	1J
IV	8.85	Total cost per pound [2]	0.480	0.620	0.810
		Man hours per year [3]	20.5	25.5	31.5
		Number and Model of truck [4]	2I	2I	2I
V	12.88	Total cost per pound [2]	0.450	0.565	0.730
		Man hours per year [3]	27.8	34.0	41.5
		Number and Model of truck [4]	4H	3I, 2K	3I, 2K
VI	17.02	Total cost per pound [2]	0.430	0.525	0.670
		Man hours per year [3]	34.5	41.5	50.5
		Number and Model of truck [4]	5H, 4I, 3K	5H, 3K	5H, 3K
VII	25.21	Total cost per pound [2]	0.400	0.475	0.600
		Man hours per year [3]	47.8	55.0	65.0
		Number and Model of truck [4]	6I, 5J, 3L	6I, 5J, 3L	6I, 5J, 3L

Table 6. (Cont.) Alternative Combinations which Minimized Total per Pound Costs of Assembling Live Poultry at Selected Annual Volumes and Mileages per Truck

Model Processing Plants[1]			Annual Mileages per Truck		
Model Number	Annual Volume (mil. lbs.)	Items	10,000	25,000	50,000
VIII	34.66	Total cost per pound[2]	0.375	0.440	0.545
		Man hours per year[3]	62.5	71.0	82.0
		Number and Model of trucks[4]	7J, 6K	7J, 6K	7J, 6K
IX	51.96	Total cost per pound[2]	0.350	0.395	0.485
		Man hours per year[3]	88.5	98.5	110.0
		Number and Model of trucks[4]	9K	9K	9K
X	69.24	Total cost per pound[2]	0.335	0.370	0.445
		Man hours per year[3]	114.5	126.0	139.5
		Number and Model of trucks[4]	14J	14J	14J

[1] Processing plants — birds per hour (broiler equivalent): Number I, 150; II, 300; III, 600; IV, 1200; V, 1800; VI, 2400; VII, 3,600; VIII, 5,000; IX, 7,500; X, 10,000.

[2] Cents.

[3] 1,000 omitted.

[4] Letters refer to trucks of following sizes and crate capacities: F-1 ton — 60 crates; G-1 — 100; H-1½ — 130; I-2 — 160; J-2½ — 190; K-3 — 220; L-TrTr — 320. Trucks operated at or close to capacity. Other truck combinations not used in cost projections, may provide a more precise adjustment in certain situations.

$2\frac{1}{2}$ ton trucks plus a tractor-trailer or plus two 2 ton trucks. But if its volume is expanded to a level of 35 million pounds annually, it might replace the tractor-trailer (or the two 2 ton trucks) with 2 trucks of the $2\frac{1}{2}$ ton size, or move to six 3 ton trucks.

Economies in truck ownership and operation can be obtained by: (1) Minimizing the total number of trucks owned; (2) maximizing the percentage of capacity at which each is operated; and, (3) minimizing the number of vehicles required to load out the average size of flock in order to restrict the number of stops per vehicle per trip and the number of partial loads. However, the volume level at which the minimum cost per pound for truck ownership and operation is achieved may not coincide with the low-cost point for the firm.

The labor problems of the assembly firm involve: (1) Minimizing crew size, if workers regard pickup work as of inferior "status" and are difficult to obtain and retain; (2) minimizing the amount of overtime wages; (3) moving the field crew, other than those who accompany trucks, most expeditiously; and (4) maximizing the output per man-hour.

Unless one or more of the preceding situations is restrictive, the combination of resources and inputs that will minimize the total per pound cost at any given volume level takes precedence. Least-cost points for the specific objectives rarely coincide. In studying cost reduction possibilities, the relative importance of specific objectives in the decision-making process of the firm is likely to differ in the long-run from that in the short-run. (See Chapter II for a discussion of actual costs and the reasons therefore.)

Importance of Cost Group in Producing Cost Reductions

Costs incurred in live poultry assembly can be segregated, according to their behavior as volume increases, into three main groups. These are, in order of importance: labor, truck costs, and management and facility costs.

Labor costs per pound of poultry decline as volume increases. The lower per pound costs result from the use of larger crews, increased specialization, minimization of in-field travel by crews through the use of supplementary vehicles, and handling flocks of larger average size. The precise effects of each of these factors are not ascertainable under the methods used.

Labor is the single largest cost in assembling live poultry. It accounts for 60 to 67 percent of total costs per pound. The share of total unit costs represented by labor declines as volume increases. This occurs because savings from increased labor productivity continue well beyond the volume levels where per pound costs for truck ownership and operation level off. But at any one volume level, the proportion of total per pound costs represented by labor increases as annual mileage per truck or per pound increases. This results from the increase in the ratio of travel time to work time and from the greater effect of overtime wage rates.

Appendix Tables X and XI show the unit costs which resulted for selected combinations of trucks and other resources as mileage per truck and total volume increased. Appendix Table XII indicates the truck sizes used in cost projections and the costs for truck ownership and operation at capacity when hauling broilers. Costs for truck ownership decline with increasing truck size. At a level of 5000 miles per truck per year, least costs per pound are realized at the 1½ ton size (130 crate capacity per load). For greater annual mileages, larger trucks give costs per pound as low or lower than the 1½ ton size. Within the area of declining costs per pound, increasing cost per mile is more than offset by the larger volume carried.

Truck costs per pound of poultry hauled rise rapidly, for any particular truck size, as average length of haul increases. The absolute, and in many cases, the relative advantage of larger trucks increases as length of haul increases.

While the cost savings attributable to ownership and operation of larger trucks are fully realized at small volumes,[12] further savings are realized on labor costs per pound as volume increases. In addition, costs per pound for management and facilities continue to decline as volume increases.

The cost items involved in assembling live poultry can be separated into accounting categories developed in a previous study.[13] The behavior of individual cost items with increasing annual volume, truck size, and mileage per truck is shown in Appendix Table XIII. Further information on the synthesis of individual items of cost is contained in the Appendix.

IV. Some Implications of Reduced Costs of Assembly and Processing

The preceding chapter of this report discussed the extent and nature of cost reductions which assembly firms can achieve within the present system. Full realization of these savings can come about only in the long-run. Overtime, the need to replace resources will generate greater mobility. Furthermore, gradual institutional changes would be required, including further integration of the growing, assembly, and processing functions. An additional condition to the full realization of these assembly cost reductions would be the continued development of production technology, including adequate disease control and methods whereby diseconomics of scale in growing did not appear.

Institutional Changes Which Would Facilitate Assembly Cost Minimization

As firm numbers decrease further, the number of pounds of poultry available to each firm as well as that available per mile of truck travel may increase in many areas. Yet with several firms operating in an area the duplication of travel and expense would still be considerable. Furthermore, the random location of farms and variability in their size and layout would maintain costs above minimum levels.

Two direct steps can be taken which will aid the individual firm in minimizing assembly costs: (1) Selection, retention, and expansion of producing units of suitable size and layout as close as possible to the plant; and, (2) movement toward an exclusive supply area for the firm.

---

[12] Less than 6 million pounds annually for trucks traveling all mileages (5,000; 10,000; 25,000; 50,000) per year. Appendix Table XII.

[13] N. H. Bul. No. 459, op. cit., p. 9-14.

Whether independent producers or contract growers are involved, inclusion of location and size as short-run criteria for payment would aid the development of a supply area of smaller radius. The potential savings in assembly costs would provide a basis for financially encouraging nearby growers. New resources can be located closer to the plant as a policy matter if investment capital is provided contract growers or assemblers own producing units outright.

The establishment of an exclusive supply area for the individual firm would further cost reduction in assembly. Development of contract growing operations in new areas offers one way to do this. The firm might also try to reshuffle supply flocks with several competitors. But extensive development in this direction would raise some legal and sociological problems and necessitate changing grower payment procedure.[14]

The cost savings from increasing the volume per mile of truck travel can be illustrated by using as an example a firm handling 30 million pounds of poultry annually. If this firm picks up poultry at the rate of 100 pounds per mile of travel, it would incur costs of 0.53 cents per pound, or $159,000, and its trucks would travel 300,000 miles. A reallocation of supply flocks with several competitors, to create the beginnings of an exclusive supply area could easily halve mileage, double density, and reduce costs to 0.46 cents per pound, or $138,000, a savings of $21,000. An additional $21,000 could be saved by increasing the pounds per mile of truck travel from 200 to 500 (Table 7). While the continued increase in the volume per mile of truck travel results in drastic reduction in miles per trip and per truck per year, cost savings per unit become smaller and smaller.

Table 7. The effect of Increased Volume per Mile of Truck Travel for a Hypothetical Assembly Firm Handling 30 Million Pounds Annually [1]

Pounds per Mile of Travel	Truck Miles per Year	Miles per Trip	Average Assembly Cost per Pound	Total Assembly Cost	Net Annual Additional Savings
	(1,000)	(number)	(cents)	($1,000)	($1,000)
100	300	90	0.530	159	—
200	150	45	0.460	138	21
500	60	18	0.391	117	21
3,000	10	3	0.344	103	14

[1] Assuming 7 trucks operated at capacity, 2 trips per day for 247 operating days.

Systemic Efficiency in Assembly

With 332 firms engaged in poultry assembly in New England in 1957, systemic costs totalled $4.64 million. Most firms obtained between 20 and 50 pounds of poultry per mile of truck travel. Only a few firms obtained 100 or more pounds of poultry per mile of truck travel.

