



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*



Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

Costs and Economies of SCALE in TURKEY PROCESSING PLANTS



+



=



Marketing Research Report No.627

PREFACE

Despite substantial gains in the efficiency of turkey processing in recent years, opportunities still exist for further reduction in costs. These savings can be realized by adopting improved technology and machinery, by fuller use of present plant capacity, and by increasing the size of plants.

Research completed earlier on costs and economies of scale in processing chickens provided scientifically developed guidelines to aid plant managers to increase efficiency. The Poultry Research and Marketing Advisory Committee and many individual firms asked the U. S. Department of Agriculture to undertake similar research to aid turkey processors. A preliminary report, ERS-26, "Costs and Efficiency in Turkey Processing Plants," issued in August 1961, presented some of the preliminary results obtained from a survey of more than 25 turkey processing plants of various sizes and types. This report examines those survey results in more detail and projects the potential economies of scale in turkey processing with standardized practices and factor cost rates for 10 model plant sizes.

This study is part of a broad research program conducted by the Economic Research Service to improve the marketing of poultry and eggs.

CONTENTS

	<u>Page</u>
Summary	iii
Background and Objectives	1
Procedure	3
Costs and Efficiency in Actual Plants	4
Costs of processing various market classes	5
Actual costs in relation to plant size	6
Investment in plant and equipment	6
Labor efficiency	9
Managerial efficiency	13
Economies of Scale in Turkey Processing	15
Plant size and use of capacity	16
The classification and nature of processing costs	19
Importance of various cost factors in producing economies of scale	23
Effect of market class on economies of scale	34
Effect of length of operating year on economies of scale	37
Effect of wage and salary levels on economies of scale	37
Adjusting to the effects of economies of scale in processing	39
Appendix	41

SUMMARY

Material gains in the efficiency of turkey processing have occurred in recent years with the adoption of new technology and machinery, increases in plant size, better utilization of capacity, and changes in industry structure. This report measures present costs and efficiency in turkey processing plants and the possibilities for both short and long-range reductions in costs and gains in efficiency. Plant managers can use these data to compare their present situations with similar plants and to plan for future adjustments to keep themselves competitive.

Lowest costs per pound in processing turkeys result when plants process good quality heavy young hens and toms. Costs for heavy young hens and toms combined averaged 5.8 cents per pound according to a sample of 25 plants surveyed in 1960-61. For breeders, average costs per pound were 6.2 cents, and for fryer-roaster turkeys, 6.7 cents per pound.

When plant size increased from 400 heavy young hens per hour to about 1,500 per hour average costs per pound declined from 6.6 to 5.4 cents per pound. While these costs suggested the existence of economies of scale in processing, they did not provide a standardized measure of the exact nature and extent of potential cost savings.

There are differences between surveys of actual costs and those derived by the study of standardized synthetic models. In addition to plant size, differences causing actual cost to vary are: Age and condition of the plant and equipment, extent of utilization of capacity, organization and efficiency in operating, supervisory, office, and managerial employees, levels of factor prices, and the weights and market classes of birds processed.

By studying synthetic model plants, in which the various factors were standardized, substantial economies of scale were found to exist in turkey processing. When model plants were processing heavy young hen turkeys weighing 13 pounds each (ready-to-cook), and operating at 100 percent of capacity for 144 days, costs declined from 6.9 to 4.5 cents per pound over a range of plant sizes from 200 to 4,000 head per hour of operation. More than half the savings of 2.3 cents per pound resulted as plant size increased from 200 to 800 head per hour. More than three-fourths of the savings were obtained with a plant having a capacity of 1,500 head per hour. The remaining savings between a plant with a capacity of 1,500 head per hour and one of 4,000 head per hour totaled about one-half cent per pound.

Similar results were obtained for heavy young toms. The potential cost savings from the smallest to the largest model plant was almost 1.9 cents per pound. Almost three-fifths of the savings were obtained as firm size increased from 150 to 600 head per hour of operation. More than three-fourths of the savings were obtained with a plant having a capacity of 1,125 head per hour. The remaining savings between a plant with a capacity of 1,125 head per hour of operation and one with a capacity of 3,000 head per hour totaled less than one-half cent per pound. If an equal number of hens and toms were processed, the toms would exert somewhat more influence on average costs per pound, since the total weight of toms would be greater.

Output per man-hour in model plants is somewhat higher than good performance levels observed in plants surveyed. This results from a higher rate of utilization of capacity, some differences in bird sizes, the more efficient crew organization assumed for model plants, and other assumption such as uniform quality and optimum scheduling of output. As plant size increases, the largest gains in output per operating employee are realized in the receiving and dressing operations. Here, fewer employees are

required, as machinery readily substitutes for labor. In the eviscerating and chilling, and packing, boxing, and freezing operations, output per man-hour tends to level off as larger plant sizes are approached.

Average total costs per pound are materially affected by the rate of use of capacity. Costs per unit of product are successively lower, without exception, for each percentage level as plant size increases. Relative advantages are minimized at 100 percent of capacity, but widen below this level. This suggests that each successively larger plant has an advantage over the next smaller unit. Using models 1, 4, 7, and 10, the respective average costs for hens per unit of product at 40 percent of capacity are 11.6, 8.7, 8.0, and 6.9 cents per pound. At 70 percent of capacity, the costs are 8.4, 6.5, 6.0, and 5.3 cents per pound, and at 100 percent of capacity, 6.9, 5.5, 5.0, and 4.5 cents per pound. These models have capacities of 200, 800, 1,500, and 4,000 head per hour of operation.

Aggregate costs per pound decline for all market classes of turkeys as plant size increases. The advantages of larger plants remain consistent irrespective of market class. When the national pattern of slaughter is used to weight heavy young hens and toms, breeders, and fryer-roasters together, the decline in costs from the smallest to the largest model plant was about 2.2 cents per pound over a volume range of 3 to 65 million pounds.

Under present conditions, the possibility of operating at capacity for 12 months is only hypothetical. If it were possible to move from 7 to 12 months operation, some costs per unit of product would be reduced. These would include some of the fixed overhead items and fixed operating costs such as salaries, miscellaneous, heat, telephone, and other utilities. The net effect would be a decline of 8-9 percent in average cost per unit of product.

Some firms do, or may, pay higher wage and salary levels than were used in most of the models. A high wage and salary level, of about 1 1/2 times the typical level, would increase costs per pound 15 percent on the smallest models, but only 10 percent on the largest, based on 7 months operation at capacity.

The existence of economies of scale, i.e., decreasing costs per unit of product with increasing plant size, suggests that there will be a movement toward fewer and larger plants in order to realize the additional economies available. In actual practice, management must seek its best adjustment on plant size as part of a package of costs and returns. The nature of cost relationships in procurement and assembly as volume increases may partially offset economies of scale in processing. Moreover, in a vertically integrated organization, costs of providing major production inputs such as feed and poults should be considered. Hence, when these other factors are considered the optimum plant size for a particular firm may be smaller than the largest model used in this study.

COSTS AND ECONOMIES OF SCALE IN TURKEY PROCESSING PLANTS

By George B. Rogers and Earl H. Rinear
Agricultural Economists
Marketing Economics Division
Economic Research Service

BACKGROUND AND OBJECTIVES

This study is concerned with the costs and efficiency of turkey processing in recent years. Material gains have resulted from the adoption of new technology and machinery, increases in plant size, better utilization of capacity, and changes in industry structure. Processing costs per pound have not fully reflected increases in wages and in prices of other items and services. Nevertheless, there remain wide variations in costs of turkey processing and in the degree of efficiency achieved by individual plants.

No systematic and comprehensive studies of turkey processing costs have been made for many years. The most recent studies of this type were published by other agencies and by State experiment stations in 1954. In the interim there have been extensive technological and structural changes in the industry. Hence, the results of earlier studies are largely inapplicable to the present industry.

Turkeys are produced in every State. Ten States, California, Minnesota, Iowa, Missouri, Texas, Wisconsin, Utah, Indiana, Ohio, and Virginia, accounted for more than 70 percent of the 1,878 million pounds produced in 1961. Of the more than 108 million head of turkey raised in 1961, almost 90 percent were heavy breeds. Virginia, Minnesota, Ohio, Iowa, and Missouri raised more than two-thirds of the total of light-breed turkeys. The marketing of turkeys from farms is heaviest from July to January.

Turkey production is concentrated on a small number of farms. Although 88,000 farms reported raising turkeys in 1959, 93 percent of the total turkey output was raised on 8,830 commercial poultry farms. Almost 88 percent of total output was on 4,746 commercial poultry farms raising 3,200 or more turkeys. Over 68 percent of the turkeys were raised on 2,076 commercial poultry farms each having 10,000 or more turkeys in 1959. The average number of turkeys raised per farm for the farms raising 10,000 or more turkeys in 1959 was over 26,000. ^{1/}

Although the number of farms raising turkeys declined about 50 percent from 1949 to 1959, the average number raised per farm reporting was more than four times as great. Larger lots of birds, plus more uniformity in size and quality of birds, has contributed to reduced assembly and processing costs.

Consumption of turkey meat in the United States is estimated at 7.5 pounds per capita in 1961; it was 6.2 pounds in 1960, and 4.4 in 1951. Turkeys are now used more widely in periods other than the Thanksgiving and Christmas seasons. This has occurred because the price is favorable in relation to that of other meats; also because of the development of satisfactory fryer-roaster strains and breeds, and less seasonality in production. Nevertheless, consumption is still highly seasonal,

^{1/} Bureau of Census. "Census Finds Poultry Industry Highly Commercialized and Specialized". CB62-35. U. S. Dept. of Commerce, Wash., D. C. Mar. 26, 1962, p. 3.

and large volumes are stored in frozen form during peak producing months for later use.

Of the 600 commercial poultry slaughtering plants processing 30,000 pounds or more per week when operating, more than 100 of them slaughter large volumes of turkeys. Of these 100 plants, four-fifths primarily slaughter turkeys; the other one-fifth slaughter more chickens than turkeys. Many turkey farmers dress and draw their own turkeys, selling most of their output locally and in fresh-killed form. On the other hand, most of the turkeys sold by commercial plants are frozen ready-to-cook. Many commercial turkey processing plants are owned and operated by farmer cooperatives. In 1960, commercial poultry slaughtering plants handled 80 percent of the live weight of turkeys sold from farms.

Commercial slaughter of turkeys is lowest in February and continues at a relatively low level well into April. Beginning in late April and continuing into July, breeders are slaughtered in some volume. Slaughter of heavy young turkeys picks up in May and June, and increases rapidly in July, August, and September. Peak slaughter of heavy young turkeys occurs from late September to Christmas. Fryer-roaster turkeys are slaughtered more uniformly the year around than other classes, though volume picks up to a limited extent during the same periods when slaughter of heavy young turkeys is heaviest.

Processing of turkeys thus remains a highly seasonal operation for many firms. Some firms process only heavy young hens and toms from July to January, and perhaps a few breeders during the spring and early summer. In recent years the operating season has been lengthened by some farms raising more than one batch of heavy young turkeys. Other measures which have allowed plants to make fuller use of capacity than formerly, and to retain the nucleus of a regular and efficient labor force, include using other market classes (such as chickens), cutting up and boning turkeys, and producing further-processed turkey products during the slack season.

Considerable excess capacity still exists in turkey processing plants. The plants need to be large enough to process the crop as rapidly as it comes to market, but much of their capacity is unused the rest of the year. In 1960-61 almost half of the plants studied operated at less than 30 percent of potential annual capacity, and almost 85 percent at less than 50 percent of potential annual capacity as the following tabulation shows: 2/

<u>Percentage of annual capacity utilized</u> <u>3/</u>	<u>Percentage of firms</u>
0 - 9.9	8
10.0 - 19.9	15
20.0 - 29.9	23
30.0 - 39.9	23
40.0 - 49.9	15
50.0 - 59.9	12
More than 60.0	4

2/ Rogers, G. B. and Rinear, E. H. Costs and Efficiency in Turkey Processing Plants. ERS-26, U. S. Dept. Agr., Aug. 1961, p. 8.

3/ Computed by assuming 247 operating days of 8 hours each per year. Capacity obtained by multiplying number of head of each market class of poultry (including both turkeys and chickens) which can be processed per hour by the firm's average eviscerating weight for that class. The proportions of various market classes of poultry at capacity and at actual levels of operation were assumed to be the same.

Earlier studies of turkey and chicken processing suggest that costs per unit of output decline as plant size increases. Determination of the exact relationship between plant size and costs, and the effect of rate of utilization of capacity on costs, should provide plant operators with goals in reducing costs, toward which they can work as industry structure and technology permit.

PROCEDURE

During late 1960 and early 1961, researchers visited more than 25 commercial turkey processing plants. The plants, ranging in capacity from less than 200 heavy young hens per hour to more than 2,000 per hour, were in Minnesota, Wisconsin, Kansas, California, Utah, Colorado, and Virginia. About 40 percent of the plants selected were operated by farmer cooperatives. The sample included plants specializing in processing turkeys as well as plants which handled large volumes of chickens. Data obtained from these plants included plant layouts, types of equipment, crew organization, practices, volumes, and operating costs for the most recent accounting year and for sample weeks and months.

The sample of plants studied was drawn from the group of commercial slaughtering plants which handle large volumes of turkeys. Sample plants accounted for more than 25 percent of the volume handled by plants using large volumes of turkeys. Many of these high-volume plants can make short-run gains in efficiency by studying and adopting some of the practices of efficient organizations. All plants can do a better job of long-range planning by studying the economies of scale which synthetic analysis indicates are inherent in turkey processing.

Within a particular operating season there is little that a plant operator can do about plant size and layout or the available volume. Hence, adjustments to reduce costs or increase efficiency are largely confined to modest changes which relate to the number, selection, and use of employees.

Management may have little opportunity at any time to control some cost items, such as supplies, materials, and utilities, and basic wage rates. Moreover, rates of use of supplies, materials, utilities, and miscellaneous items are related to trade practices, sanitary standards, and machine capacities.

Between processing seasons, or in slack periods, management can rearrange processing lines; add new equipment; more extensively reorganize its operating crew and supervisory, managerial, office, and service activities; and initiate steps to increase total volume, or change the proportions of various market classes. Only over a longer period, however, can management make major changes in plant capacity or completely replace existing facilities and equipment.

The long-range planning curve for the firm can be derived by an economies of scale analysis. Average cost curves can be derived for selected model plant sizes, and assuming all costs to be variable in the long run, an envelope curve can be drawn approximately tangent to these individual plant curves. Study of these basic relationships between plant size and costs per unit of output can suggest to managers of turkey processing plants the adjustments they should plan to make over time to remain competitive. These may involve: (1) Expanding plant capacity toward more optimum sizes if they continue in mass-volume operations; or (2) increased reliance on marketing through other channels or in other product forms if plant capacity is not likely to be increased.