[14] Apprehension exists relative to the extent to which firms can work jointly without facing anti-trust investigation. In the present environment, the association of buyer and seller, or fieldman and grower frequently may be based on personal considerations rather than economic decisions. Furthermore, many growers experience difficulty in evaluating the alternative contracts offered. One solution would be the periodic negotiation of uniform terms, practices, and supervision, with growers assigned to assemblers on the basis of proximity to the plant.

To provide a point of reference for evaluating present and prospective systems of live poultry assembly in New England, the number of firms of several sizes needed to assemble output and the systemic costs for selected density levels are indicated in Table 8.

Table 8. Number of Firms of Selected Sizes Required to Assemble 1957 Volume of Live Poultry in New England and Resulting Systemic Costs at Various Volumes per Mile of Truck Travel

Firm Size	Number of Firms	Pounds of Poultry per Mile of Truck Travel					
		20	50	100	200	500	2000
(mil. lbs.)		Total Systemic Costs					
(annually)		(million dollars)					
1.17	401	5.78	4.44	3.74	3.25	2.47	2.19
2.37	198	5.34	4.24	3.58	3.11	2.27	2.04
4.61	102	4.98	4.02	3.36	2.89	2.11	1.88
8.85	53	4.63	3.68	2.98	2.57	1.95	1.74
12.88	36	4.45	3.46	2.77	2.41	1.86	1.65
17.02	28	4.28	3.23	2.59	2.26	1.79	1.59
25.21	19	4.12	2.99	2.35	2.06	1.70	1.52
34.66	14	4.08	2.85	2.22	1.92	1.62	1.46
51.96	9	4.32	2.76	2.06	1.77	1.55	1.43
69.24	7	5.02	2.94	2.11	1.76	1.49	1.40

The present live poultry assembly system in New England is characterized by the existence of excess capacity. If all the trucks owned by assembly firms operating in the region in 1957 had been used at 100 percent of capacity, volume handled through the system could have been more than tripled. Processing plants alone could have handled the entire volume. Or, the truck resources of any two of the three next largest groups — contract haulers, contractors, and live-poultry buyers — would have sufficed (Table 9).

Table 9. Characteristics and Capacity of the System of Live Poultry Assembly in New England, 1957

	Number of Firms	1957 Volume	Average Volume per Firm	Percent of Capacity at which Group Operated [1]	Capacity of Present Firms if Each Operated at 100 Percent of Capacity: Total	Capacity of Present Firms if Each Operated at 100 Percent of Capacity: Per Firm
		(mil. lbs.)	(1000 lbs.)	(percent)	(mil. lbs.)	(1000 lbs.)
Processing Plants	35	285.6	8,160	40.0	714.0	20,400
Contract Haulers	10	81.5	8,150	38.0	214.5	21,450
Contractors	22	45.4	2,064	19.0	238.9	10,859
Live-Poultry Buyers	125	52.6	421	18.5	283.8	2,270
Live-Poultry Stores	90	3.9	43	9.5	41.1	457
Small Slaughterers	50	0.6	12	7.0	8.6	172
Total	332	469.6	—	—	1,500.9	—
Average	—	—	1,414	31.3	—	4,521

[1] Based upon the number and capacity of trucks if each used to haul two full loads per day for 247 operating days.

Substantial reductions in firm numbers from 1957 levels are likely. Even with no change in density of production, systemic costs would be reduced materially due to increased volume per firm. But the reduction in firm numbers may also be accompanied by increased volume per mile of truck travel for most firms, and hence, further cost reductions. Savings in the system, as for individual firms, would be augmented by efforts to increase the volume per mile of truck travel beyond the level resulting from reduced numbers of firms.

If the firms engaged in poultry assembly in 1957 took steps to double the pounds of poultry per mile of truck travel, systemic costs could be reduced from $4.64 million to $3.93 million, or a saving of more than $700,000 annually (Models I and II, Table 10). These results could be achieved by more attention to flock selection and by movement toward exclusive supply areas.

Table 10. Number of Firms Required and Aggregate Costs of Alternative Model Systems of Assembling New England Chicken Output

Firm Size and Type[1]	Model I			Model II[4]	Model III[5]	
	Volume	No. of Firms[2]	Assembly Costs[3]	Assembly Costs	No. of Firms	Assembly Costs
	(mil. lbs.)		(1000 dollars)	(1000 dollars)		(1000 dollars)
Processing Plants	285.6	35	2,256	1,914	28	1,448
Contract Haulers	81.5	10	693	587	8	451
Contractors	45.4	22	654	554	11	384
Live-Poultry Buyers	52.6	125	894	763	40	552
Live-Poultry Stores	3.9	90	117	94	25	78
Small Slaughterers	0.6	50	27	20	12	19
Total	469.6	332	4,641	3,932	124	2,932

[1] Under each type, firms of different sizes occur.

[2] From Table 1.

[3] Average per pound costs from Table 4 except unit costs for live-poultry stores and small slaughterers are adjusted to 3.00 and 4.50 cents per pound, respectively, on the assumption vehicles are used for purposes in addition to live poultry assembly. Pounds per mile of truck travel from Table 3.

[4] Same number and volume, by types of firms, and rate of use of truck capacity, as for Model I. Pounds per mile of truck travel doubled from rates in Model I. Unit costs in Model I adjusted by using percentage changes from data for Table 5.

[5] Use of a more limited number of vehicles at 100 percent of capacity, a reduction in firm numbers based on the preceding plus known mortality. Unit costs derived from data for Table 5. Pounds per mile fractionally higher than in Model II.

Further developments to create exclusive supply areas plus a sufficient reduction in firm numbers to enable operation at 100 percent of capacity would further increase savings. The reduction in firm numbers would approximate 60 percent, and the additional cost savings a million dollars annually (Model III, Table 10).

Combining the Assembly and Processing Functions

By combining the assembly and processing functions under one management, savings can be achieved in unit costs. These arise from the elimination of a duplicate set of personnel engaged in managerial, buying, and office duties and from the economies obtained by including garage and holding space in the greater square footage of a processing plant rather than in distinct facilities for an assembly firm. The magnitude of unit savings decrease as firm size increases (Table 11). In the 1957 system, it was estimated that 70 percent of the 469.6 million pounds handled by assembly firms was already included under combined-function firms.

Table 11. Annual Savings Obtainable from Combining the Poultry Assembly and Processing Functions under One Management

Model Plant		Savings Obtainable from Combining Assembly and Processing		
Number	Annual Volume	Per Firm		Systemic [1]
	(million lbs.)	(cents per pound) [2]	(dollars)	(1000 dollars)
I	1.17	.129	1,509	606
II	2.37	.110	2,607	517
III	4.61	.093	4,287	437
IV	8.85	.075	6,638	352
V	12.88	.065	8,372	305
VI	17.02	.063	10,723	296
VII	25.21	.058	14,622	272
VIII	34.66	.051	17,677	239
IX	51.96	.042	21,823	197
X	69.24	.042	29,081	197

[1] If system composed of firms of successive uniform sizes. See Table 12.

[2] Live weight basis.

[15] N. H. Sta. Bul. 459, op. cit. At 100 percent of capacity, 150 broilers or 120 fowl per hour vs. 10,000 broilers or 6,000 fowl per hour. Broilers weighing 3.5 pounds each and fowl 6.0 pounds each.

Figure 7 shows the combined cost curves (assembly plus processing) for selected levels of volume per mile of truck travel. At levels of 1,000 pounds per mile of truck travel and over, unit cost savings for any particular plant size become exceedingly small as volume per mile of truck travel increases. But the dollar savings, at any level of volume per mile of truck travel, may be substantial as plant size increases.

For example, suppose poultry is available at the rate of 500 pounds per mile of truck travel. One large firm could assemble and process 69 million pounds of poultry for 2.898 cents per pound, or $1,999,620. Costs for the same volume handled by two firms, each with half the capacity of the larger firm, would equal 3.162 cents per pound, or $2,181,780 (Table 12). Of the total savings of $182,160 economies in processing would account for $165,220 and economies in assembly for the balance of $16,940.

Combination of the assembly and processing functions further increases the advantage of large plants as compared to small plants. For the processing function alone, the cost savings from the smallest model plant to the largest model plant [15] is estimated at 1.75 cents per pound live weight basis. For the combined functions, comparisons of the small-

Figure 7. Costs for The Combined Assembly and Processing Functions at Various Annual Volumes and at Selected Pounds per Mile of Truck Travel

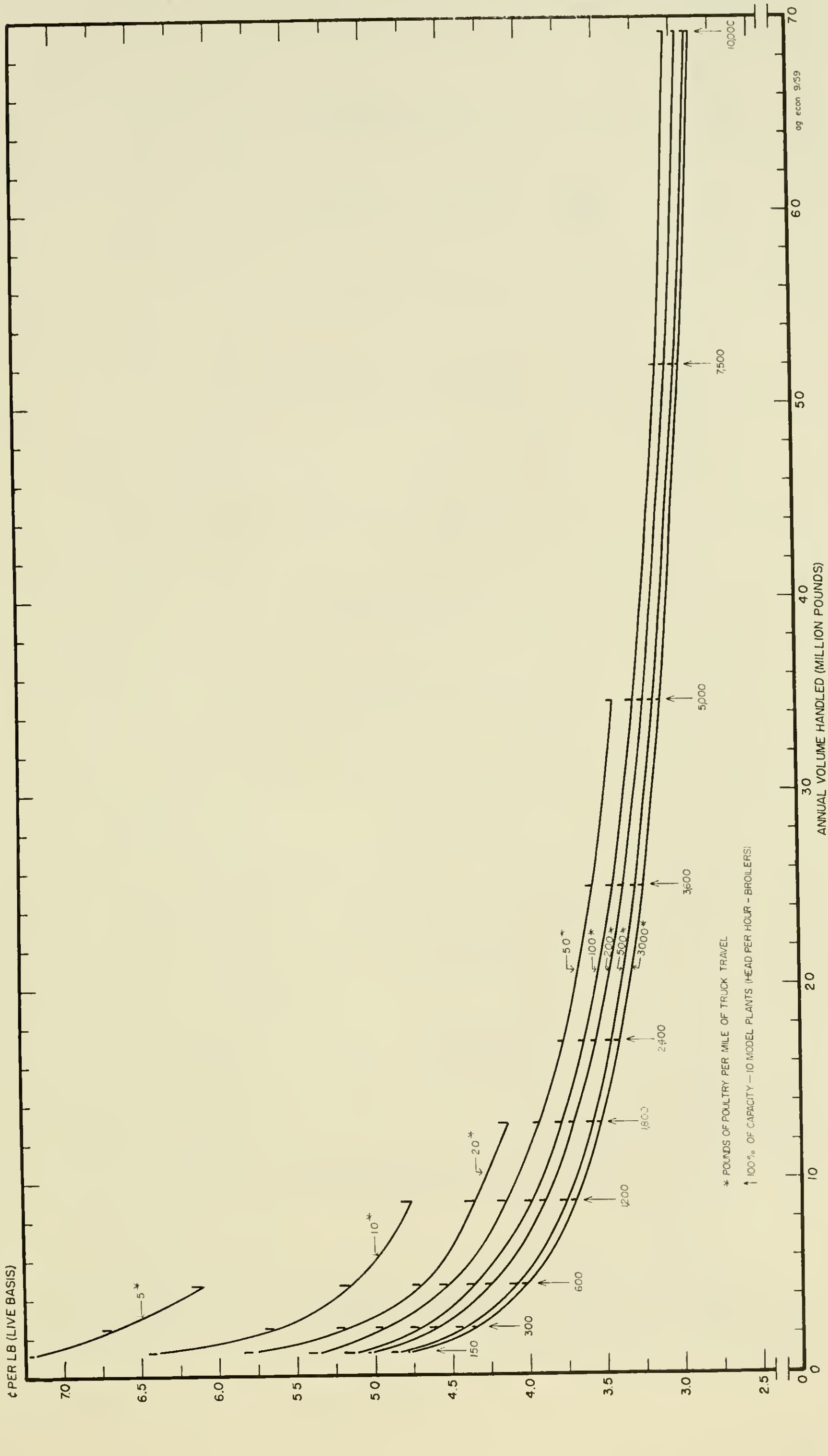


Table 12. Combined Costs per Pound for 10 Model Plants for Assembling and Processing Poultry at Selected Density Levels [1]

Model Plant		Pounds of Poultry per Mile of Truck Travel										
Number	Annual Volume	5	10	20	50	100	200	500	1000	2000	3000	4500
	(mil. lbs.)	(cents per pound-live weight basis)										
I	1.17	7.175	6.385	5.745	5.345	5.113	5.010	4.842	4.801	4.783	4.767	4.750
II	2.37	6.632	5.582	5.132	4.922	4.712	4.612	4.432	4.397	4.384	4.368	4.345
III	4.61	6.085	5.135	4.685	4.515	4.345	4.245	4.080	4.045	4.031	4.015	3.995
IV	8.85	[2]	4.758	4.343	4.143	3.980	3.983	3.760	3.728	3.715	3.699	3.681
V	12.88		[2]	4.125	3.925	3.780	3.703	3.587	3.557	3.542	3.529	3.512
VI	17.02			[2]	3.775	3.630	3.560	3.460	3.433	3.418	3.405	3.391
VII	25.21				3.566	3.431	3.369	3.291	3.264	3.246	3.239	3.229
VIII	34.66				3.422	3.289	3.225	3.162	3.138	3.127	3.115	3.105
IX	51.96				[2]	3.115	3.053	2.998	2.990	2.982	2.973	2.963
X	69.24					3.029	2.954	2.898	2.885	2.879	2.871	2.863

[1] Data for Figure 7. A computed economies of scale curve for processing (Log Y=1.40682 — .12625 log X) was obtained by using data from N. H. Sta. Bul. 459, Fig. 5, 7; Tables 2, 3, p. 16-20, and by varying the proportions of young and mature chickens with volume, as in Appendix Table VII. Duplicate costs were removed, and the processing costs were added to the costs for poultry assembly at various densities. (Figure 5 and Table 5).

[2] Before these levels of volume are reached, assembly costs per unit will increase or level-off due to excessive travel time, mileage, and overtime wage rates, and/or restriction of operations to a single load per operating day, and/or use of a larger number of vehicles than at higher densities.

est to largest plant (or the smallest plant to the low-cost point for low levels of volume per mile of truck travel) indicate a spread of 1.9 cents per pound or more, live weight basis.

Greater flexibility in operations of the firm can be secured by combining assembly and processing. Either a single-function firm (engaging only in assembly) or a combined-function firm (engaging in both assembly and processing) may realize economies by: (a) Increasing density of supplies while holding volume constant; or (b) increasing volume at a given density. But a single-function firm would face increased costs per pound for assembly if it expanded volume by entering a supply area of lower density. On the other hand, the preponderant influence of decreasing per unit costs of processing upon the total per unit costs of the combined-function firm would make feasible expansion of volume by entering a supply area of lower density.

This feature may find application mainly as a short-run expedient. Over a longer period, the competitive interests of the firm would be enhanced by reducing the size of the supply area and reducing both assembly and processing costs.

The following example illustrates the extent to which increased costs per pound in assembly could be offset by economies of scale in processing. Suppose Firm A is assembling and processing 20 million pounds of poultry and Firm B, 40 million pounds, in a supply area where poultry is available at the rate of 1,000 pounds per mile of truck travel. If Firm A can increase volume 20 percent, it can reduce processing costs from 3.036 to 2.965 cents per pound. Firm A's assembly costs can be increased from 0.327 to 0.398 cents per pound, or the volume per mile of truck travel reduced from 1,000 to 300 pounds, without increasing total unit costs. Firm B, in increasing volume 20 percent, can reduce processing costs from 2.777 to 2.715 cents per pound. This means assembly costs can be increased from 0.305 to 0.367 cents per pound, or the volume per mile of truck travel reduced from 1,000 to 200 pounds, without increasing total unit costs.

Cost reduction, of which integration of the assembly and processing functions is but one method, will encourage further development of stratified competition. At present this feature is most noticeable in the alignment of small farms, small assemblers and processors, and small outlets versus large farms, large assembler-processors, and volume outlets. But declines in firm numbers and further adjustments of firms to supply areas will accentuate the sectional aspects. For example, small local slaughterers and firms servicing alternative marketing channels (live-poultry stores and live-poultry buyers) will constitute the main outlets for producers in non-commercial areas. In contrast, large combined-function firms will dominate in commercial areas. The participation of smaller and older types of firms will be limited to filling limited needs for certain market classes at favorable prices, buying small and mixed lots, and handling excess fowl.

Optimum Adjustments for Selected Supply Areas

The establishment of a least-cost system for a particular supply area initially depends on maximizing the efficiency of the operations of the individual firm. The accumulation of these efficiencies, plus the development of exclusive supply areas, will make a substantial contribution. But further reduction in systemic costs can be achieved by elimination of redundant resources and the realignment of supply areas.

In any given area, the least-cost combination of resources will involve maximizing the number of the largest feasible plant sizes. Taking the upper limit of projections in this and an earlier study[16] — 70 million pounds annually at 100 percent of capacity — as the present technological limit, one plant of this size would suffice if usable volume[17] in the area was 70 million pounds. If volume in the area were less than this level, one plant of a smaller capacity would provide the best adjustment. If volume exceeded 70 million pounds, one 70 million pound plant plus one additional smaller plant, rather than two or more medium sized plants, would provide the least-cost combination. In an area where volume exceeded 140 million pounds, two large plants and one smaller plant would be optimum.

The least-cost system for an area might place certain plants at a competitive disadvantage. Hence, in practice, if usable volume would support more than one large plant, such plants would tend to approximate each other in size. The competitive position of a small plant would be enhanced if it concentrated on fowl, with larger plants concentrating on broilers where economies of scale are greatest.

At the time data collection for the study of live poultry assembly was begun there were 28 commercial poultry slaughtering plants[18] operating in New England, excluding those engaged in processing specialty items. By mid-1959, only 21 were still operating. Figure 8 shows the areas lying within 10, 25, and 50 miles of these plants and the areas where there are two or more plants within 10 and 25 airline miles. This illustrates the extensive overlapping of supply areas which can exist in the present environment.