The succeeding sections of this report are concerned with the study of factors determining present costs and efficiency and with the possibilities for both short and long-range reductions in costs and increases in efficiency. Costs covered in this report are for within-plant processing operations and do not include procurement and delivery. These latter costs may have an important effect on plant size and location in some environmental situations.

Levels of present costs and efficiency are represented by the results of the survey completed in 1961. Such costs reflect lower levels of performance than are derived in this report by the synthetic method. They exist because of lower rates of utilization of capacity, varying ages and conditions of plants and equipment, institutional factors which affect cost rates, and differing managerial situations.

Thus, the economies of scale were analyzed by synthesizing model plants of different capacities and by standardizing operations. The 10 model plants constructed for analysis were standardized to the most up-to-date technology available and least-cost methods. Facilities, equipment, factor costs, and practices were standardized. Both the resources required and input-output rates for the syntheses were chosen on the basis of known attainable levels. Projections were made for the 100 percent of capacity level for each model size. Input-output data from actual plant records formed the basis for extending certain unit costs to lower levels of output. Cost rates were those generally applicable during 1959-61. In general, this methodology parallels that employed in a previous study of chicken processing. 4/

This report contains the results of the survey of actual plants followed by a synthetic analysis, discussing the uses and limitations of each approach. Neither approach is completely substitutable for the other. By showing the differences between them, it is hoped that this report will also provide additional perspective with which to evaluate the economies of size of plant in turkey processing.

COSTS AND EFFICIENCY IN ACTUAL PLANTS

Actual average costs per pound for processing turkeys depend partly on decisions of plant managers with respect to certain factors. Among these factors are utilization of plant capacity, emphasis on particular market classes, substitution of equipment and facilities for labor, organization of the working force, and selection and assignment of supervisory and office personnel. Actual average costs per pound are also affected by institutional and technological forces. These include: Prices for supplies, materials, and utilities, and basic wage rates prevailing in different areas; rates of use of supplies, materials, utilities, and miscellaneous items which are functions of trade practices; sanitary standards, machine capacities; the types of market classes and the aggregate volume available in the supply area; and the underlying relationships between plant capacity and costs per unit of product with present technology. Cost levels are also affected by the investment in buildings and equipment, which is associated with the individual unit as a function of its particular history and circumstances. It is extremely difficult to quantify the exact effects of each of these factors on the average cost per pound achieved by a given processing plant. The relationships presented in subsequent pages must, therefore be viewed with this qualification in mind. Averages of costs per pound of product, dollar investment per plant, and physical input-output relationship all reflect heterogeneous circumstances.

4/ Rogers, G. B. and Bardwell, E. T. Marketing New England Poultry 2. Economies of Scale in Chicken Processing. N. H. Agr. Expt. Sta. Bul. 459. Apr. 1959, p. 7-14.

Cost of Processing Various Market Classes

The survey indicated that lowest costs per pound resulted when plants were processing a mixture of good quality heavy young hens and toms. While fewer toms can be processed per hour of operation, weight per bird is higher. Consequently, total pounds per hour is greatest with heavy toms and average costs per pound lowest. This is reflected in the average cost per pound of processing toms of about 5.4 cents as compared to about 6.7 cents for hens (table 1).

Table 1.--Average processing costs per pound (eviscerated weight), for major market classes of turkeys, 1960-61 1/

Item	: Heavy : young : hens	: Heavy : young : toms	: Heavy young : hens and toms : combined	: Breeders	: Fryer- : roasters
	: <u>Cents</u>	: <u>Cents</u>	: <u>Cents</u>	: <u>Cents</u>	: <u>Cents</u>
Wages and salaries <u>2/</u>	2.70	2.02	2.27	2.68	3.04
Packaging, supplies, miscellaneous <u>3/</u>	2.00	1.87	1.92	1.94	2.19
Utilities, ice, freezing, storage <u>4/</u>.....	.95	.72	.80	.73	.70
Fixed overhead <u>5/</u>	1.01	.76	.85	.85	.78
Total processing costs.....	6.66	5.37	5.84	6.20	6.71
	: <u>Pounds</u>	: <u>Pounds</u>	: <u>Pounds</u>	: <u>Pounds</u>	: <u>Pounds</u>
Average weight per head.....	11.29	19.45	15.37	15.08	6.76

1/ For most plants, records were for a fiscal year ending in 1960; however, for a few of the last plants visited, records were for a fiscal year ending in 1961.

2/ Includes plant labor for receiving, killing, picking, pinning, eviscerating, packing, boxing, cleanup, maintenance, freezing, storing, and loading; supervisory, office, and managerial personnel; plus fringe benefits.

3/ Includes all plant and office supplies, grading and inspection, professional services, management travel, dues, contributions, advertising.

4/ Includes ice if purchased; outside freezing and storage facilities where used; and allowance for storage on a share of volume if not otherwise included in plant records.

5/ Includes repairs and maintenance, rent, depreciation, interest, taxes, insurance.

Fewer breeder turkeys than heavy young turkeys can be processed per hour. Breeders may often require additional pinning labor. Also the cost per pound for bagging and packing is slightly higher for breeders than for heavy young toms, though slightly lower than for heavy young hens.

More fryer-roaster turkeys than heavy young turkeys can be processed per hour. However, since fryer-roaster turkeys are considerably smaller lower total poundage per hour results. This produces a higher labor cost per pound of fryer-roasters, and higher packaging costs despite some lower unit prices for bags and boxes.

Much of the variability in total costs per pound, and in the component costs, for various market classes is attributable to the characteristics of plants surveyed. Not all of the plants process each of the four market classes. Moreover, breeders and fryer-roasters probably are not held in storage in frozen form to the same extent as heavy young turkeys.

Some plants surveyed processed chickens as well as turkeys. Some of these plants had higher costs for processing turkeys than plants which processed only heavy young turkeys. These higher costs apparently resulted from: Time lost in changing over from one class of poultry to another; handling and storing additional types of packaging material; use of a standard crew which cannot be readily adapted to least-cost operations for different classes; and additional supervisory, office, and managerial requirements. Thus, the gains which might have been expected from better utilization of capacity were not always realized.

The cost per pound for processing chickens in plants designed primarily for turkey processing frequently is noticeably higher than in specialized chicken processing plants. In plants designed primarily for processing turkeys, the type of equipment and the wide shackle-spacing may not permit least-cost operations when processing chickens. Conversely, however, many plants designed primarily for processing chickens could process turkeys efficiently. However, in either instance the other restrictions noted above would need to be overcome for costs in diversified plants to be as low for each market class as they are in specialized plants.

Actual Costs in Relation to Plant Size

Total costs per pound for processing turkeys declined, for the plants surveyed, as plant size increased from less than 400 heavy young hens per hour to almost 1,500 per hour (table 2). Decreased unit costs for utilities, ice, freezing, storage, and overhead accounted for some of the declines in total costs. However, variations in costs per pound for wage and salaries, packaging, supplies, and miscellaneous items are not necessarily related to plant size. Total costs per pound in table 2 should not be taken as a final judgment of the relationship between costs and plant size. Indeed, the economies of scale analysis contained in a later section of this report show declining total costs per pound through the largest model plant size studied.

Costs varied widely among plants surveyed in each size group. Many factors in addition to plant size affect costs. Among the factors are age and condition of the plant, utilization of capacity, market classes handled, types of packs, labor and managerial efficiency, wage rates, and prices of other items and services.

Faced with the prospect of high processing costs per pound, most small firms have developed premium local outlets for their turkeys. These outlets, plus selection and retention of nearby producers to minimize pickup and trucking costs, have enabled many small firms to offset the effects of higher processing costs.

Investment in Plant and Equipment

Many of the firms surveyed have been in business over a long period of years. Their present plants were developed by expanding smaller initial units. As a consequence, they have added to their buildings and the result is quite different than if the plant had initially been built for the present capacity. Some firms occupy

Table 2.--Average processing costs per pound (eviscerated weight), for heavy young turkeys in plants of various capacities, 1960-61 ^{1/}

Item	Plant capacity (number of heavy young hens per hour of operation)					
	Less than: 400	400-699	700-899	900-1,499	1,500-1,999	2,000 and over
	Cents	Cents	Cents	Cents	Cents	Cents
Wages and salaries ^{2/}	2.33	2.30	2.28	2.11	2.31	2.25
Packaging, supplies, miscellaneous ^{3/}	2.11	1.66	1.91	1.77	1.88	2.12
Utilities, ice, freezing, storage ^{4/}	1.15	1.01	.78	.70	.74	.42
Fixed overhead ^{5/}.....	.98	.90	.90	.81	.65	.83
Total processing costs ^{6/}	6.57	5.87	5.87	5.39	5.57	5.62

^{1/} For most plants, records were for a fiscal year ending in 1960; however, for a few of the last plants visited, records were for a fiscal year ending in 1961.

^{2/} Includes plant labor for receiving, killing, picking, pinning, eviscerating, packing and boxing, cleanup, maintenance, freezing, storing, and loading; supervisory, office, and managerial personnel; plus fringe benefits.

^{3/} Includes all plant and office supplies, grading and inspection, professional services, management travel, dues, contributions, and advertising.

^{4/} Includes ice if purchased; outside freezing and storage facilities where used; and allowance for storage on a share of volume if not otherwise included in plant records.

^{5/} Includes repairs and maintenance, rent, depreciation, interest, taxes, and insurance.

^{6/} These processing costs are for door-to-door operations and do not include costs for procurement and delivery.

buildings originally built for other purposes. A few plants are in relatively new buildings constructed specifically for turkey processing. These variations in buildings are reflected not only in the amount of space available for performing various functions, but also in the dollar investment in plant and in the annual charges for overhead costs. Many firms carry excess space since in the future they may wish to expand capacity further.

Plants which have expanded their facilities gradually are likely to own (but may not have currently in use) relatively more pieces of equipment than newer plants. Some of this equipment may have been acquired second hand. This sometimes reflects an attempted compromise between making do with older equipment and acquiring newer, larger, and more efficient equipment. Hence, some older equipment may be unused while other items are still operating. Much older equipment may be entirely or mostly depreciated on the books.

Moreover, there is great variation among actual plants in the amount of capacity for storing turkeys in frozen form. This affects investment in both buildings and equipment. Some firms own little or no frozen storage space, relying heavily on commercial storage space. This is more likely to be true in areas close to larger population centers where commercial storage space is readily accessible. Few turkey plants currently have enough frozen storage space of their own to enable them to carry as much volume as they might wish over long time periods.

The average investment per plant for plants of various capacities (table 3) is lower than if identical resources were valued at current replacement costs. This reflects the acquisition of these resources new or second hand at earlier and lower costs. In some instances records showed current "book values," representing partially depreciated resources rather than original costs. Investment per plant in the plants surveyed is generally lower than in model plants developed later in this report. This is due both to the use of current and higher cost levels and to the inclusion of more frozen storage capacity than the averages for plants surveyed.

Table 3.--Investment per plant in building and equipment in turkey processing plants of various capacities, 1960-61 1/

Item	Plant capacity (number of heavy young hens per hour of operation)					
	Less than 400	400-699	700-899	900-1,499	1,500-1,999	2,000 and over
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Building cost <u>2/</u>	30,315	84,720	98,240	224,000	254,960	338,750
Equipment cost <u>3/</u> ...	24,005	84,723	132,355	224,000	405,058	570,463

1/ Estimated from accounting records. Includes facilities and equipment acquired second hand by present ownership. Moreover, in some cases, current "book values," representing partially depreciated resources were furnished in lieu of original costs.

2/ Includes some freezing and holding space in many instances. Many buildings had two or three floors.

3/ Includes line equipment in all instances; office equipment, freezing and ice machinery in many instances; and automotive equipment in a few instances.

For the firms studied the total annual dollar cost for repairs and maintenance, interest, taxes, and insurance averaged about the same as total depreciation to buildings and equipment. Dollars spent for repairs and maintenance were about 40 percent as large as total charges for depreciation, whereas each of the other three items was about 20 percent as large as depreciation. A somewhat different picture could be expected with model plants where resources were priced at current levels and tailored specifically for a given capacity. Total charges for depreciation could be expected to be larger. Interest charges would rise in total and also be about 30 percent as large as depreciation. Taxes and insurance would each be closer to 10 percent as large as depreciation. With new facilities, repairs and maintenance would then be only about 33 percent as large as depreciation.

Most of the turkey processing plants surveyed had more square feet of building space than was required for their present operations (table 4). Much of the excess space consisted of dry storage areas, corridors, and extra space in areas used for eviscerating, packing, utility equipment, receiving, and offices. Some plants also had substantial areas devoted to byproducts and manufactured items relative to their outputs of these goods.

In designing model plants for given capacities less total square feet of building space was allowed than in many existing plants even though larger frozen storage rooms were provided. Building space used could be reduced by using newer and more compact equipment, particularly for cooling and freezing. Despite the reductions

Table 4.--Building space per plant, and functions performed in turkey processing plants of various capacities, 1960-61 1/

Item	Plant capacity (number of heavy young hens per hour of operation)					
	Less than: 400	400-699	700-899	900-1,499	1,500-1,999	2,000 and over
	Square feet	Square feet	Square feet	Square feet	Square feet	Square feet
Building space for:						
Receiving and dressing <u>2/</u>	1,006	4,887	4,232	4,910	5,544	4,822
Eviscerating and chilling.....	1,363	5,752	4,365	6,387	9,870	7,381
Packing <u>3/</u>	1,202	2,193	3,125	4,243	4,699	4,599
Icing, freezing, storing.....	1,191	6,149	5,845	15,396	10,343	12,588
Supply storage <u>4/</u>	511	943	3,445	3,281	4,449	3,614
Utilities, offices, employee needs <u>5/</u>	1,150	3,548	4,380	8,437	6,518	8,314
Other <u>6/</u>	1,344	2,351	2,812	3,144	7,584	5,620
Total	7,767	25,823	28,204	45,798	49,007	46,938

1/ Many buildings had two or three floors.

2/ Includes unloading, holding, killing, picking, pinning.

3/ Includes sorting, bagging, boxing, box making.

4/ Often called dry storage.

5/ Utility space includes boiler rooms, compressor rooms, electrical controls.

Employee needs include washrooms, rest rooms, locker and lunch rooms, first aid.

Category also includes stairways and corridors.

6/ Includes offal and feather handling, byproducts and manufactured products, truck storage and washing, loading and shipping (except outside docks and platforms), shop and tool, and large separate cut-up rooms.

in total square feet of building space, dollar costs for buildings in the model plants exceeded those for plants surveyed because of higher current building costs and the extra expense associated with larger frozen storage spaces.