In contrast, Figure 9 shows how exclusive supply areas could be devised for a more limited number of firms of larger average size than at present. Such a system assumes eventual mobility of capital investment, a distinct possibility with rapid depreciation of plant equipment and the pressures of intra-regional and inter-regional competition. The realignment of supply areas results in 10 commercial plants — excluding those handling specialty items and those oriented toward supplying both the Kosher and poultry store trade.

Since preceding comparisons in this report were based on the 1957 system, the cost estimates in Table 13 are presented in these terms. Residual demand for live poultry outside New England and for live and processed birds through the older marketing channels is held constant. The difference in the cost estimates relates to the substitution of the exclusive supply areas and reduced numbers of plants of larger average capacity for the commercial assembly and processing structure existent in 1957. The reduction in systemic costs could approximate 35 percent, or a savings of $8,000,000. To a considerable extent, the exclusive supply

---

16 Ibid.

17 "Usable volume" may be defined as that available from producing units of a size sufficient to warrant assembly or purchase by commercial plants. Excluded would be small and mixed lots which might better be handled through alternative marketing channels.

18 Annual volume exceeding one million pounds.

Table 13. Aggregate Costs of Model Systems of Assembling and Processing 1957 New England Chicken Output

Volume	Model IV[1]	Model V[2]
	(million pounds)	
Assembled by New England firms	469.6	469.6
Processed by New England firms	429.9	429.9
Live Poultry Hauled from New England	43.1	43.1
Systemic Costs	(million dollars)	
Live Poultry Hauled from New England	1.3	1.3
Assembled and Processed within New England		
By Commercial Plants	20.8	12.8
By Other Plants	1.7	1.7
Total Assembly and Processing	22.5	14.5
Total Costs	23.8	15.8

[1] The 1957 Assembly System.
[2] Fewer but larger plants with exclusive supply areas handling same volume.

areas in Figure 9 permit continued operation by remaining plants in many sections where they traditionally operated or which would have been advantageous to them on the basis of Figure 8.

In the Maine supply area, one plant would be concentrating on fowl and the other three almost entirely on broilers. In Vermont, fowl would predominate. In the New Hampshire, Massachusetts, and Connecticut areas fowl would be more important than in Maine. Hence, all of these plants would handle 15-25 percent fowl. These adjustments are necessitated by the availability of particular market classes from local production and influence the maximum plant size considered feasible in the various supply areas in Figure 9.

Just as assembly cannot be viewed in isolation from processing, so the combined assembly and processing functions cannot be viewed without regard for distribution. Minimization of the movement of poultry between plants and ultimate consumer, including saturation of local needs from adjacent production, can be accomplished with a model system similar to that shown in Figure 9. This would be true whether a least-cost distributing system involved an expanded role in direct-to-store delivery by plants or service from centrally located distributing points in each geographic area.

Figure 8. Duplication of Live Poultry Supply Area for Commercial Poultry Processing Plants, New England, 1958-59

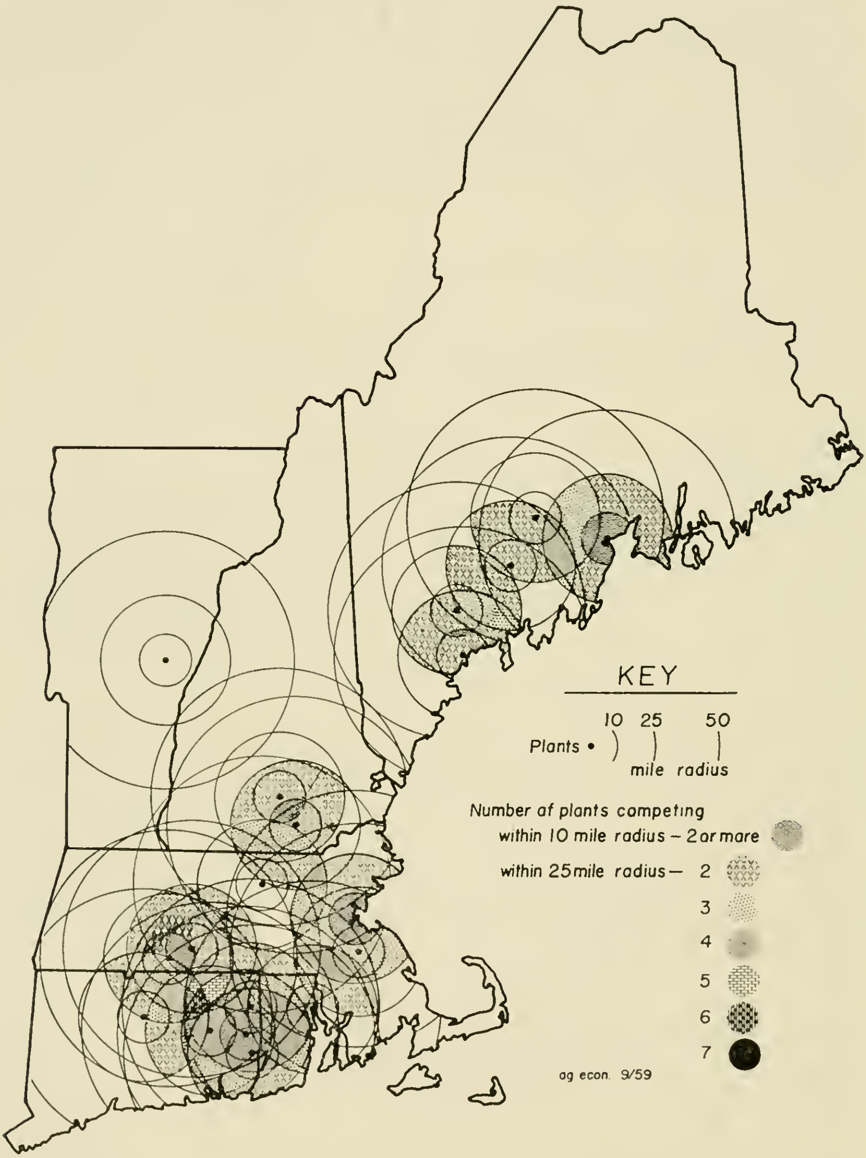
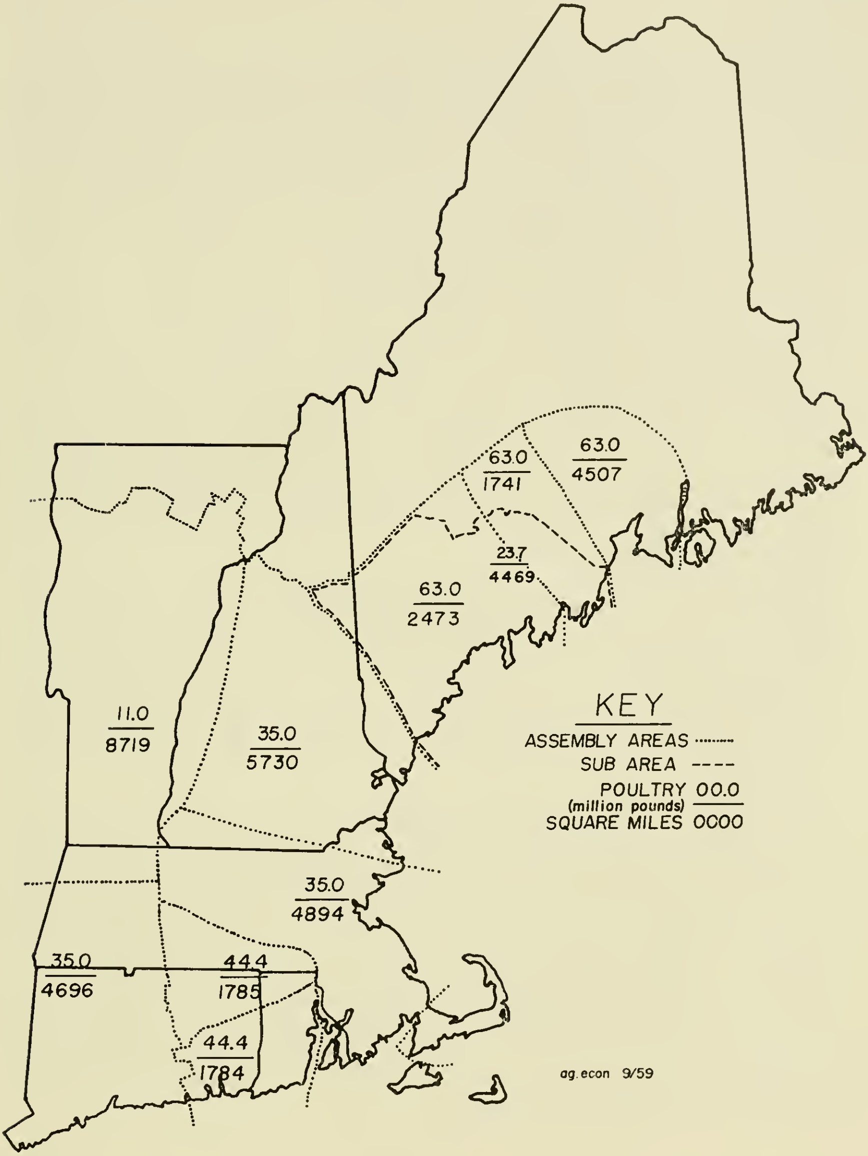


Figure 9. A Model System of Poultry Assembly for Commercial Poultry Processing Plants, New England*



* Exclusive supply areas based on 1957 volumes.

APPENDIX

Methods of Standardizing Individual Cost Items

Wages

Travel time was basically determined by route mileage (Figure I). As route mileage increases, the average rate of speed rises to a maximum level.[1] However, hours in travel were adjusted for the number of men accompanying trucks and for in-field travel via passenger vehicles. For 1 and 2 truck models, three men were assumed to be carried per truck, including drivers. For other models the total number of men carried on trucks was as follows: 3 trucks, 7.5; 4 trucks, 9.0; 5-10 trucks, 10 men; 11 trucks, 11 men; 12 trucks, 12 men.

In-field travel time per crew member above those carried on trucks varied from 0.7 of truck travel time with one man to 0.4 with 8 men, 0.3 with 13, and 0.2 at 55 and over.

The number of foremen was as follows: 1 with 6-10 in the crew; 2 with 11-22; 3 with 23-33; 4 with 34-44; 5 with 45-55; 6 with 56-66; and 7 with 67-77. The salaries of foremen were related to volume, and their hours were limited to 1976 (247 days of 8 hours each) for purposes of calculating overtime wages. With volume below 5 million pounds annually, the annual salary of a foreman was $4,000; with volume up to 20 million pounds annually, $4,500. In larger operations some were valued at $5,000 and others at $4,500.

Where part of the crew travelled in passenger vehicles, the cost of operating passenger vehicles was included at 7 cents per mile. It was assumed each vehicle could haul up to 8 men. The first such vehicle operated was assumed to travel the same distance as trucks. Thereafter, the distance travelled per passenger vehicle ranged from 0.6 the truck travel distance for the second vehicle to 0.4 per vehicle for the second and third, to 0.2 per vehicle when 7 additional vehicles above the first were required.

Work time involved in loading and related functions were combined in these analyses. The levels of output per man hour were determined by reference to Figure II. These relationships probably contain some inefficiencies subject to reduction through detailed time-and-motion study or improvement of farm facilities. These data were derived from information used in Figure 2, with estimated travel time, as established in Figure I, being substracted from the aggregate hours of labor.

Wage rates used were $1.50 per hour for drivers and $1.20 per hour for helpers, plus 5 percent fringe benefits. Time-and-a-half was paid for work by the crew beyond 1976 hours (247 days of 8 hours each) per year. Figure III shows the relationship of volume and crew size, as determined from survey records.

---

[1] Travel time for routes of 60 miles round trip or less determined by reference to: N. H. Sta. Bul. 427, op. cit., Fig. 9, p. 37. This figure derived from records on deliveries to farms by grain trucks traveling over New England routes. Above 60 miles, a constant speed of 46.2 miles per hour was used.

Figure I
Relationship Between Route Mileage and Truck Travel Time

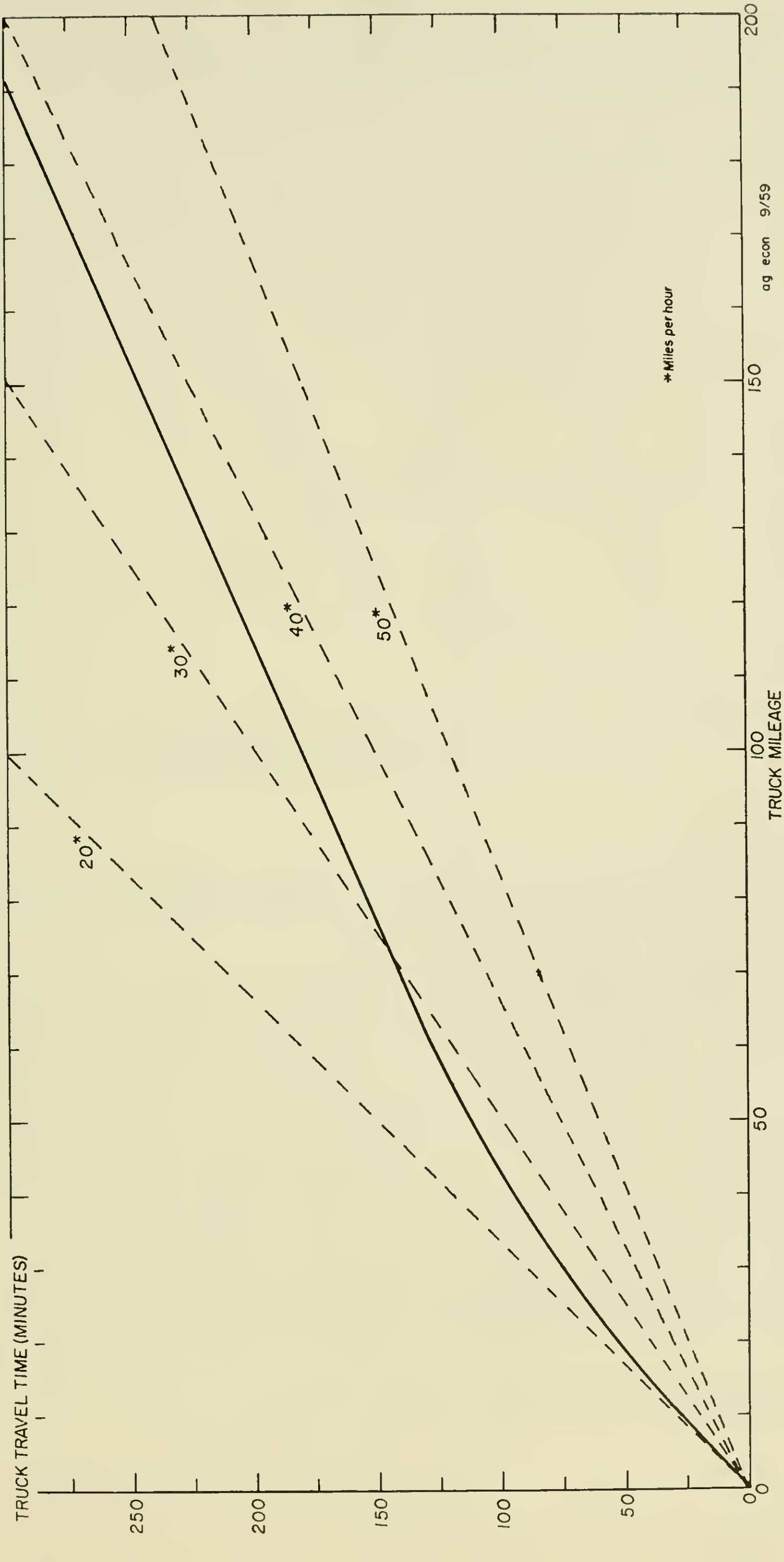
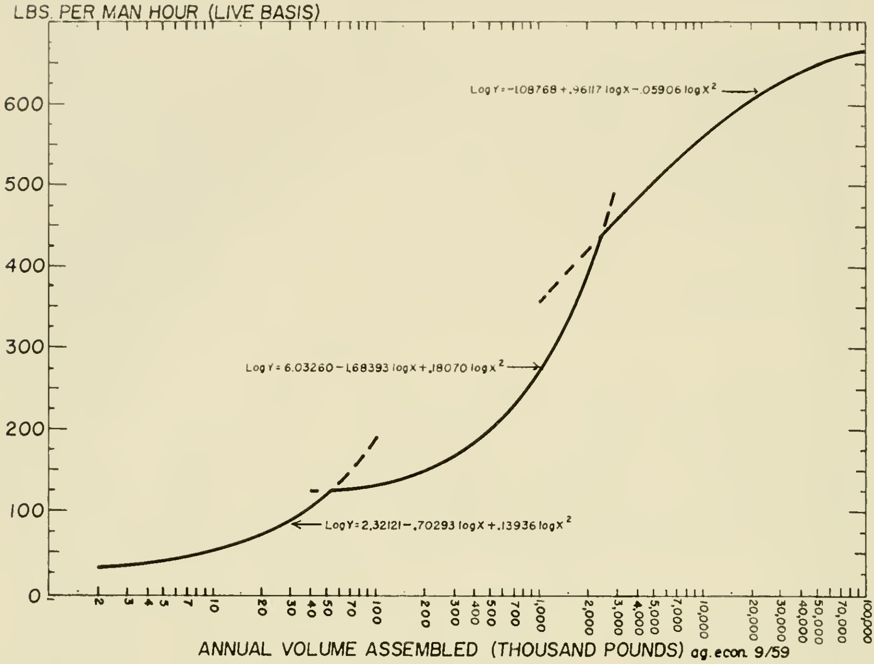


Figure II
Calculated Relationship Between Annual Volume and Pounds Handled per Man Hour of Labor in Loading Live Poultry*



Truck Costs

Repairs and Maintenance. These costs depend basically on truck size, age, miles travelled, rate of loading, and road conditions. For purposes of this study road conditions were assumed to be constant and rate of loading to have a negligible effect.