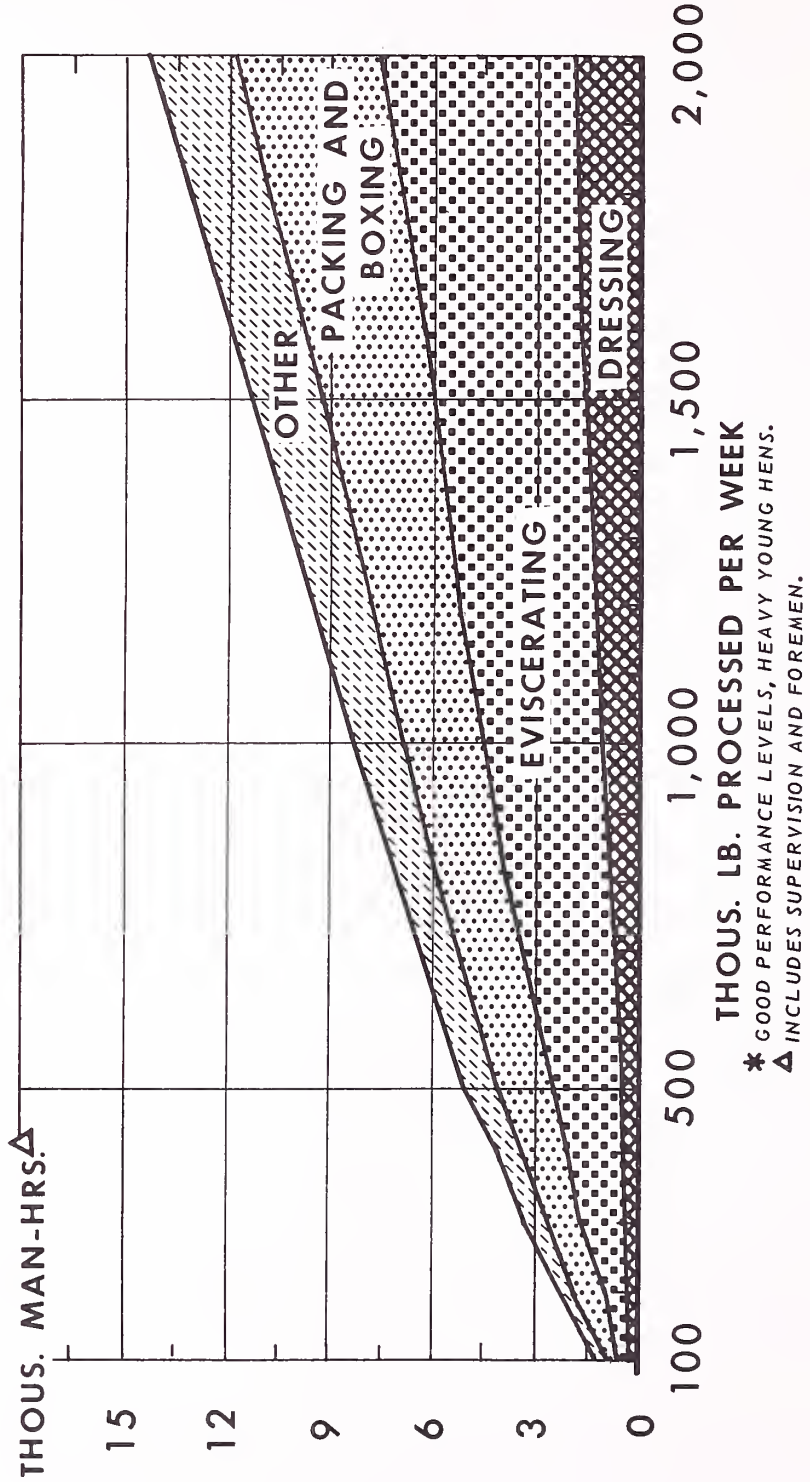
Labor Efficiency

Plant labor efficiency in processing turkeys is of great consequence to plant management as the weekly payroll is the largest single item of expense in processing. Moreover, labor efficiency is one of the few areas where management can make substantial savings.

The number of hours of labor required to process specified volumes of heavy young hens (fig. 1) were derived from the better performance levels observed in weekly payroll data from plants studied. At basic wage rates for line workers, ranging from about \$1.10 to \$1.75 per hour, the dollar payroll to be met is certainly substantial. Hence, labor efficiency deserves intensive and continued study.

MAN-HOURS REQUIRED PER WEEK TO PROCESS TURKEYS, BY TYPE OF LABOR AND SIZE OF PLANT

Selected U. S. Plants, 1960*



U. S. DEPARTMENT OF AGRICULTURE

NEG. ERS 2171-63 (7) ECONOMIC RESEARCH SERVICE

Figure 1

Table 5.--Output per man-hour in selected turkey processing plants, by volume processed per week, 1960 1/

Average performance levels			Good performance levels		
Volume processed per week	: Selected summer and fall weeks, mostly heavy young hens and toms <u>2/</u>		Volume processed per week	: Heavy young hens	
	: Weighted average (A)	: Range (B)		: Observed <u>3/</u> (C)	: Model plants <u>4/</u> (D)
	: Pounds	: Pounds		: Pounds	: Pounds
	: Pounds	: Pounds		: Pounds	: Pounds
Less than 100.....	58	28- 78	100.....	74.0	74
100 - 199.....	72	46-100	200.....	83.5	92
200 - 299.....	72	48-113	300.....	90.0	106
300 - 499.....	86	63-124	400.....	95.5	118
500 - 699.....	101	59-148	500.....	100.0	126
700 - 899.....	104	67-160	600.....	105.0	132
900 and over.....	98	74-131	700.....	109.0	137
			800.....	113.0	142
			900.....	116.5	146
			1,000.....	120.0	150
			1,200.....	126.0	158

1/ Generally includes plant operations, but not general supervision, office force, and overall management activities.

2/ Based on preliminary tabulation of selected weeks in the summer and fall period when almost the entire volume consisted of heavy young hens and toms.

3/ Adjusted data for a slightly different sample of weeks than (A) and (B)--footnote 1/, this table.

4/ Estimated from data developed in later section of this report.

The range in basic wage rates in the preceding paragraph reflect differences in geographic location in the sample of plants studied. Higher basic wage rates were not accompanied by higher output per man-hour in the sample of plants studied.

The level of output per man-hour of labor in processing turkeys depends mainly on such factors as: Equipment; plant capacity; size of birds and proportions of various market classes; the percentage of capacity at which the plant operates; and, the organization and competence of the crew and supervisory force.

In table 5, the data in columns (A) and (B) are the same as were presented in an earlier report. 5/ Since these data included various sizes of plants and levels of operation and, in particular, a mixture of mostly heavy young hens and toms, they show a wide range in performance. The data in column (C) are based on a single market class -- heavy young hens, with further adjustments to minimize variations due to plant size and level of operations. Consequently, the observations fall within the ranges in column (B) primarily because heavy young toms are excluded. While fewer head of heavy young toms can be processed per hour, average weight per head is greater. Thus, output per man-hour in pounds will be higher for toms.

5/ See table 4, page 11 of reference cited in footnote 2, page 2.

The differences between columns (C) and (D) are due to three factors. The model plants in column (D) were assumed to be operating at 100 percent of capacity, processing a slightly heavier bird than for most observations in column (C), and in most situations attaining a slightly higher output per man-hour. Comparisons in table 5 provide some indications of the improvements in labor efficiency which could be realized under nearly ideal conditions.

In table 6, the aggregate estimates of total man-hours per week required to process heavy young hen turkeys shown in figure 1, have been translated to output per man-hour in pounds. The data for good performance levels realized by plants in the survey suggest the rate of improvement in output per man-hour can be expected to decrease materially as plant capacity reaches larger limits.

Output per man-hour in the eviscerating, packing, and boxing operations appears to level off more rapidly than for other operations. To a large extent this is a function of present technologies which call for different balances between labor and equipment. The dressing operation today is highly mechanized and relatively few workers are required. Thus, beyond a certain point, the number of additional workers required as plant capacity increases is nominal. On the other hand, much hand work remains in the eviscerating, packing, and boxing operations. As plant capacity increases, and single eviscerating lines give way to divided lines the number of additional people begins to rise almost in proportion to volume. The "other" category in table 6 includes various supporting functions plus the supervisory function.

Table 6.--Output per man-hour for specified operations in selected turkey processing plants, by volume of heavy young hens processed per week, 1960-61 1/

Volume processed per week per plant	Dressing	Eviscerating	Packing and boxing	Other <u>2/</u>	Total, all operations <u>2/</u>
Thousand pounds	Pounds	Pounds	Pounds	Pounds	Pounds
100	480	200	240	442	74.0
200	640	218	262	500	83.5
300	720	233	290	505	90.0
400	760	245	320	513	95.5
500	800	255	335	543	100.0
600	825	265	352	589	105.0
700	850	275	370	603	109.0
800	870	283	390	624	113.0
900	890	293	405	634	116.5
1,000	920	300	424	643	120.0
1,200	960	315	460	647	126.0
1,400	990	325	460	699	130.0
1,500	1,010	330	460	724	132.0
1,600	1,030	335	460	750	134.0
1,800	1,060	345	460	779	137.0
2,000	1,100	350	460	797	139.0

1/ Developed from weekly payroll and volume data, using good performance levels.

2/ Generally included supervision, foremen, cleanup, maintenance, supply handling, in-plant moving, loading out. Same data as (C) in table 5, footnote 5/.

Figure 2 shows most of the individual jobs which are performed in turkey processing and a possible sequence in which they may occur.

Managerial Efficiency

Many industry people have long contended that "management overhead" has an important effect on turkey processing costs. Table 7 shows that the average number of heavy young turkeys processed per managerial employee increases with plant size. However, within each size group there is a wide range, suggesting that many processing plants have more supervisory, office, and management personnel than may be needed.

The management and supervisory functions have a material bearing on the efficiency of line operations. Hence, without relating the number of managerial employees to the output per man-hour obtained on line operations, the processing yield obtained, and to the quality of product resulting, it is difficult to judge the number of managerial employees needed. Yet, the efficiency of the management and supervisory functions have probably received less attention to date than is deserved.

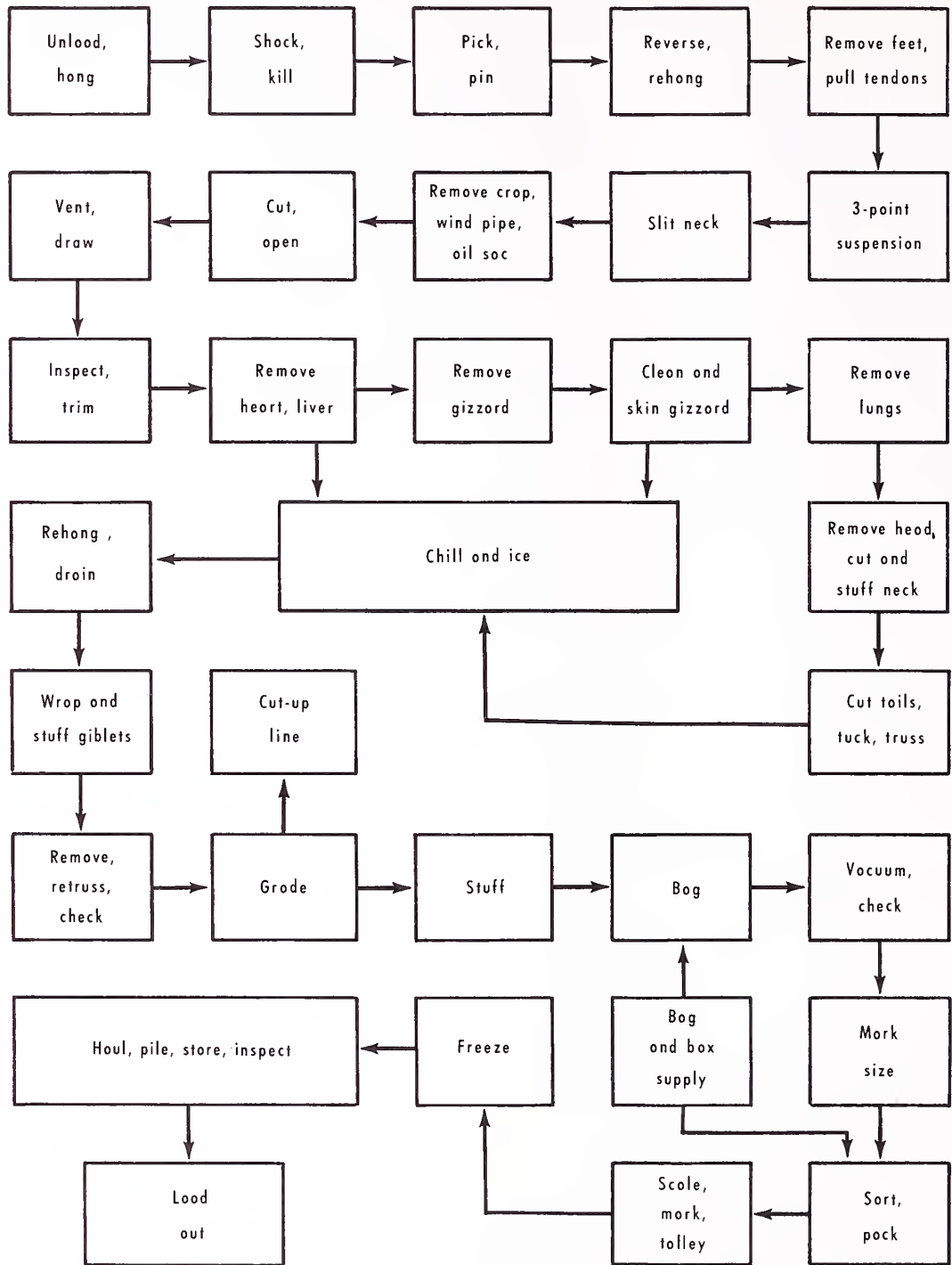
While management and supervisory functions may be important factors in the success or failure of individual plants in actual situations, in standardized analysis these functions are assumed to be of equal and acceptable quality.

Table 7.--Number of heavy young hens processed per hour per managerial employee in selected turkey processing plants, 1960-61 1/

Size of plant (turkeys processed per hour)	Average	Range
	<u>Turkeys</u>	<u>Turkeys</u>
Less than 400	119	63-175
400-699	148	136-160
700-899	160	110-212
900-1,499	184	130-260
1,500-1,999	224	192-260
2,000 and over	243	225-264

1/ Includes general supervision, office force, and overall management activities.

JOBS INVOLVED IN TURKEY PROCESSING



U. S. DEPARTMENT OF AGRICULTURE

NEG. ERS 2172-63 (7) ECONOMIC RESEARCH SERVICE

Figure 2

ECONOMIES OF SCALE IN TURKEY PROCESSING

For purposes of studying the potential economies of scale in turkey processing, 10 model plants were synthesized. These model plants were capable of processing the following numbers of heavy young hen turkeys per hour of operation at capacity: 200; 400; 600; 800; 1,000; 1,200; 1,500; 2,000; 3,000; and 4,000. Heavy young hens were assumed to weigh 13 pounds ready-to-cook. Plants were assumed to be capable of processing at capacity 75 percent as many head of heavy young tom as heavy young hen turkeys; 60 percent as many head of breeders; and 125 percent as many head of fryer-roaster type turkeys. Assumed average weights per head were: Heavy young toms, 22 pounds; breeders, 16 pounds; and fryer-roasters, 7 pounds.