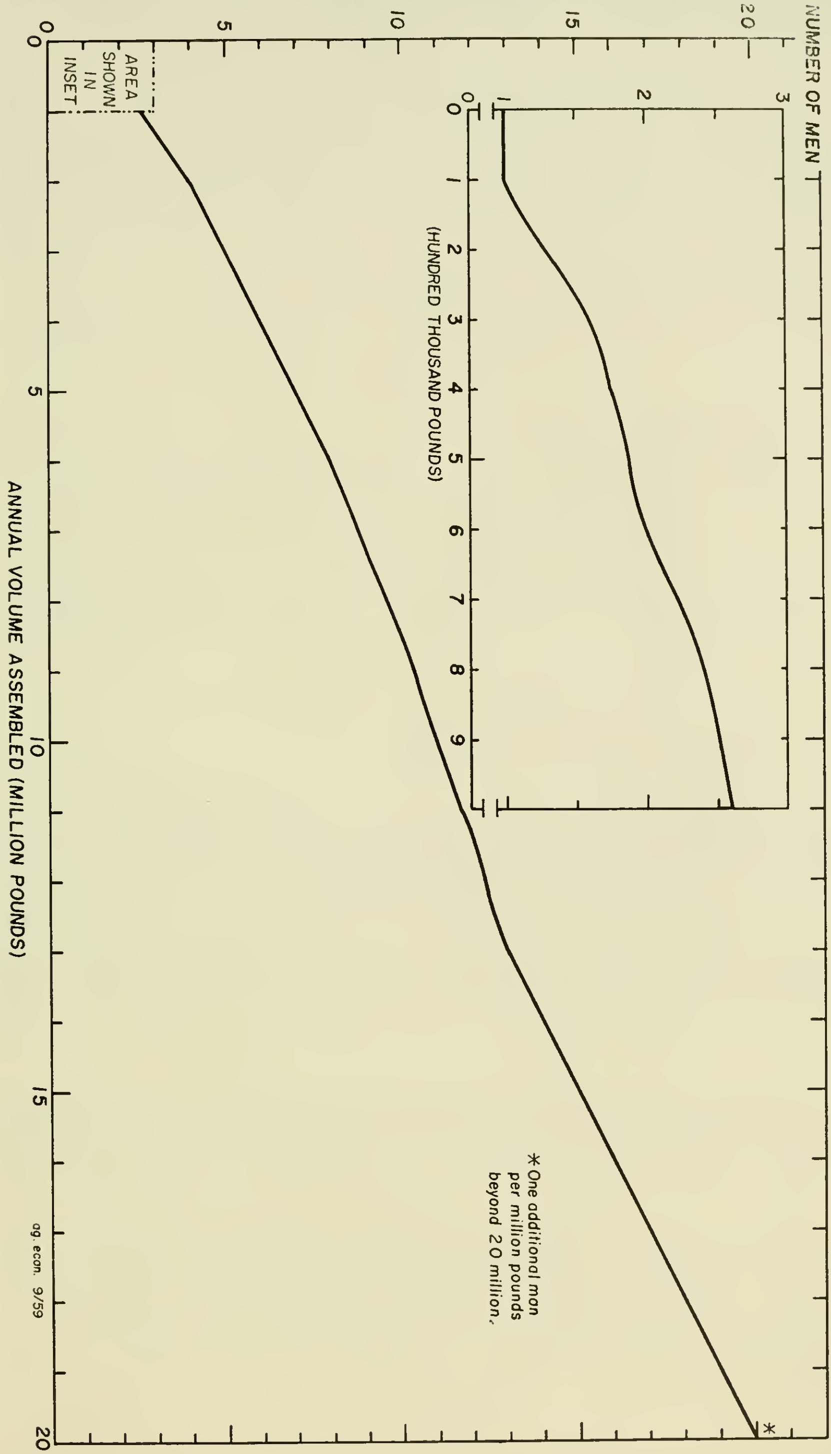
As truck size increases, repair and maintenance costs increase, but not in proportion to truck capacity or purchase price. Over the range of truck sizes studied, capacity increases more than 150 times, but average costs per mile for repairs and maintenance only four times. The larger (and more costly) the truck, the higher the repair bill for any particular job, but the greater the "length of life," or the miles which can be travelled before major overhauling becomes necessary. In these calculations, for example, major overhauling was specified at 60,000 miles for pickup trucks and at 90,000 miles for 3-ton trucks.

For any particular truck size, repair and maintenance costs per mile tend to increase with mileage travelled at an increasing rate until it becomes necessary to carry out a major overhaul or replace the motor. However, time depreciation affects repair and maintenance costs. If, for example, a truck travels 50,000 miles in one year, the repair bill per

* (Excluding truck and crew travel time.)

Figure III

Relationship Between Annual Volume and Average Number of Men in Pickup Crew, 75 New England Live Poultry Assemblers, 1957



mile is likely to be lower than if the 50,000 miles is spread over five years. This point requires some modification of the relationship of repair costs to total miles travelled when annual mileage travelled varies.

In these analyses it was assumed that vehicles would be traded prior to major overhauling or engine replacement. Normal mileage per year was assumed to be 10,000. Based upon data from assembly firms, dollar costs per successive 10,000-mile intervals were constructed for each truck size. The accumulation of these through the 10,000-mile interval preceding major overhauling or engine replacement yielded the "cycle cost." Regardless of age or mileage, some "maintenance" work is required, providing an irreducible base to which "variable repairs" are added. Maintenance is estimated at 1 percent of new cost per year.

The following formula was used to calculate repairs and maintenance:

$$RM = \frac{(C + (Y - X.01\ N)}{m}\ m'$$

In the preceding formula:

- RM = annual $ cost of repairs and maintenance for specified annual mileage m′.
- C = "cycle cost" — based on increasing rate per mile for period prior to major overhaul.
- Y = number of years to major overhaul at m′ miles per year.
- X = number of years to major overhaul at 10,000 miles per year.
- N = new cost of vehicle in dollars (truck + ½ body or trailer, if separate).
- m = miles in cycle to major overhaul.
- m′ = specified annual mileage.

Oil. Costs per mile decrease with annual miles travelled. Although oil consumption increases with aggregate mileage, calculations in these analyses are centered on average rates of consumption for the life cycle of the engine. Furthermore, proper servicing requires oil changes based on time periods when annual mileage is low. Hence, it is assumed oil will be changed every 2,000 miles or 90 days, whichever results in most frequent changes. Oil consumption for periods between changes is estimated at one quart per 250 miles for vehicles of 5-quart crankcase capacity, with consumption for vehicles of different capacity proportional to this rate. A price of 30 cents per quart was used.

Lubrication. Costs per mile decrease with annual miles travelled to the minimum level and are constant beyond this point. It was assumed vehicles would be serviced every 2,000 miles or 90 days, whichever occurred most frequently. Costs per job were increased with truck size.

Tires. As truck size increases, the size and ply of tires increases. Hence, the cost of a new tire or of a recapping rises. However, as size and ply increase, the original mileage obtainable, the number of recapping possible, and the mileage per recapping increase. The number of tires per vehicle increases as dual wheels become standard (or as a tractor-trailer is used).

The mileage obtainable per tire cycle — original plus recapping mileage — is modified by the time factor. As more years are involved in the cycle, total mileage falls. Hence, a modified formula, similar to that derived by Clarke and Bressler,[2] was used to determine total mileage obtainable with various levels of annual mileage:

$$TY = \frac{m}{m' + 4{,}240}$$

In the preceding equation, T Y = tire life in years; m = normal miles obtainable from tires for the particular truck size; m′ = annual miles of travel. To obtain the annual cost for tires (and tubes), the following equation was used:

$$TC = \frac{C}{TY}$$

in which C = the dollar cost per tire cycle for original purchase plus recappings and TC = the annual dollar cost.

Gasoline. As truck size increases the number of miles obtained per gallon declines. On the basis of data obtained in the survey and from secondary sources, gasoline consumption was assumed to decline from 16 miles per gallon for the smallest truck size to 5 miles per gallon for a tractor. A price of 25c per gallon of gasoline was used.

Other investigators have divided gasoline consumption into a fixed amount per day plus a variable component related to miles travelled.[3] However, the size of the fixed item is likely to be of minor importance for trucks such as those used in poultry assembly, whereas for delivery trucks making numerous stops it would be relatively larger.

Other Fixed Operating Costs. These include: registration and license fees, bonding charges, and purchase of anti-freeze. Registration and bonding costs were established in relation to truck capacity by interpolating from information obtained on field schedules. License costs were established at $3 per vehicle, the modal value of charges levied by the New England states when transfer costs were included. Cost of anti-freeze, at $2 per gallon, was determined by radiator capacity. Provision was made for temperatures of –30°F.

Federal Excise Tax. This has been included at $1.50 per year for each 1,000 pounds taxable gross weight paid by registrant on truck combinations over 26,000 G.V.W.[4]

---

[2] Clarke, D. A., Jr., and R. G. Bressler, Jr. Efficiency of Milk Marketing in Connecticut: 6. Truck Costs and Labor Requirements on Milk Delivery Routes. Storrs (Conn.) Agr. Exp't. Sta., Bul. 248. June 1943, p. 8.

$$Y = \frac{20{,}000}{R + 4{,}240}$$; Y = years of life; R = the annual rate of travel.

This formula was intended to apply only to tires with a life of 20,000 miles. For other situations the factor of 4240 should be adjusted.

[3] Clarke, D. A. Jr., and Bressler, R. G., Jr., op.cit., p. 4.

[4] *Motor Truck Facts,* Automobile Manufacturers Association, Detroit, Michigan, 1957 Edition, p. 28-33.

Other Taxes. Other Federal excise taxes on motor truck sales, tires, parts, accessories and gasoline, general State sales taxes, State gasoline taxes, tolls, special city and county taxes, etc., are assumed to be included under other cost items.

Highway-User Tax. Taxes are levied by States against truck operators on the basis of mileage or value. However, these generally exclude operators of vehicles not for hire. Hence, since contract haulers would be the only group of poultry assemblers materially affected, no cost has been included for highway-user taxes in these analyses.

Depreciation — Trucks. A standardized list of percentages of original cost, by years of age, was derived by using published "book values" for trucks.[5] These percentages decline progressively — from 25 percent in the first year to 3.25 percent between the 9th and 10th years. Appendix Table I summarizes these rates. Depreciation rates established by reference to automotive industry pricing are presumed to reflect "normal" wear depreciation and time depreciation. Vehicle age and aggregate mileage were assumed to offset each other and "condition" was assumed as standardized at trade-in time by the repair and maintenance program. New cost prices were established by 1957-58 values quoted by poultry assembly firms in New England.

Furthermore, it was assumed that trucks would be traded every 10 years or prior to a major overhaul or engine replacement, whichever occurs first. For vehicles where chassis and body can be purchased separately (in this study, 1-ton trucks and larger with platform bodies), it was assumed the body would be traded half as frequently as the chassis, or at least every 10 years.

Interest — Trucks. Annual costs were determined according to the formula:[6]

$$I = (P - S) \frac{(r) \quad (n + 1)}{(2) \quad (n)} + Sr$$

where I represents annual cost, P the original investment, r the rate of interest, n the years of expected use, and the S the salvage value at the end of the useful life. Charges for chassis and body, with different years of expected use, were separately determined and combined into the total charge.

Property Taxes — Trucks. The "normal" depreciated values, described under the section entitled "depreciation-trucks," were used as a basis for calculating the property tax. This was levied at the rate of 3 mills per dollar of value for the particular number of years of age, with a minimum charge of $4.50 per year per truck.

Insurance — Trucks. Rates for trucks of various sizes were interpolated from information on field schedules. Considerable variation exists from State-to-State, and rates are also influenced by distance travelled and extent of coverage desired. Herein, modal values were used.

---

[5] Official Automobile Guide, Price Edition, Recording and Statistical Corporation. 87th Edition, Jan. 1958.

[6] Clarke, D. A. Jr., and R. G. Bressler, Jr., op. cit., p. 14.

Other Costs

Management. Annual costs for buying, management, and office functions were determined for each truck size, and for multiples of each truck size up to 12. These were based upon fractional allocations from data for these and other functions, plus selling, for the entire operation of a poultry processing plant.[7] Allowance for selling live birds is not included in the "management" group figures for this study. Multiple unit firms (additional trucks of the same size) are able to realize economies of scale in management. Economics also exist in moving from a given truck to one of larger capacity provided volume is expandable.

Depreciation — Crates. Crates are an item of considerable expense to poultry assemblers. Probably careful handling, periodic repairing, and minimizing exposure to the elements would reduce costs below the present levels.

In this analysis, depreciation was varied according to the percent of capacity at which the unit operated. Each 10 percent change in volume was accompanied by a charge of 10c per crate per year for depreciation. For example, at 50 percent capacity, the charge was $1.50 per crate per year, and at 100 per cent capacity, $2.00 per crate per year.

The number of crates owned was determined to be proportionate to numbers established in an earlier study involving model processing plants.[8] Crate numbers are more than double the number per truck to allow for crates held at loading and unloading points and in the process of repair. The number of crates required was approximated by the following formula:

$$\text{No. of crates} = \frac{\text{Annual volume in pounds at 100 percent capacity}}{11{,}667}$$

Buildings

Building space provided for model assembly firms includes provision for areas devoted to an undercover unloading dock, platform for full and empty crates, crate cleaning and storage, weighing, and office. Most assembly firms do not provide garage space for vehicles; at best, some might back vehicles into the unloading area. Although some firms provide space for repairing and servicing vehicles, herein, no provision is made for special areas for these purposes. While some firms may have space devoted to holding birds in batteries, such is regarded in these analyses as related to processing or selling rather than assembly. Hence, no battery area is included under building space.

The square feet of building space provided for assembly firms was determined in relation to annual volume. The amount of space was determined in proportion to that provided in an earlier study of processing plants for the same purposes enumerated above. The total cost of such space was established by using the costs per square foot for processing plants of like area.[9]

Appendix Table II shows the rates used to determine certain fixed overhead costs, and Appendix Table III the dollar investment required for selected model firms.

---

[7] N. H., Sta. Bul. 459, op. cit., Table 8, p. 30.
[8] Op. cit., Appendix Table I, p. 52.
[9] Op. cit., data used to calculate Tables 5 and 6, p. 24 and 26.

Appendix Table I. Depreciation Rates on Trucks Used for the Assembly of Live Poultry

Year	Trade-in Value as Percentage of New Value [1]	Annual Depreciation Rate [2]
1	75.00	25.00
2	60.00	15.00
3	51.00	9.00
4	43.00	8.00
5	36.00	7.00
6	30.00	6.00
7	25.00	5.00
8	21.00	4.00
9	17.50	3.50
10	14.25	3.25
11	11.75	2.50
12	10.00	1.75

[1] End of Year

[2] Relative to new price

Appendix Table II. Rates Used to Determine Certain Fixed Overhead Costs per Year for Firms Assembling Live Poultry

Item	Percent of New Cost
Depreciation — buildings	5
Repairs and maintenance — buildings	3
Insurance — buildings and equipment other than trucks	1
Property tax — buildings and equipment other than trucks	1
Interest — trucks, buildings, equipment	3

Appendix Table III. Investment Required for Selected Model Firms Assembling Live Poultry

Firm		Investment				
Model No.	Annual Volume	Trucks	Buildings	Crates	Total	Per pound of Annual Capacity
	(mil. lbs.)		(dollars)			(cents)
I	1.17	2,400	4,000	300	6,700	0.57
II	2.37	3,050	4,700	600	8,350	0.35
III	4.61	4,800	5,800	1,200	11,800	0.26
IV	8.85	8,250	7,300	2,400	17,950	0.20
V	12.88	11,250	8,375	3,600	23,225	0.18
VI	17.02	15,750	9,300	4,800	29,850	0.18
VII	25.21	22,500	11,100	7,200	40,800	0.16
VIII	34.66	30,000	12,600	9,000	51,000	0.15
IX	51.96	45,000	15,100	13,500	73,600	0.14
X	69.24	60,000	18,500	18,000	96,500	0.14

Appendix Table IV. Relationship Between Processing Plant Size and Number, Size and Type of Units, Supplying 4 New England Plants, 1956–57

Item	Size Group[1]			
	Less than 1 million	1–4 million	10–15 million	More than 25 million
Type of producing area where located	Semi-commercial; eggs important, meat chickens secondary	Semi-commercial; eggs important, meat chickens secondary	Commercial; meat chickens and eggs both important	Commercial; meat chickens dominant, eggs minor importance
Number of units from which birds acquired (annually)	80	165	407	250
Average no. lots acquired per unit	4.38	4.22	4.15	4.00
Number of lots acquired (annually):				
Broilers	44	51	838	635
Heavy young chickens	47	108	232	235
Fowl, miscellaneous	259	538	617	130
Total	350	697	1,687	1,000
Average no. lbs. per lot acquired:				
Broilers	1,605	9,090	13,709	32,424
Heavy young chickens	2,171	4,800	12,896	24,123
Fowl, miscellaneous	2,070	1,875	2,384	5,208
Average	2,025	2,770	9,124	26,961
Relative importance of various types of producing units:				
Owned farms	none	none	none	minor
Own contract flocks	none	none	minor	bulk
Other contract flocks	none	secondary	secondary	minor
Independent producers	all	primary	primary	minor

[1] Pounds, live weight, annually

Appendix Table V. Distribution of Sizes of Trucks Registered by Assemblers of Live Poultry, New England, 1957

Item	Firms with Specified Numbers of Trucks				
	1 truck	2–3 trucks	4–6 trucks	7 or more trucks	Total
			(number)		
Firms	232	82	15	13	342
Trucks	232	184	69	131	616
Classification:	Distribution of Truck Sizes by Tonnage Classification				
			(percent)		
½	18.1	4.4	4.9	0.0	8.5
¾	11.4	8.7	3.3	2.8	7.8
1	18.1	11.5	6.6	4.2	11.8
1½	27.3	24.0	9.8	4.2	19.3
2	22.9	33.3	39.3	15.5	25.9
2½	2.2	9.3	3.3	18.3	8.2
3	0.0	2.2	18.0	15.5	6.0
Trailers	0.0	6.6	14.8	39.5	12.6
Total	100.0	100.0	100.0	100.0	100.0

Appendix Table VI. Inventory Value of Trucks Owned by Assemblers of Live Poultry Registered in New England, 1951–57[1]

Year	Assembler Size by Number of Trucks[2]				Value all Trucks	Average Value Trucks Each Assembler
	1 Truck	2–3 Trucks	4–6 Trucks	7 or more Trucks		
			(dollars)			
1951	428,536	332,401	131,673	58,717	951,327	1252
1952	397,256	305,057	119,780	92,211	914,304	1293
1953	345,644	280,276	91,746	117,434	835,100	1338
1954	321,402	251,223	59,465	109,164	741,254	1303
1955	283,084	217,898	75,606	109,164	685,752	1353
1956	236,164	173,464	59,465	133,974	603,067	1426
1957	181,424	158,083	59,465	109,164	508,136	1486

[1] At 1957 price level — Retail value averaged for several makes as given in "Official Automobile Guide" — 87th Edition — The Recording & Statistical Corporation, Boston 25, Mass.