For each model plant, average total costs per pound were projected when operations were at 30, 40, 50, 60, 70, 80, 90, and 100 percent of capacity. Two different operating years were assumed: 144 operating days and 153 payroll days; and, 243 operating days and 261 payroll days. The difference between operating and payroll days reflects paid holidays and paid vacation time. A normal week was 5 days, 8 hours per day. Finally, average total costs per pound were projected for two wage and salary levels; a typical level, representative of most leading turkey States, and a high level reflecting rates about 1 1/2 times the typical level.

In an economies of scale study, which seeks to determine the potential cost savings as the capacity of firms is increased, standardized factor prices and input-output relationships are used. Thus, the results compare firms of different capacities, when each utilizes its capacity to the same degree. For an industry, the economies of scale curve indicates the direction and extent to which firm sizes could be expected to increase, other things remaining equal. ^{6/} Under a later section of this report, other factors external to the processing segment are discussed which affect the feasibility of increasing the size of processing plants in order to realize the potential economies of scale in processing.

^{6/} Thus, the economies of scale curve is also called the long-range planning curve. It is usually drawn tangent to the average total cost curves for individual plant sizes. In this report, points of tangency approximately coincide with points defining 100 percent of capacity. Costs were not estimated for outputs beyond 100 percent of defined capacity. The long-run planning curve in this instance was fixed by the definition of capacity (see footnote 7).

Plant Size and Use of Capacity

Substantial economies of scale exist in processing turkeys. Average total costs per pound (ready-to-cook weight) decline with successively larger plants, each operated at 100 percent of capacity.

For the 10 model plants, an operating year of 144 days is assumed to represent a feasible standard under present conditions. With plants operating over such a period, processing heavy young hens, and paying typical wage and salary levels, the potential cost savings from the smallest to the largest model plant is about 2.3 cents per pound. More than half of the savings are attained as firm size increases from 200 to 800 head per hour of operation. More than three-fourths of the savings or 1.8 cents per pound are attained with a plant with a capacity of 1,500 head per hour. The remaining savings between a plant with a capacity of 1,500 head per hour of operation and one with a capacity of 4,000 head per hour total about 0.5 cents per pound. The annual volumes for plants capable of processing 200, 800, 1,500 and 4,000 heavy young hens per hour at capacity would be approximately 3, 12, 22.5, and 60 million pounds, respectively (fig. 3).

Although fewer head of heavy young toms than hens can be processed per hour of operation, the average weight per bird is greater. Hence the volumes of toms which could be processed annually in the model plants are greater than for hens. Annual volumes for plants capable of processing 150, 600, 1,125, and 3,000 heavy young toms per hour at capacity would be approximately 3.8, 15.2, 28.5, and 76.0 million pounds, respectively. The potential cost savings from the smallest to the largest model plant is almost 1.9 cents per pound. Almost three-fifths of the savings are attained as firm size increases from 150 to 600 head per hour of operation. More than three-fourths of the savings are attained with a plant with a capacity of 1,125 head per hour. The remaining savings between a plant with a capacity of 1,125 head per hour of operation and one with a capacity of 3,000 head per hour total about 0.45 cents per pound (fig. 4).

Heavy Young Hens

PROCESSING COSTS BY PLANT SIZE AND CAPACITY

10 Model Plants Operating 144 Days

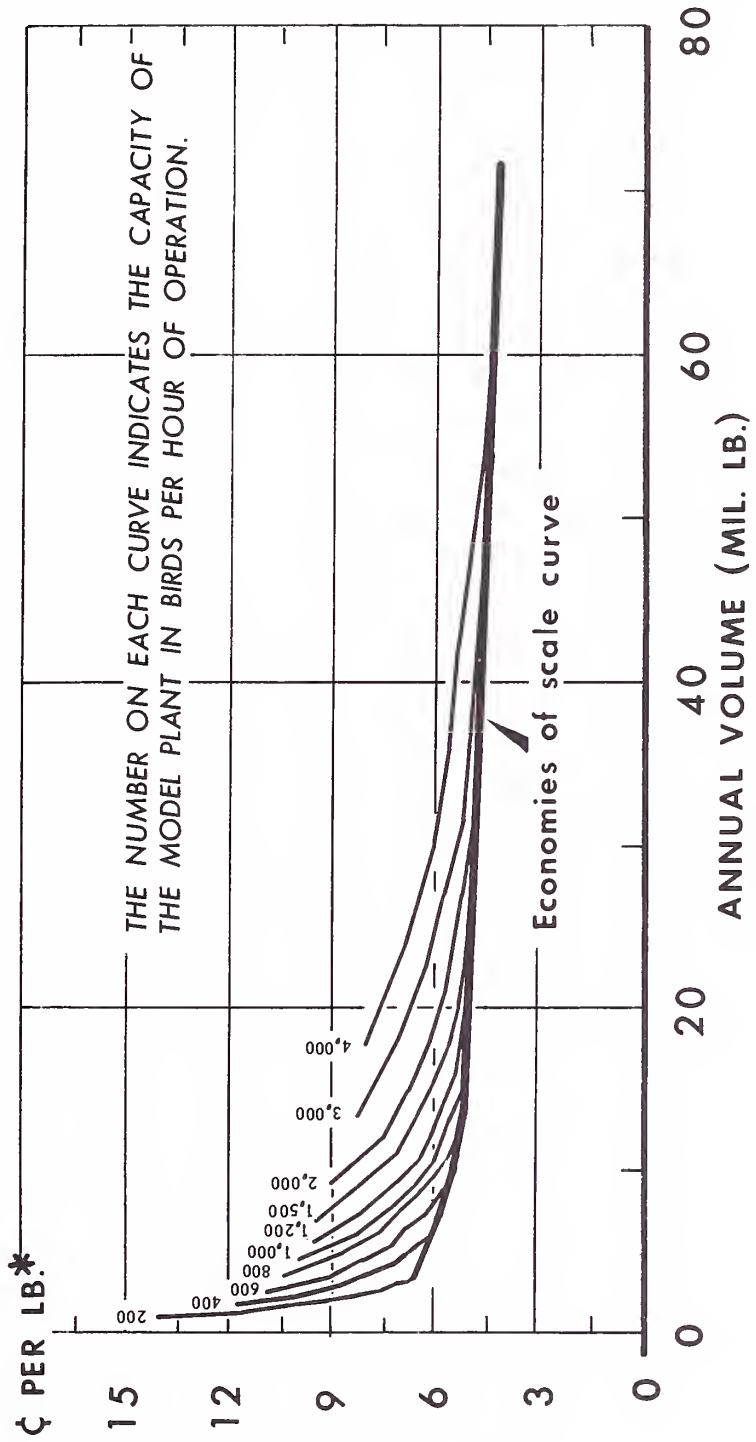


Figure 3

Heavy Young Toms

PROCESSING COSTS RELATED TO SIZE OF PLANT AND ANNUAL VOLUME

For 10 Model Plants Operating 144 Days

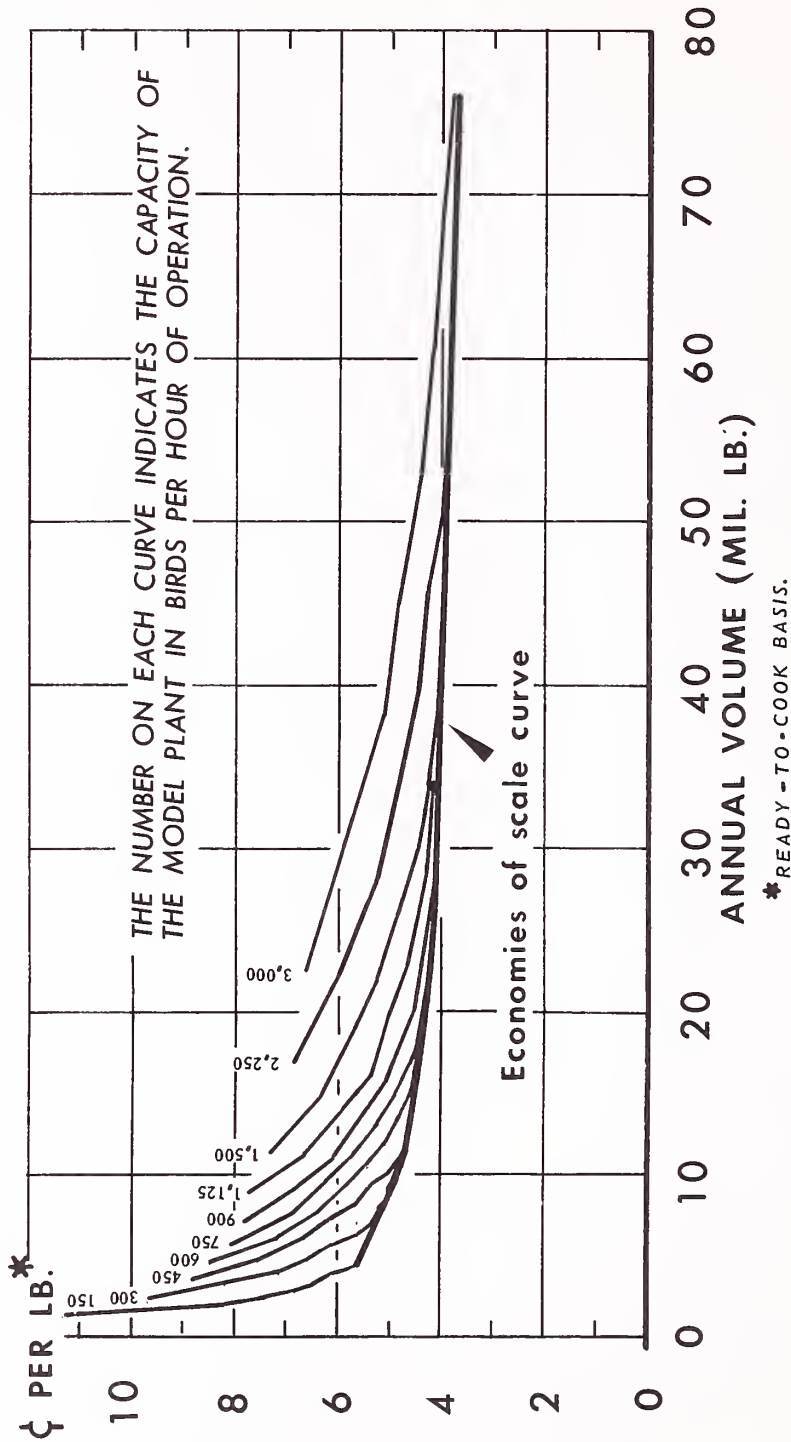


Figure 4

Average total costs per pound are materially affected by the rate of use of capacity. Curves for the 10 model plants handling heavy young hens show that costs per unit of product are successively lower, without exception, for each percentage level as plant size increases (fig. 5). Relative advantages are minimized at 100 percent of capacity, but widen below this level. This suggests that each successively larger plant has an advantage over the next smaller unit. Using models 1, 4, 7, and 10, the respective average costs per unit of product at 40 percent of capacity are 11.6, 8.7, 8.0, and 6.9 cents per pound. At 70 percent of capacity, the costs are 8.4, 6.5, 6.0, and 5.3 cents per pound, and at 100 percent of capacity, 6.9, 5.5, 5.0, and 4.5 cents per pound.

The Classification and Nature of Processing Costs

Costs may be classified under four types: Variable operating; constant-unit operating; fixed operating; and fixed overhead. All costs in this report are on the basis of ready-to-cook weight. They can be converted to a live weight basis by multiplying by the percentage yield from live to ready-to-cook weight.

Figure 6 illustrates the behavior of major cost groups for one model plant size.

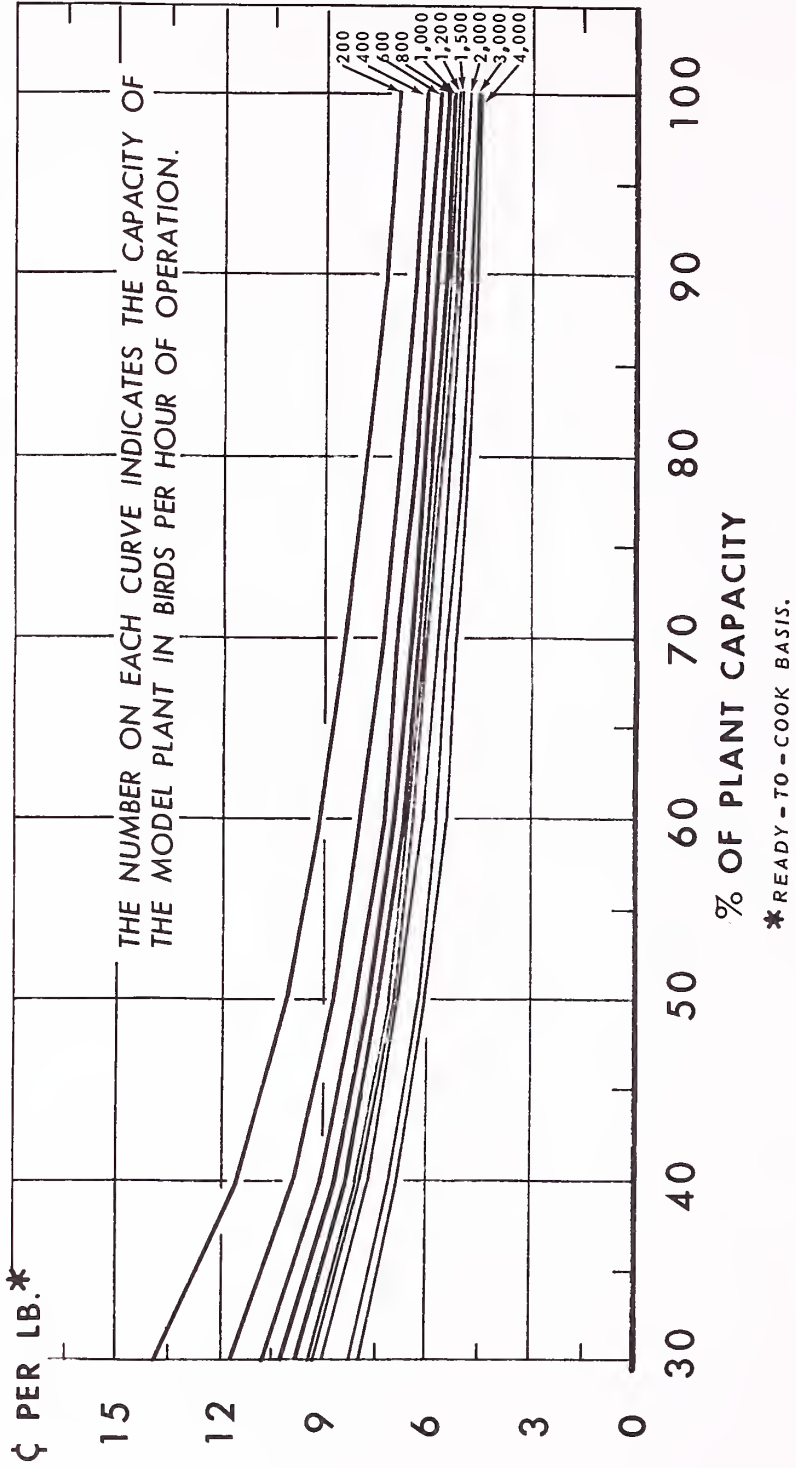
Variable Operating Costs

Major components of variable operating costs are wages (including 6 percent fringe benefits), electricity and water, variable repairs, and wear depreciation. Costs in this group increase in total as volume increases, but decline on a per pound basis. If volume were to exceed 100 percent of capacity, these costs might be expected to increase on a per pound basis and might eventually produce an upturn in the average total cost per unit for each model plant.