[2] Includes trucks and truck trailers.

Appendix Table VII. Proportions of Young and Mature Chickens and Average Lot Size Hauled by Selected Sizes of Model Assembly Firms

Firm Capacity	Young Chickens [1]	Mature Chickens [2]	Average Lot Size per Farm
(million pounds hauled annually)	(percent)	(percent)	(pounds)
0.5 and less	50	50	[3]
1.0	56	44	3,000
2.0	60	40	4,600
3.0	63	37	5,500
4.0	67	33	6,400
5.0	70	30	7,000
7.5	75	25	8,000
10.0	80	20	9,000
12.5	81	19	10,000
15.0	82	18	12,500
17.5	83	17	15,000
20.0	84	16	20,000
25.0	86	14	27,000
30.0	90	10	28,000
35.0	94	6	29,000
40.0	95	5	30,000
50.0	96	4	30,000
60.0	97	3	30,000
70.0	98	2	30,000

[1] Broilers, caponettes, roasters, pullets. 52.5 pounds per crate.

[2] Fowl and roasters. 60.0 pounds per crate.

[3] From 40 pounds at 2,000 pounds annually to 1,400 pounds at 500,000 pounds annually.

Appendix Table VIII. Age of Trucks Owned by Assemblers of Live Poultry Registered in New Hampshire, 1957

Age in Years	Assembler Size by Number of Trucks[1]				
	1 Truck	2–3 Trucks	4–6 Trucks	7 or more Trucks	All Trucks
		(percent)			
1	6.8	2.2	2.0		2.9
2	4.5	20.0	9.8	6.1	10.4
3	18.2	26.7	17.6	27.3	21.9
4	18.2	4.4	11.8	3.0	9.8
5	13.7	4.4	17.6	18.2	13.3
6	9.1	17.8	9.8		9.8
7	9.1	6.7	13.7	18.2	11.6
8	4.5	11.1	11.8	6.1	8.7
9–18	15.9	6.7	5.9	21.2	11.6[2]
Total	100.0	100.0	100.0	100.0	100.0
			(years)		
Ave. Age	5.7	4.8	5.3	6.0	5.4

[1] Trucks and truck trailers.

[2] 24 percent of trailers are from 9–18 years old.
9.5 percent of trucks are from 9–18 years old.

Appendix Table IX. Average Length of Haul for Live Poultry Assemblers, New England, 1957[1]

Firm size	Number of firms whose average round-trip haul was given number of miles:							Weighted average route length in miles
Annual Volume	Less than 25	26–50	51–75	76–100	101–125	Over 125	Total	
(1,000 pounds)								
Less than 50	2	5	5	2	0	0	14	51.1
50–300	0	0	7	5	3	1	16	85.3
300–1,000	0	0	0	2	5	4	11	116.3
1,001–4,000	0	0	0	1	8	3	12	119.8
4,001–10,000	0	0	2	4	1	1	8	86.6
10,001–20,000	0	0	0	3	5	0	8	102.7
Over 20,000	0	0	1	4	1	0	6	88.0
Total	2	5	15	21	23	9	75	

[1] Based on a stratified random sample of 75 firms.

Appendix Table X. The Effect of Increasing Truck Size and Annual Mileage on the Cost of Live Poultry Assembly [1]

Model number and description [2]	Annual Volume	Cost Group	Annual Mileage per Truck 5,000	10,000	25,000	50,000
	(1,000 lbs.)		(cents per pound)			
E	965	Labor	.605	.674	.916	1.244
¾ Ton–30 crate		Other	.231	.264	.344	.462
capacity		Total	.836	.938	1.260	1.706
H	3,535	Labor	.342	.396	.559	.792
1½ Ton–130 crate		Other	.155	.166	.198	.248
capacity		Total	.497	.562	.757	1.040
K	5,924	Labor	.333	.373	.514	.695
3 Ton–220 crate		Other	.145	.153	.181	.224
capacity		Total	.478	.526	.695	.919
L	8,572	Labor	.289	.335	.449	.615
Trailer–320 crate		Other	.147	.154	.182	.226
capacity		Total	.436	.489	.631	.841

[1] At 100 percent of capacity.

[2] Single truck operation.

Appendix Table XI. The Effect of Increasing Firm Size and Annual Mileage on the Cost of Live Poultry Assembly [1]

Number of Trucks [2]	Annual Volume	Cost Group	Annual Mileage per Truck 5,000	10,000	25,000	50,000
	(1,000 lbs.)		(cents per pound)			
1	5,924	Labor	.333	.373	.514	.695
		Other	.145	.153	.181	.224
		Total	.478	.526	.695	.919
3	17,464	Labor	.275	.306	.398	.510
		Other	.123	.130	.152	.190
		Total	.398	.436	.550	.700
5	28,825	Labor	.251	.267	.321	.397
		Other	.115	.123	.145	.183
		Total	.366	.390	.466	.580
7	40,061	Labor	.243	.257	.274	.365
		Other	.108	.116	.138	.177
		Total	.351	.373	.412	.542
9	51,431	Labor	.239	.251	.282	.331
		Other	.103	.110	.132	.171
		Total	.442	.361	.414	.502

[1] At 100 percent of capacity.

[2] 3 ton trucks of 220 crate capacity — Model K.

Appendix Table XII. Costs of Operating Various Sizes of Trucks at Various Annual Mileages per Truck in Assembling Live Broilers [1]

Model No.	Truck Size: Tons	Truck Size: Crate capacity	Annual volume	Annual Mileage per Truck: 5,000	10,000	25,000	50,000
			(1,000 lbs.)	(cents per pound)			
A	Homemade[3]	2	52	.042	1.418	2.568	4.297
B	Homemade[2]	5	129	.405	.607	1.080	1.798
C	Homemade[2]	10	259	.220	.325	.576	.948
D	½ ton	20	519	.128	.187	.324	.527
E	¾ ton	30	908	.083	.119	.203	.328
F	1 ton	60	1,556	.056	.078	.133	.217
G	1 ton	100	2,594	.041	.055	.093	.152
H	1½ ton	130	4,372	.035	.048	.081	.133
I	2 ton	160	4,150	.037	.048	.079	.126
J	2½ ton	190	4,928	.039	.049	.078	.125
K	3 ton	220	5,681	.042	.050	.079	.124
L	Trailer[3]	320	8,299	.055	.062	.091	.136
				(cents per mile)			
A	Homemade[2]	2	52	9.78	7.36	5.33	4.46
B	Homemade[2]	5	129	10.48	7.85	5.59	4.65
C	Homemade[2]	10	259	11.42	8.43	5.98	4.92
D	½ ton	20	519	13.30	9.69	6.73	5.47
E	¾ ton	30	908	15.04	10.79	7.40	5.96
F	1 ton	60	1,556	17.30	12.09	8.27	6.74
G	1 ton	100	2,594	21.16	14.23	9.64	7.89
H	1½ ton	130	3,732	23.74	16.06	10.92	8.99
I	2 ton	160	4,150	30.94	19.78	13.05	10.43
J	2½ ton	190	4,928	38.86	24.34	15.44	12.31
K	3 ton	220	5,681	47.28	28.64	17.97	14.08
L	Trailer[3]	320	8,299	91.56	51.36	30.24	22.61

[1] At 100 percent of capacity–15 broilers, 3.5 pounds each, 52.5 pounds per crate. Includes: repairs, maintenance, oil, grease, lubrication, Fed. excise tax, tires, gas, registration, license, bond, anti-freeze depreciation, interest, insurance, property tax.

[2] Car and trailer or homemade pickup truck.

[3] Tractor-trailer combination.

Appendix Table XIII. Changes in Per Pound Costs of Poultry Assembly of Selected Items with Changes in Volume, Truck Size, and Miles Travelled

Cost Group	Item	Change in Cost per Pound: As firm volume increases	As truck size increases	As mileage per truck increases
Variable operating	Labor [1]	Decreases	Decreases	Increases
	Truck repairs and maintenance	Decreases	Decreases	Increases
Constant-unit operating	Gasoline [2]	Decreases	Decreases	Constant [2]
	Oil, lubrication [2]	Decreases	Decreases	Constant [2]
	Tires [2]	Decreases	Decreases	Constant [2]
	Fed. excise tax [3]	Constant	Constant	Constant
Fixed operating	Management	Decreases	Decreases	Constant
	Miscellaneous [4]	Decreases	Decreases	Constant
	Truck insurance	Decreases	Decreases	Constant
Fixed overhead	Truck depreciation	Decreases	Decreases	Constant
	Truck interest	Decreases	Decreases	Constant
	Truck property tax	Decreases	Decreases	Constant
	Crate depreciation	Decreases	Constant	Constant
	Building costs [5]	Decreases	Decreases	Constant

[1] Drivers, helpers, foremen.

[2] Gasoline consumed in starting and idling, oil changes and lubrication at time intervals, and time depreciation (age) on tires constitute an initial cost. Thereafter, rates of use related to mileage.

[3] Flat rate per pound on largest trucks only.

[4] Registration, license, bonding, anti-freeze.

[5] Depreciation, interest, taxes, insurance.