Heavy Young Hens

PROCESSING COSTS BY PLANT SIZE AND USE OF CAPACITY

10 Model Plants Operating 144 Days



U. S. DEPARTMENT OF AGRICULTURE

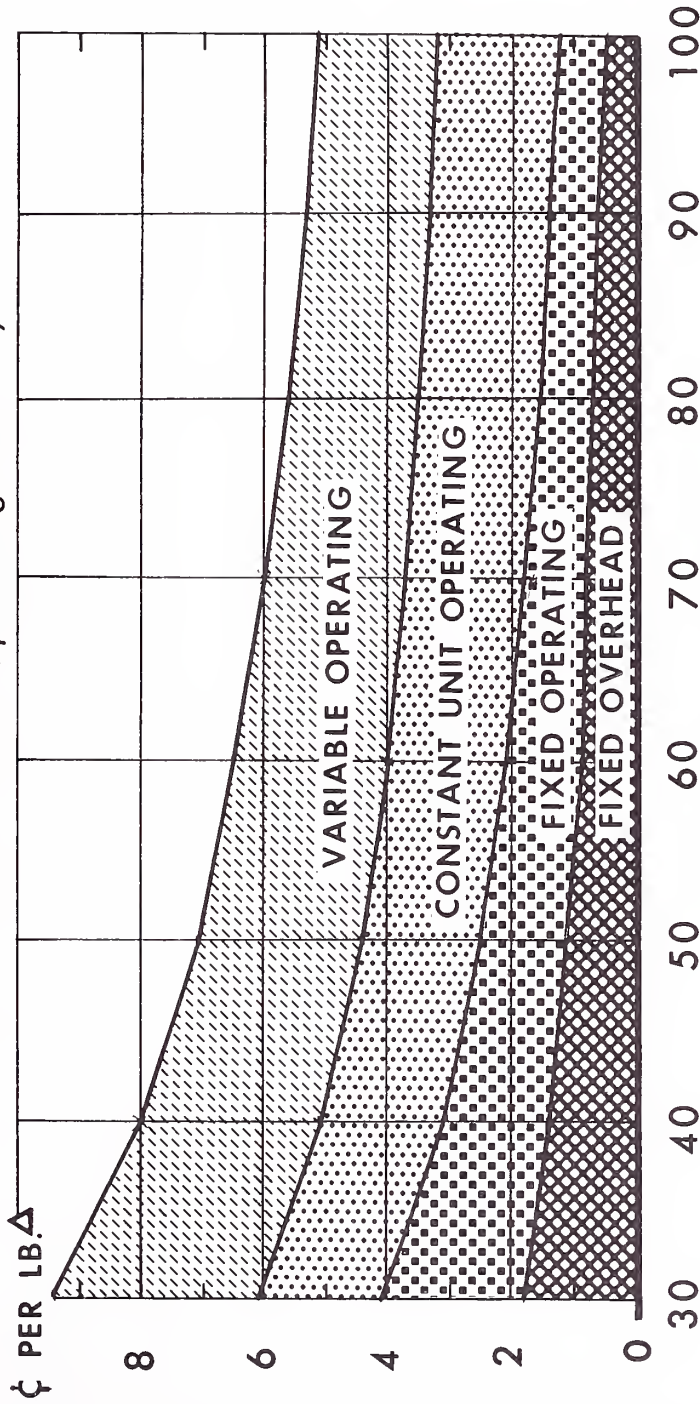
NEG. ERS 2175-63 (7) ECONOMIC RESEARCH SERVICE

Figure 5

Heavy Young Hens

PROCESSING COSTS BY TYPES OF COSTS AND USE OF PLANT CAPACITY

For a Model Plant Operating 144 Days*



% OF PLANT CAPACITY

* CAPABLE OF PROCESSING 1,500 HEAD PER HOUR OF OPERATION.

Δ READY-TO-COOK BASIS.

Figure 6

Wages.--Payroll and volume data indicate that output per dollar of input increases and cost per unit of output decreases as utilization of capacity increases from 30 to 100 percent. When plants are operated at more than 100 percent of capacity, output per dollar of input decreases and cost per unit of output increases. ^{7/} Wage levels assumed for model plants in this study are shown in table 8.

Table 8.--Regular hourly rates of pay for plant operations in model turkey processing plants

Function	Typical wage level per hour	High wage level per hour
	<u>Dollars</u>	<u>Dollars</u>
Unload, hang	1.40	2.10
Shock, kill	1.75	2.625
Pick, pin; cleanup; bag and box supply	1.15	1.725
Rehang, 3-point; slit neck, remove windpipe and oil sac; cut, open, vent, draw; remove and clean giblets; wrap and stuff giblets; manifest and load	1.20	1.80
Rehang, reverse, transfer; remove feet, pull tendons; remove lungs; move tanks, drain, rehang; remove birds, truss, check; bag, vacuum, check; size and mark; sort and pack; scale, mark, tally	1.25	1.875
Remove crop; wash, inspect; remove head, cut and stuff neck, cut tails, truss, tuck, take-off; move tanks, ice, tend chilling ...	1.30	1.95
Help inspector, trim; cut-up line; handle undergrades, byproducts ...	1.35	2.025
Handle to freeze and store; freezer crew	1.40	2.10
Grade; tractor operator	1.50	2.25
Maintenance	1.60	2.40

Electricity and water.--Cost per unit of product declines as plant volume increases. Rate structures usually have a fixed initial charge and successively lower rates -- to a maximum level as physical units used increase.

^{7/} 100 percent of capacity is defined as the output in an 8-hour day with a crew of optimum size. Technically, this definition of capacity may be exceeded in two ways: (1) Line speed can be increased and more workers added, with operations confined to 8 hours per day and 40 hours per week; and, (2) the length of the working day may be increased with the optimum-sized crew. In the first situation, the optimum adjustment of labor to equipment is upset, and output per worker declines, thus increasing cost per unit of product. In the second situation, lower productivity per worker and payment of overtime wage rates increases cost unit of product when allocated over the entire day's operation.

Variable repairs.--The amount of servicing of equipment increases with rate of use.

Wear depreciation.--Beyond a minimum rate of depreciations of equipment prescribed by obsolescence or statute, and time depreciation, equipment depreciates in proportion to rate of use.

Constant-Unit Operating Costs

Bags, boxes, and expendable supplies and services are the major items contributing to these operating costs. Items are used in direct proportion to volume. Quantity discounts which exist in their purchase are granted only within rather large intervals. In the model plants in this study, it is assumed that rate of use of capacity of any one model plant does not affect cost per unit of inputs. An additional 1/4 cent per pound is included for additional costs associated with frozen storage.

Fixed Operating Costs

When a plant begins operations, it sustains costs for salaries and certain other items essentially fixed in total. Costs per unit of product thus decline in direct proportion to increases in volume.

Salaries.--These include annual salaries for management, supervisory, professionals, department foremen, and office workers (plus 6 percent fringe benefits). Salary levels assumed for model plants in this study are shown in table 9.

Miscellaneous.--This category includes such items as contributions, dues, advertising, listings, meeting expenses, management travel, entertainment, legal, accounting, and auditing services.

Heat and telephone.--Although a seasonal item, cost for heat is assigned to each unit of output. Telephone costs do not appear to vary systematically in relation to volume.

Fixed Overhead Costs

These costs relate to the ownership of plant and equipment. They are considered as fixed in total, over the planning period involved. Costs per unit of product decline in direct proportion to increases in volume. The group includes certain elements of depreciation and obsolescence on equipment, all depreciation on buildings and facilities, property taxes, interest on investment, insurance, plant repairs and maintenance, and equipment maintenance. Table 10 shows the rates used to determine these costs plus those for wear depreciation and variable repairs on plant equipment.

Importance of Various Cost Factors in Producing Economies of Scale

The cost items discussed in the previous section can be divided into two categories: (1) Those which cannot be affected materially by managerial decisions of firms within particular size groups; and, (2) those where managerial decisions can greatly influence efficiency and, hence, decrease average total costs per pound of product. Table 11 shows a regrouping of cost items so that they can be separated into the

Table 9.--Annual salaries for managerial, supervisory, and office personnel in model turkey processing plants

Plant model number	Salary level	Management		Professionals		Superintendents		Foremen		Office managers		Office workers	
		Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
1	Typical	5,000				4,000							
	High	6,500				5,500							
2	Typical	6,000				5,000							3,000
	High	7,200				6,000							4,500
3	Typical	7,000				5,500			4,500				3,000
	High	8,000				6,500			5,000				4,500
4	Typical	8,000				6,000			4,000-4,500				3,000
	High	9,000				7,000			4,500-5,000				4,500
5	Typical	9,000				6,000			4,000-4,500				3,000
	High	11,000				7,000			4,500-5,500		5,000		4,500
6	Typical	10,000				6,000			4,000-4,500				3,000
	High	12,000				7,000			4,500-5,500				4,500
7	Typical	9,000-12,000				7,000			4,500-5,000				3,000
	High	10,000-13,000				8,000			4,500-6,000				4,500
8	Typical	9,000-13,000				7,000-8,000		6,000-8,000	4,500-5,000				3,000
	High	10,000-15,000				7,500-9,000		8,000-9,000	4,500-6,000				4,500
9	Typical	9,000-13,000				6,000-9,000		7,000-9,000	4,500-5,000				3,000-4,000
	High	10,000-15,000				7,500-10,000		9,000-10,000	4,500-6,000				4,500-5,000
10	Typical	9,000-13,000				6,000-9,000		6,000-9,000	4,500-5,000				3,000-4,000
	High	10,000-15,000				7,500-10,000		10,000-11,000	5,000-7,000				5,000

Table 10.--Rates (as a percentage of new costs) used to determine capital costs in model turkey processing plants

FIXED COSTS

Cost item	Building	Equipment	
		Ice, frozen storage and utility equipment	Line equipment
	Percent	Percent	Percent
Taxes	1	1	1
Interest	3	3	3
Insurance	1	1	1
All depreciation	5	10	--
Repairs and maintenance ...	3	4	--
Time depreciation	--	--	5
Maintenance	--	--	2

VARIABLE COSTS, INPLANT EQUIPMENT

Percentage of capacity	Plant operating 144 days a year		Plant operating 243 days a year	
	Obsolescence and wear depreciation	Variable repairs	Obsolescence and wear depreciation	Variable repairs
	Percent	Percent	Percent	Percent
30	15	.95	15	1.25
40	15	1.10	15	1.50
50	15	1.25	15	1.75
60	15	1.40	15	2.00
70	15	1.55	16.25	2.25
80	15	1.70	17.50	2.50
90	15	1.85	18.75	2.75
100	15	2.00	20.00	3.00
110	15.75	2.15	21.25	3.25
120	16.50	2.30	22.50	3.50

above categories. Supplies, materials, utilities, and miscellaneous items fall within the first category; plant wages and salaries (management), and costs of capital ownership and use, in the second category.

The relative importance of various cost categories is affected not only by plant size, but by the rate of use of capacity, the market classes handled, prices paid for inputs, and by the length of the operating year. For any one model plant size, the relative importance of supplies and materials to average total costs rises as use of capacity increases; the relative importance of management and fixed overhead costs declines; and the relative importance of wages and utilities and miscellaneous

Table 11.--Capacity of model plants, and specified costs as percentage of total costs, 144 operating days ^{1/}

Market class, plant capacity, and cost item	Unit	Model plant number																		
		1	2	3	4	5	6	7	8	9	10									
<u>Heavy young hens ^{2/}</u>																				
Capacity	Head per hour	200	400	600	800	1,000	1,200	1,500	2,000	3,000	4,000									
Cost item	Percent	27.4	24.8	22.8	21.0	20.4	19.9	19.1	18.2	17.4	17.0									
Plant wages	do.	31.0	35.0	36.6	37.3	38.1	38.5	38.7	40.0	42.5	43.3									
Supplies and materials	do.	4.7	3.7	3.7	3.9	4.5	5.1	6.4	6.7	6.2	6.2									
Management	do.	20.4	21.6	22.0	22.4	22.2	21.9	21.4	20.9	19.6	19.4									
Utilities, miscellaneous	do.	16.5	14.9	14.9	15.4	14.8	14.6	14.4	14.2	14.3	14.1									
Capital ownership and use	do.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0									
Total costs	do.	150	300	450	600	750	900	1,125	1,500	2,250	3,000									
<u>Heavy young toms ^{3/}</u>																				
Capacity	Head per hour	150	300	450	600	750	900	1,125	1,500	2,250	3,000									
Cost item	Percent	25.9	23.2	21.3	19.6	19.1	18.5	17.8	17.0	16.2	15.8									
Plant wages	do.	34.8	39.0	40.6	41.4	42.2	42.6	42.7	44.0	46.5	47.3									
Supplies and material	do.	4.4	3.5	3.5	3.7	4.2	4.8	6.0	6.2	5.7	5.8									
Management	do.	19.3	20.3	20.7	20.9	20.7	20.5	20.0	19.5	18.3	18.0									
Utilities, miscellaneous	do.	15.6	14.0	13.9	14.4	13.8	13.6	13.5	13.3	13.3	13.1									
Capital ownership and use	do.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0									
Total costs	do.	120	240	360	480	600	720	900	1,200	1,800	2,400									
<u>Breeders ^{4/}</u>																				
Capacity	Head per hour	120	240	360	480	600	720	900	1,200	1,800	2,400									
Cost item	Percent	32.4	29.8	27.5	25.5	24.7	24.2	23.0	21.9	20.9	20.5									
Plant wages	do.	26.0	29.8	31.5	32.2	32.7	32.9	33.0	34.2	36.2	37.2									
Supplies and material	do.	5.6	4.5	4.5	4.8	5.6	6.3	7.9	8.2	7.6	7.7									
Management	do.	16.2	17.7	18.2	18.6	18.9	18.7	18.4	18.3	17.9	17.1									
Utilities, miscellaneous	do.	19.8	18.2	18.3	18.9	18.2	17.9	17.7	17.4	17.4	17.5									
Capital ownership and use	do.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0									
Total costs	do.	250	500	750	1,000	1,250	1,500	1,875	2,500	3,750	5,000									
<u>Fryer-roasters ^{5/}</u>																				
Capacity	Head per hour	250	500	750	1,000	1,250	1,500	1,875	2,500	3,750	5,000									
Cost item	Percent	32.1	29.5	27.2	25.3	24.4	23.9	22.7	21.6	20.6	20.3									
Plant wages	do.	26.7	30.5	32.1	32.9	33.4	33.7	33.8	34.9	37.0	38.0									
Supplies and material	do.	5.5	4.5	4.5	4.7	5.5	6.2	7.8	8.1	7.5	7.6									
Management	do.	16.1	17.5	18.1	18.4	18.7	18.5	18.2	18.1	17.7	16.9									
Utilities, miscellaneous	do.	19.6	18.0	18.1	18.7	18.0	17.7	17.5	17.3	17.2	17.2									
Capital ownership and use	do.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0									
Total costs	do.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0									

^{1/} Operated at 100 percent of capacity for 144 operating days.

^{2/} 13 lbs. average weight.
^{3/} 22 lbs. average weight.
^{4/} 16 lbs. average weight.
^{5/} 7 lbs. average weight.

costs remains somewhat constant. In comparing the relative importance of individual cost categories with average total costs per pound in processing heavy young hens in any one model plant, the relative importance of wages, management, and costs of capital ownership and use is less when processing heavy young toms and more when processing breeders and fryer-roasters. In contrast, the relative importance of supplies and materials is greater with toms and less with breeders and fryer-roasters. Utility and miscellaneous costs are relatively less important for the other three classes than with hens (table 11). The only change in basic prices for inputs in this study involves wages and salaries. The relative importance of these items would thus be greater for firms in areas (i.e., the West Coast) where wage and salary levels exceed those in other major turkey areas. As the length of the operating year is increased, the relative importance of wages, supplies and materials, and utilities and miscellaneous costs, increases in relation to other categories (tables 11 and 12).

As plant size increases, the relative importance of plant wages and costs of capital ownership and use declines; there is little change in utility and miscellaneous costs; and costs of supplies, materials, and management increase (table 11).

For model plants processing heavy young hens, operating 144 days per year at full capacity, and paying typical wage and salary levels, average total costs per pound decline from 6.866 cents per pound for a plant with a capacity of 200 head per hour to 4.531 cents per pound for a plant with a capacity of 4,000 head per hour of operation. Over this range, the decline in plant wage costs is 1.113 cents per pound or 59 percent. Management costs decline 0.036 cents per pound, or 11 percent, and costs of capital ownership and use decline 0.491 cents per pound, or 43 percent. Costs for supplies and materials decline only 0.170 cents per pound, or 9 percent, but utility and miscellaneous costs decline 0.525 cents per pound, or 32 percent. Thus of the total decline of 2.335 cents per pound, or 34 percent, the items which management decisions can materially affect (wages, management, capital ownership and use) account for 1.640 cents per pound, or 70 percent of the total decrease in costs per unit of product. The balance of this section provides further detail on these areas of costs.

Capital Investment

The estimated capital investment required for the model plants is substantial, ranging from less than \$200,000 for the smallest plant to over \$2,000,000 for the largest. Buildings, including frozen storage space, account for less than half of the total investment. The remainder is divided between line equipment and other items including land, office and handling equipment, ice machinery, and frozen storage and utility equipment. The investment in line equipment slightly exceeds investment in the latter group (table 13).

Building costs.--There were two basic requirements in the planning of buildings for model plants: (1) To provide adequate working room for functions carried out, and for employee comfort; and, (2) to enable plants to meet Federal inspection standards. Plants were developed without provision for further expansion. If this had been anticipated, smaller model plants would have been placed at a greater short-run disadvantage. Space requirements are shown in table 14.

Model plants were assumed to have concrete floors with drains, concrete block walls (with impervious surfaces where required), steel casing windows and doors, wall-ventilating fans, and insulated or drip-proof ceilings under wood frame A-roofs

Table 12.--Capacity of model plants, and specified costs as percentage of total costs, 243 operating days ^{1/}

Market class, plant capacity, and cost item	Unit	Model plant number																		
		1	2	3	4	5	6	7	8	9	10									
<u>Heavy young hens 2/</u>																				
Capacity	Head per hour:	200	400	600	800	1,000	1,200	1,500	2,000	3,000	4,000									
Cost item	Percent	30.3	27.1	24.9	23.2	22.4	22.0	21.3	20.3	19.1	18.7									
Plant wages	do.	33.9	37.9	39.7	40.6	41.4	42.1	42.6	44.0	46.0	47.1									
Supplies and material	do.	3.0	2.6	2.9	3.2	3.7	4.2	5.1	5.5	5.0	4.9									
Management	do.	21.3	22.1	22.2	22.2	22.2	22.2	20.8	20.1	20.0	19.5									
Utilities, miscellaneous	do.	11.5	10.3	10.3	10.7	10.3	10.2	10.2	10.1	9.9	9.8									
Capital ownership and use	do.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0									
Total costs																				
<u>Heavy young toms 3/</u>																				
Capacity	Head per hour:	150	300	450	600	750	900	1,125	1,500	2,250	3,000									
Cost item	Percent	28.5	25.4	23.2	21.5	20.8	20.4	19.7	18.8	17.6	17.2									
Plant wages	do.	37.8	42.0	43.8	44.9	45.6	46.3	46.7	48.1	50.1	51.1									
Supplies and material	do.	2.8	2.5	2.7	3.0	3.4	3.8	4.8	5.0	4.7	4.6									
Management	do.	20.1	20.6	20.7	20.7	20.7	20.0	19.3	18.7	18.5	18.0									
Utilities, miscellaneous	do.	10.8	9.5	9.6	9.9	9.5	9.5	9.5	9.3	9.1	9.1									
Capital ownership and use	do.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0									
Total costs																				
<u>Breeders 4/</u>																				
Capacity	Head per hour:	120	240	360	480	600	720	900	1,200	1,800	2,400									
Cost item	Percent	36.2	33.1	30.3	28.4	27.4	27.0	25.7	24.5	23.5	23.0									
Plant wages	do.	28.8	32.7	34.5	35.3	35.9	36.3	36.7	37.9	40.4	41.2									
Supplies and material	do.	3.7	3.2	3.5	4.0	4.6	5.2	6.3	6.8	6.3	6.2									
Management	do.	17.3	18.4	19.0	19.1	19.3	18.9	18.7	18.4	17.4	17.2									
Utilities, miscellaneous	do.	14.0	12.6	12.7	13.2	12.8	12.6	12.6	12.4	12.4	12.4									
Capital ownership and use	do.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0									
Total costs																				
<u>Fryer-roasters 5/</u>																				
Capacity	Head per hour:	250	500	750	1,000	1,250	1,500	1,875	2,500	3,750	5,000									
Cost item	Percent	35.9	32.7	30.1	28.0	27.1	26.6	25.4	24.2	23.2	22.7									
Plant wages	do.	29.5	33.4	35.1	36.1	36.7	37.1	37.5	38.7	41.2	42.0									
Supplies and material	do.	3.6	3.2	3.5	4.0	4.6	5.1	6.2	6.7	6.2	6.1									
Management	do.	17.2	18.2	18.7	18.9	19.0	18.7	18.5	18.1	17.2	17.0									
Utilities, miscellaneous	do.	13.8	12.5	12.6	13.0	12.6	12.5	12.4	12.3	12.2	12.2									
Capital ownership and use	do.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0									
Total costs																				

^{1/} Operating at 100 percent capacity for 243 operating days.

^{2/} 13 lbs. average weight.

^{3/} 22 lbs. average weight.

^{4/} 16 lbs. average weight.

^{5/} 7 lbs. average weight.

Table 13.--Capital investment required for model turkey processing plants

ITEM	Model plant number									
	1	2	3	4	5	6	7	8	9	10
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Buildings 1/	90,293	148,779	206,743	267,708	299,140	335,000	402,280	507,896	745,951	960,645
Line equipment	43,793	61,975	97,956	128,464	152,245	182,086	226,136	289,163	386,190	511,964
Other 2/	50,285	90,530	112,262	152,509	179,286	208,466	250,943	313,752	460,858	585,352
Total	184,371	301,284	416,961	548,681	630,671	725,552	879,359	1,110,811	1,592,999	2,057,961
Cost per square foot:										
Basic building alone	4.85	4.50	4.30	4.20	4.17	4.13	4.11	4.10	4.10	4.10
Basic building plus frozen storage	12.13	12.05	12.05	12.09	12.88	12.44	12.37	12.50	13.07	12.99
Cost per pound of annual capacity 3/	.030	.025	.023	.022	.020	.019	.018	.017	.017	.016
Buildings	.015	.010	.011	.011	.010	.010	.010	.010	.009	.009
Line equipment	.017	.015	.012	.013	.012	.011	.011	.010	.009	.009
Other	.062	.050	.046	.046	.042	.040	.039	.037	.035	.034
Total										

1/ Including frozen storage. 2/ Land, office equipment, ice machinery, handling equipment, frozen storage, and utility equipment
 3/ Processing heavy young hens at capacity for 144 operating days.

Table 14.--Building space required for various functions in model turkey processing plants

Model number	Building space required for various functions in model turkey processing plants									
	Capacity: heavy young hens per hour of operation	Receiving and dressing	Eviscerating, chilling, icing	Packing, shipping, supply storage	Freezing and storing	Offices and employee needs	Other	Total	Square feet	Square feet
1	200	1,182	1,220	803	3,541	300	200	7,446		
2	400	1,300	1,849	1,132	6,861	500	300	12,342		
3	600	2,000	1,758	1,555	9,998	750	500	17,161		
4	800	2,595	2,204	1,892	13,203	1,000	750	22,444		
5	1,000	2,805	2,476	2,272	12,425	1,250	1,000	23,228		
6	1,200	3,190	3,329	2,720	13,734	1,500	1,250	26,923		
7	1,500	3,804	3,875	3,367	16,587	1,800	1,600	32,533		
8	2,000	4,040	4,409	4,272	21,654	2,250	2,000	40,625		
9	3,000	4,240	5,974	6,001	31,971	3,375	2,500	57,061		
10	4,000	4,806	8,068	7,837	41,755	4,500	3,000	73,966		

1/ Includes lunch room, locker space, rest rooms. 2/ Includes offal and feather room, utility room.

or flat roofs with built-up roofing. Building costs were estimated on the basis of survey results and other recent studies. Under these conditions, the cost per square foot for the basic building declined from \$4.85 per square foot for model 1 to a minimum of about \$4.10 for models 7-10 (table 13).

However, an important distinction between these model plants for processing turkeys and earlier models for processing chickens is the inclusion of a substantial area for holding turkeys in frozen form. ^{9/} When a frozen storage area adequate to hold several week's output at capacity levels of operation is included, aggregate costs per square foot tend to rise as plant size increases. The height of the storage area was increased for the larger models to effect the required increase in cubic capacity. Despite the substantial dollar investment required for the basic building and storage capacity, the investment cost per pound of annual capacity is small, ranging from 3.0 to 1.6 cents per pound (table 13).

Costs of building materials, construction labor rates, and structural requirements may vary from area to area. Hence, the relative comparisons rather than the absolute numbers in table 13 are of greater significance.

Equipment Costs.--The selection of equipment for model plants was determined by the least-cost combinations of equipment and labor for the particular size of plant. In general, this meant adding more and larger units as plant size was increased. In all model plants, overhead lines and appropriate mechanical equipment for such operations as scalding; picking; washing; hock, neck, and head cutting; giblet cleaning; vacuuming bags; icemaking and dispensing; and handling are included. Some of these operations require plant workers only for smaller models. Feather and offal flow-away systems are included beginning with model 3. Partial budgeting results suggested the inclusion of continuous freezing equipment as desirable for all models because of the savings of space, time, and original costs. Similar analyses on the chilling operations suggested the use of mechanical (or continuous) chilling for all but the two smallest models because of savings in space, ice requirements, and time, despite the higher initial investment required.

It is difficult to demonstrate that it is cheaper to build and operate frozen storage space than to pay commercial rates. From a cost standpoint, the answer seems to depend on the extent of use which plants would make of frozen storage space they owned. Many plant operators felt commercial rates were high, but with operations still highly seasonal in nature, much frozen storage space at the plant might be empty much of the time. Hence, the inclusion of sufficient frozen storage space in model plants to hold several week's volume at capacity operations represents a partial concession to convenience and flexibility in shipping rather than choice between commercial and privately-owned frozen storage space. The frozen storage space, and the equipment associated with it, represent a substantial investment.

Equipment costs for model plants were determined by costs incurred by processing plants surveyed for recent acquisitions, and by price lists of equipment manufacturing firms. Costs used include estimates for shipping and installation charges.

Despite the substantial dollar investments in equipment required, the costs per unit of product for acquiring and using equipment are small with capacity operations. For example, investment in line equipment ranged from 1.5 to 0.9 cents per pound of annual capacity for plants processing heavy young turkeys for 144 days per year.

^{9/} See footnote 4.

Investment cost in other equipment for similar plants ranged from 1.7 to 0.9 cents per pound of annual capacity (table 13).

Labor Efficiency

In this section, plant operations are combined into groups of related functions to summarize the relative gains in output per worker which result as plant size increases. Obviously, several alternative ways exist to organize the crews within these departments, depending on the exact types and arrangements of equipment and on the types of packs produced. One possible organization is shown in table 15. Summary data discussed below are expressed as the full-time equivalent number of employees at full capacity operations for heavy young hens and toms. With less-than-capacity operations, some of these people could be used on more than one job. One way to do this would be to dress and eviscerate in the morning, and pack in the afternoon. Using a full crew fewer hours, or a smaller crew for more hours gave similar results in the projections made. Plants surveyed used both methods at less-than-capacity operation.

Increasing labor productivity results from the substitution of machinery for labor, and by increasing the proportion of the labor force employed at near-peak efficiency. Waste time on individual jobs is difficult to eliminate entirely. However, increased specialization with larger volumes enable a closer approach to this objective.

In the receiving and dressing operations, some tasks such as unloading, hanging, killing, pinning, rehangng and transferring, continue to be done by hand. However, it is possible to substitute additional machinery for labor to the point where the number of full-time pinners levels off. Because the dressing operation employs a high degree of mechanization, the total number of employees rises at a slower rate than in other departments. Hence, the output per worker continues to rise throughout the range of plant sizes studied. The length of the dressing line and the space required is essentially determined by the number of pieces of equipment used rather than by the number of employees.

As plant capacity increases, additional pieces of mechanized equipment are added for eviscerating. However, the reduction in the number of employees per unit of volume in eviscerating is not as great as in dressing. Providing working space for employees is a major factor in determining the length of the eviscerating line and the room size required. Moreover, output per worker rises at a more gradual rate, due to the increased proportion of workers employed at near-peak efficiency. Eviscerating lines in model plants were changed from single to single-divided, and from double to double-divided lines as plant size increased.

Most of the operations related to packing and boxing are necessarily done by hand at present. Hence, beyond a certain point, the ratio of people to volume becomes virtually constant. Table 16 shows the increases in output per employee which result in receiving and dressing; eviscerating and chilling; packing, boxing, and freezing; and in other plant operations as size of firm is increased. The rates of increase in pounds per employee from the smallest to the largest model for these operations are about 4.3, 2.5, 2.0, and 1.8 times, respectively.

Output per man hour in model plants is somewhat higher than good performance levels observed in plants surveyed (see table 5 and 6). This results from a higher rate of utilization of capacity, some differences in bird sizes, the specific crew

Table 15.--Number of line employees by jobs performed for one type of crew organization in model turkey processing plants

Job classification	Model number									
	1	2	3	4	5	6	7	8	9	10
	----- Employees -----									
Unload, hang	1	2	3	4	4	5	6	8	12	16
Shock, kill	1	1	1	1	1	2	2	2	3	4
Reverse, rehang, transfer	2	2	2	2	3	3	3	3	4	5
Pick and pin	3	6	7	8	8	8	8	8	8	8
Remove feet, pull tendons	1	1	1	1	1	2	2	2	3	4
Receiving and dressing	8	12	14	16	17	20	21	23	30	37
Rehang, 3-point		1	1	1	1	2	2	2	3	4
Split neck, remove crop, windpipe, oil sac	2									
Cut, open, vent, draw		2	3	5	5	6	6	8	10	12
Help inspector, trim	1	2	4	6	7	7	8	10	12	14
Remove and clean heart and liver	1	1	1	1	1	2	2	2	3	4
Remove, skin, clean gizzard	3	5	6	7	3	4	5	5	7	8
Remove lungs	3	5	6	7	5	5	6	8	10	13
Remove lungs	1	2	2	2	2	2	3	4	5	6
Wash, inspect	1	1	1	1	2	2	2	3	4	4
Wrap, stuff giblets		2	2	3	4	5	6	8	12	15
Remove head, cut and stuff neck	4	2	2	3	3	3	4	4	5	6
Cut tails, tuck, truss, take-off		2	3	3	4	5	6	8	9	12
Move tanks, ice, tend chilling		1	2	2	3	3	4	4	5	5
Eviscerating and chilling	13	21	27	34	40	46	54	66	85	103
Move tanks, drain, rehang	1	2	2	2	2	2	2	3	4	5
Remove birds, retruss, check	1	1	2	2	2	2	2	3	4	5
Grade	1	1	1	1	1	1	2	2	3	4
Bag, vacuum, check	2	3	5	6	6	7	7	8	12	16
Size and mark		1½	2	2	3	4	5	6	9	12
Sort, pack	2	2	2	2	3	3	5	8	11	16
Scale, mark, tally		1½	2	2	3	3	4	5	8	10
Handle to freeze and store				3	4	4	4	5	7	10
Inspect packed birds	2	2	3	1	1	1	1	1	2	3
Pack, box, freeze	8	14	19	21	25	27	32	41	60	81
Box and bag supply	1	2	2	2	2	3	3	4	6	7
Cleaning, maintenance	1	2	3	4	5	6	7	10	13	16
Load and ship	1	2		1	1	1	2	2	3	4
Undergrades and byproducts			3	3	4	4	6	8	11	15
Freezer crew	2	2	1	1	1	1	2	2	2	3
Cut-up line			2	2	3	4	5	6	8	12
Other	5	8	11	13	16	19	25	32	43	57

Table 16.--Output per hour per employee in model turkey plant processing heavy young hens 1/

	Model plant number									
	1	2	3	4	5	6	7	8	9	10
Number of heavy young hens processed per hour	200	400	600	800	1,000	1,200	1,500	2,000	3,000	4,000
Birds per hour per employee:										
Operating employees	5.9	7.3	8.5	9.5	10.2	10.7	11.4	12.3	13.8	14.4
Managerial, supervisory employees ..	100.0	133.3	133.3	123.1	111.1	104.3	100.0	95.2	111.1	117.6
All employees	5.6	6.9	7.9	8.8	9.3	9.7	10.2	10.9	12.2	12.8
Pounds processed per hour	2,600	5,200	7,800	10,400	13,000	15,600	19,500	26,000	39,000	52,000
Pounds per hour per employee:										
Receiving, dressing	325	433	557	650	765	780	929	1,130	1,300	1,405
Eviscerating, chilling	200	248	289	306	325	339	361	394	459	505
Packing, boxing, freezing	325	371	411	495	520	578	609	634	650	642
Other <u>2</u> /	520	650	709	800	812	821	780	812	907	912
Operating, total	77	95	110	124	133	139	148	160	179	187
Managerial, supervisory	1,300	1,733	1,733	1,600	1,444	1,356	1,300	1,238	1,444	1,529
All employees	73	90	103	114	121	126	133	142	159	166

1/ 100 percent of capacity. Average weight 13 lbs. per head. See table 17 for number of employees used to calculate these ratios.

2/ Includes supply, cleaning, maintenance, byproducts, shipping, freeze crew, and cut-up line.

organization assumed for model plants, and other assumptions such as uniform quality and optimum scheduling of output. Data in table 16 thus provide productivity goals toward which plant management can strive.

Managerial Efficiency

Some economies in managerial, supervisory, and office functions are inherent in large-scale operations. However, adequate performance of these functions eventually requires a constant proportion of such employees in relation to the total number of employees in operating departments. While there is no conclusive evidence of diseconomies appearing in these functions in the models used, it may well be that diseconomies would appear in multi-plant companies.

Table 17 shows the number of employees required in model plants, by functions. The ratio of plant employees to managerial, supervisory, and office employees decreases and then levels off at a firm size equivalent to model 8. However, the increases in efficiency which continue to be realized in plant operations through model 10 are more than enough to cause output per total employee to continue to rise.

Effect of Market Class on Economies of Scale

Aggregate costs per pound of product decline as plant size increases for all market classes of turkeys. Because of differences in weight per bird and in the number of head per hour which can be processed, the rates of decline in the economies of scale curves vary. This can be seen in figure 7, where the economies of scale curves for fryer-roasters, breeders, heavy young hens, and heavy young toms become flatter and successively apply to larger annual volumes.

For any one model plant size, the total dollar costs would be approximately equal regardless of the market class processed. Consequently, the relative cost advantages of successively larger plants remain consistent irrespective of market class. The actual proportions of various market classes which firms of different sizes elect to handle may depend, therefore, not on relative cost advantages or disadvantages, but on factors external to plant operations. Principal factors are the composition of local supplies, and the premiums which smaller plants can get (i.e., the range in market prices for various market classes) by servicing special outlets. In the latter instance, for example, the overall spread between the costs of the smallest and largest plant is more than three cents per pound on fryer-roasters, but less than two cents on heavy young toms.

Since capacity operations on breeders is impossible for plants with the current seasonal pattern of selling breeders, and since only a limited number of plants could potentially operate at capacity on fryer-roasters, the four economies of scale curves have been aggregated in figure 7. The combined curve, labeled "1960 slaughter pattern," reflects a composition by weight of 85.7 percent for heavy young turkeys, 4.2 percent for old turkeys (breeders) and 10.1 percent for fryer-roasters. These were the proportions slaughtered under Federal inspection in 1960. The 85.7 percent for heavy young turkeys was estimated to breakdown by weight into 47.9 percent for toms and 37.8 percent for hens. The spread from the smallest to the largest plant was about 2.2 cents per pound for a range in volume from 3,250,000 to 65 million pounds.

Table 17.--Number of employees required in model turkey processing plants by major functions 1/

Function	Model plant number									
	1	2	3	4	5	6	7	8	9	10
----- Employees -----										
Operating:										
Receiving and dressing	8	12	14	16	17	20	21	23	30	37
Eviscerating and chilling	13	21	27	34	40	46	54	66	85	103
Packing, boxing, freezing	8	14	19	21	25	27	32	41	60	81
Other <u>2/</u>	5	8	11	13	16	19	25	32	43	57
Total	34	55	71	84	98	112	132	162	218	278
Managerial, supervisory:										
Supervision, foremen	1	1	2	4	5	6	7	12	15	19
Office	1	1	1½	1½	2	3	5	5	7	9
Management <u>3/</u>	1	1	1	1	2	2½	3	4	5	6
Total	2	3	4½	6½	9	11½	15	21	27	34
Total, all employees	36	58	75½	90½	107	123½	147	183	245	312
Ratio of operating employees to managerial and supervisory employees	17.0	18.3	15.8	12.9	10.9	9.7	8.8	7.7	8.1	8.2

1/ At 100 percent of capacity.

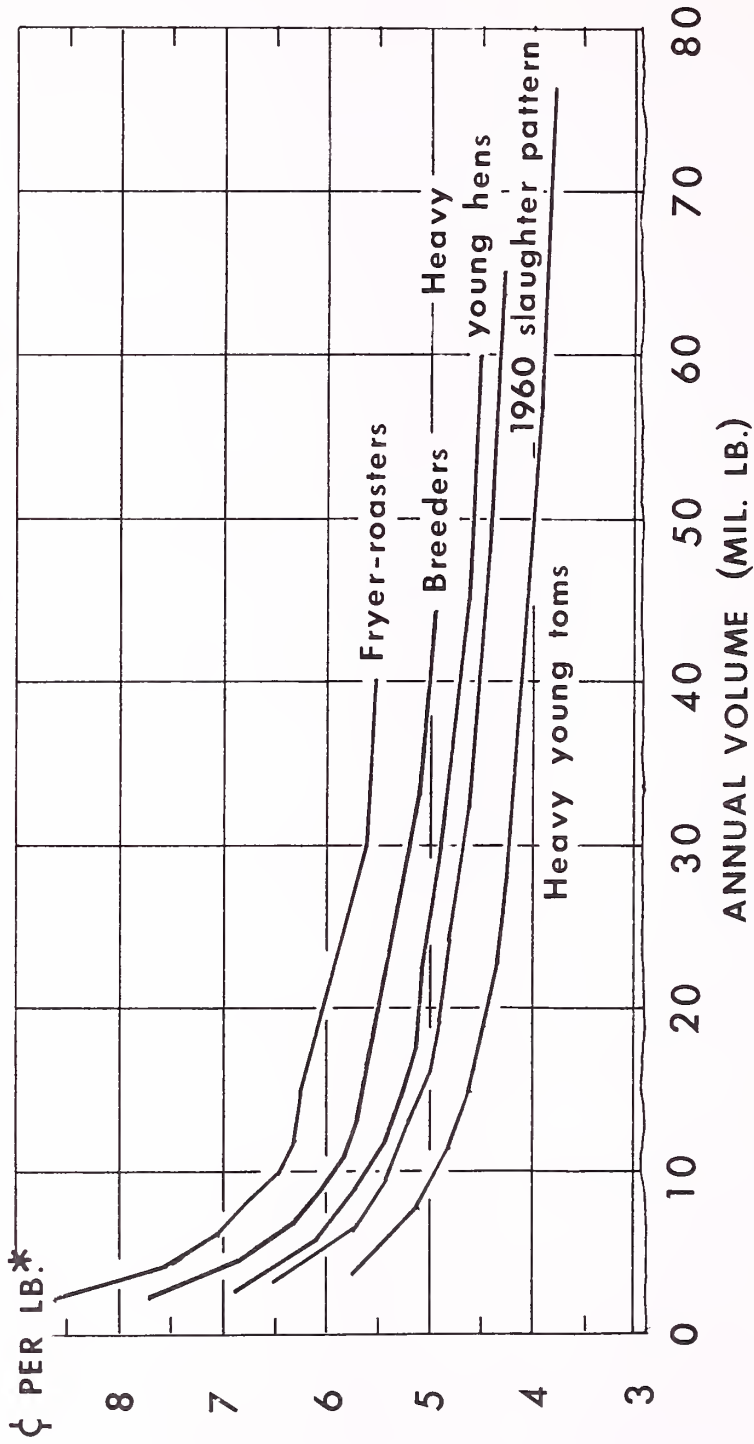
2/ Includes supply, cleaning, maintenance, byproducts, shipping, freezer crew, and cut-up line.

3/ Includes accountants, engineers, office managers.

Turkeys

PROCESSING COSTS BY PLANT SIZE AND MARKET CLASS

10 Model Plants Operating for 144 Days



*READY-TO-COOK BASIS.

Figure 7

Effect of Length of Operating Year on Economies of Scale

Most of the discussions and examples in previous sections of this report have involved model plants operating 144 days per year (and with 153 payroll days). This period is equivalent to about 7 months of operation, from mid-June to mid-January, when processing only heavy young hens and toms. Some plants operate in each month of the year, particularly if they process breeders, fryer-roasters, and chickens in addition to heavy young turkeys. However, underutilization of capacity is common, even during the period when heavy young turkeys move to market. Hence, a full 7 month's operation at capacity represents a high goal for plants concentrating on turkeys.

Under present conditions few, if any, plants concentrating on turkeys have the opportunity to operate at capacity for a full 12 months. Nevertheless, the effects of such a program on costs was studied. Comparisons made for this purpose involve the same ten model plants. A full year's operation would result in 243 operating days and 261 payroll days. This is based on 5-day, 40 hour weeks, with time off for holidays and vacations.

In moving from a 7 to 12 month's operation at capacity, some costs per unit of product would be reduced. The costs of capital ownership and use would decline because they are spread over a larger volume. While total dollar costs for wear depreciation and variable repairs would rise because of higher rates of usage, fixed overhead costs would decline. Similarly, fixed operating costs such as managerial, supervisory, and office salaries, miscellaneous, and heat and telephone would be spread over a larger volume and decline on a per unit of product basis. Under the assumptions made, constant-unit operating costs would increase in total, but not on a per unit of product basis. Dollar costs for electricity and water would rise, but probably decline per unit of product. Labor costs would increase in total, but remain constant per unit of product.

Heavy young hens and toms (fig. 8) may be used to illustrate the effect of operating at capacity 12 months rather than 7 months. For all models, annual volume would increase 69 percent but costs per unit of product would decline 8-9 percent. Thus, there would be no measureable effect on the relative positions of various sizes of firms.

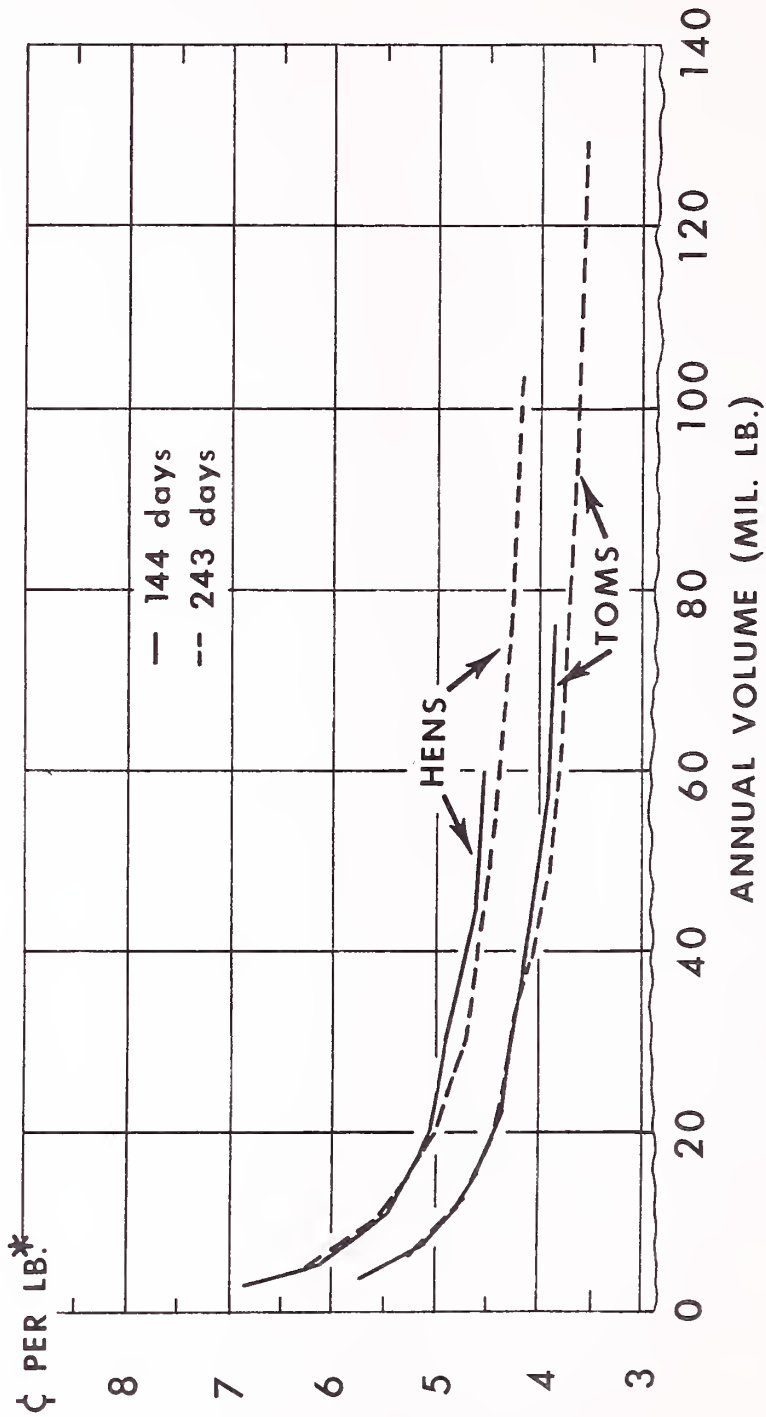
Effect of Wage and Salary Levels on Economies of Scale

While wage and salary levels in turkey processing plants vary from plant to plant, and from area to area depending on alternative employment opportunities, two general levels exist. Plants located at country points usually pay lower wage rates than plants in densely populated and heavily industrialized areas. Geographically, one might describe these levels as somewhat representative of Midwestern vs. West Coast conditions. Most of the preceding comparisons have been made using the more typical wage and salary level.

Heavy Young Hens and Toms

**PROCESSING COSTS BY PLANT SIZE
AND LENGTH OF OPERATING YEAR**

10 Model Plants



*READY-TO-COOK BASIS.

Figure 8

If a plant were faced with higher wage and salary levels, it would be concerned about the effect of these on its competitive position with respect to plants in other areas. Figure 9 presents such a comparison using heavy young hens as an example. The calculations for the high wage and salary level involve wage rates which are 1 1/2 times those at the typical level, and salary rates which are 15-40 percent higher, depending on the particular job. It is assumed the pressure for higher wages and salaries would result in the greatest percentage increase on hourly wage rates and on the lowest salary levels (table 8 and 9 show the wage and salary rates for the typical and high levels).

The net effect of a change to high wage and salary rates varies somewhat, depending on plant size. For plants operating at full capacity for 144 days, average total costs per unit of product are increased about 15 percent for model 1, 12 percent for model 3, 11 percent for model 5, and about 10 percent for model 7-10. This suggests that in the long run such plants, to remain competitive, should seek to operate at a higher rate of capacity, expand size more rapidly than plants in other areas, or seek offsetting differences in costs external to the processing plant.

Adjusting to the Effects of Economies of Scale in Processing

The economies of scale concept involves the determination of average total cost curves for model plants of different sizes, and the portrayal of a long-range planning curve. It is assumed that in the long run all costs are variable. The existence of economies of scale, i.e., decreasing costs per unit of product with increasing plant size suggests that, other things being equal, there will be a movement toward fewer and larger plants until all possible economies are realized. A necessary condition is that technological conditions also remain constant, or change in such a way that proportionate relationships will not be upset.

In actual practice, the processing plant cannot be viewed as an entity unto itself, nor can minimum costs be achieved at the expense of quality. In this study quality has been assumed constant in the absence of empirical data to the contrary. Even if the processing plant is not part of a vertically-integrated organization, the management of the plant cannot consider processing costs in isolation from procurement and assembly costs. Moreover, the types of outlets available for the ready-to-cook product may afford premiums or assess discounts to individual plants. Thus, management must seek its best adjustment on plant size as part of a package of costs and returns. One can, of course, assume other conditions will change in the long run. Even here, however, the nature of cost relationships in procurement and assembly may be such as to partially offset plant cost relationships.

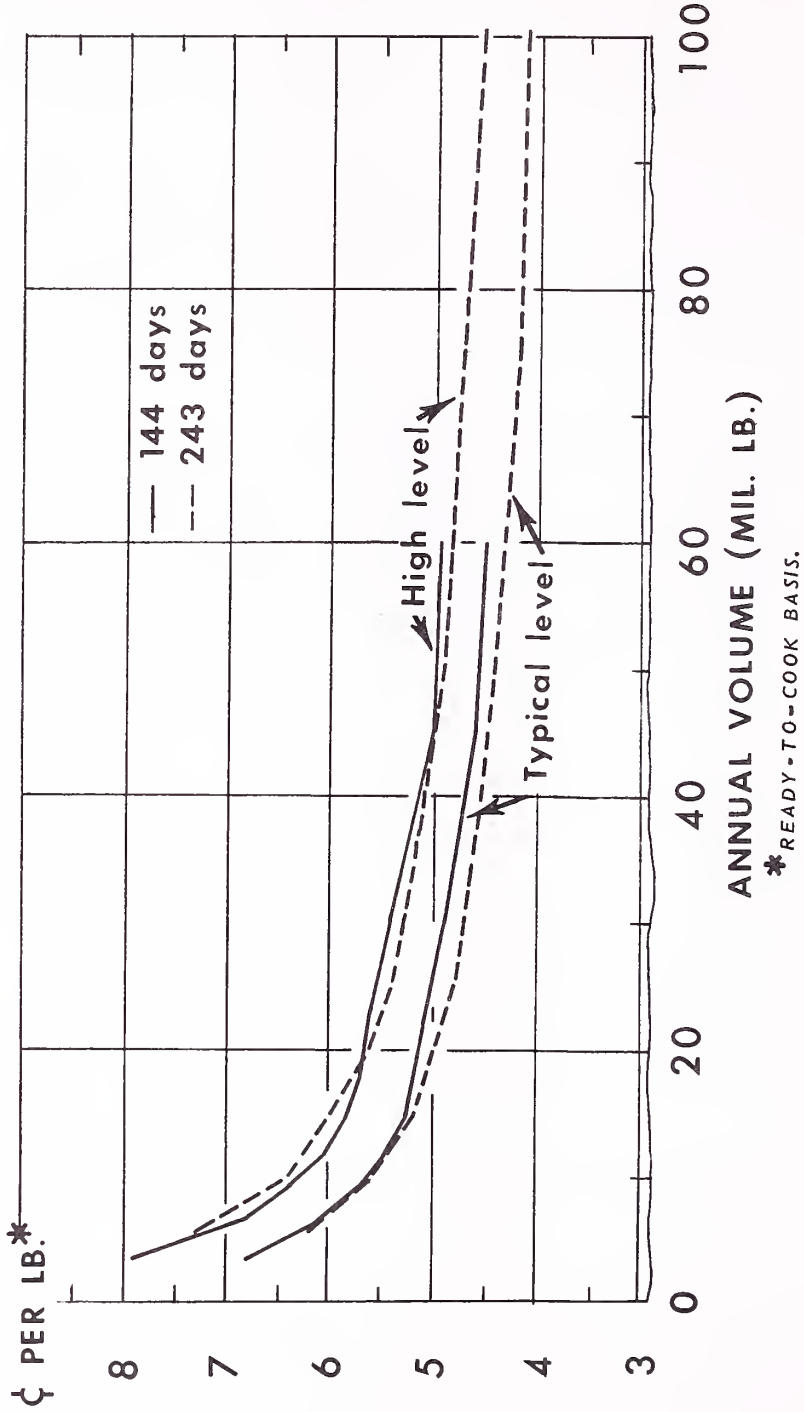
Moreover, if the processing plant is part of a vertically-integrated organization, costs of providing production inputs such as feed and poults, become a part of the overall cost and returns package.

This report, then, should provide guidelines to plant management concerning the potential savings available from use of capacity and expanded plant size. Research being prepared for publications concerns costs and efficiency in assembling turkeys, costs and economies of scale in turkey poult hatcheries, and the extent and nature of integration in the turkey industry. These and other factors will determine the extent to which inherent economies of scale in turkey processing can be realized.

Heavy Young Hens

PROCESSING COSTS BY PLANT SIZE, LENGTH OF OPERATING YEAR, AND PAY LEVEL

10 Model Plants



U. S. DEPARTMENT OF AGRICULTURE

NEG. ERS 2179-63 (7) ECONOMIC RESEARCH SERVICE

Figure 9

APPENDIX

Table 18.--Average cost per pound (ready-to-cook weight) in processing turkeys, by market classes and length of operating year, typical wage and salary levels 1/

Market class and length of operating year	Model plant number <u>2/</u>									
	1	2	3	4	5	6	7	8	9	10
<u>144</u> operating days <u>3/</u>										
Heavy young hens (13 lbs.)	Cents 6.866	Cents 6.088	Cents 5.707	Cents 5.470	Cents 5.276	Cents 5.173	Cents 5.092	Cents 4.903	Cents 4.615	Cents 4.531
Heavy young toms (22 lbs.)	5.724	5.109	4.798	4.613	4.453	4.369	4.292	4.140	3.914	3.847
Breeders (16 lbs.)	7.760	6.775	6.313	6.032	5.815	5.714	5.627	5.411	5.115	4.973
Fryer-roasters (7 lbs.)	8.585	7.509	6.979	6.689	6.455	6.334	6.243	6.009	5.681	5.522
<u>243</u> operating days <u>4/</u>										
Heavy young hens (13 lbs.)	6.284	5.613	5.262	5.019	4.857	4.731	4.622	4.452	4.257	4.165
Heavy young toms (22 lbs.)	5.265	4.733	4.450	4.257	4.125	4.018	3.921	3.783	3.630	3.558
Breeders (16 lbs.)	7.012	6.180	5.773	5.494	5.291	5.179	5.073	4.882	4.584	4.492
Fryer-roasters (7 lbs.)	7.765	6.855	6.389	6.097	5.879	5.749	5.635	5.424	5.100	4.996

1/ 100 percent of capacity. 2/ Capacities in terms of heavy young hens per hour: 200; 400; 600; 800; 1,000; 1,200; 1,500; 2,000; 3,000; 4,000 for model plant numbers 1 to 10, respectively. 3/ Wages paid for 153 days. 4/ Wages paid for 261 days.

Table 19.--Average cost per pound (ready-to-cook weight) in processing turkeys, by market classes and length of operating year, high wage and salary levels 1/

Market class and length of operating year	Model plant number <u>2/</u>									
	1	2	3	4	5	6	7	8	9	10
<u>144</u> operating days <u>3/</u>										
Heavy young hens (13 lbs.)	Cents 7.913	Cents 6.896	Cents 6.399	Cents 6.082	Cents 5.865	Cents 5.744	Cents 5.626	Cents 5.404	Cents 5.065	Cents 4.965
Heavy young toms (22 lbs.)	6.549	5.746	5.343	5.095	4.917	4.818	4.713	4.534	4.269	4.188
Breeders (16 lbs.)	9.160	7.860	7.237	6.853	6.603	6.481	6.338	6.076	5.712	5.547
Fryer-roasters (7 lbs.)	10.122	8.700	7.993	7.590	7.320	7.177	7.023	6.734	6.338	6.154
<u>243</u> operating days <u>4/</u>										
Heavy young hens (13 lbs.)	7.298	6.414	5.951	5.631	5.441	5.295	5.149	4.944	4.700	4.591
Heavy young toms (22 lbs.)	6.064	5.363	4.993	4.739	4.587	4.464	4.335	4.171	3.978	3.894
Breeders (16 lbs.)	8.367	7.255	6.694	6.313	6.070	5.937	5.775	5.536	5.173	5.059
Fryer-roasters (7 lbs.)	9.252	8.034	7.399	6.996	6.735	6.581	6.406	6.142	5.747	5.619

1/ 100 percent of capacity. 2/ Capacities in terms of heavy young hens per hour: 200; 400; 600; 800; 1,000; 1,200; 1,500; 2,000; 3,000; 4,000 for model plant numbers 1 to 10, respectively. 3/ Wages paid for 153 days. 4/ Wages paid for 261 days.

Table 20.--Average cost per pound (ready-to-cook weight), by major cost groups and in total, for processing turkeys in model plants operating at various percentages of capacity for 144 days

Plant capacity (number of heavy young hens per hour) and cost groups 1/	Percentage of capacity							
	30	40	50	60	70	80	90	100
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
200	6.128	5.186	4.533	4.132	3.767	3.471	3.232	3.019
Variable operating costs.....	2.130	2.130	2.130	2.130	2.130	2.130	2.130	2.130
Constant-unit operating costs.....	2.779	2.083	1.667	1.390	1.191	1.042	.926	.834
Fixed operating costs.....	2.946	2.209	1.768	1.473	1.262	1.104	.982	.883
Fixed overhead costs.....	13.983	11.608	10.098	9.125	8.350	7.747	7.270	6.866
Total costs.....	4.939	4.216	3.728	3.417	3.145	2.903	2.706	2.533
400	2.130	2.130	2.130	2.130	2.130	2.130	2.130	2.130
Variable operating costs.....	2.309	1.731	1.385	1.154	.989	.866	.769	.693
Constant-unit operating costs.....	2.440	1.824	1.464	1.220	1.046	.916	.813	.732
Fixed operating costs.....	11.818	9.901	8.707	7.921	7.310	6.815	6.418	6.088
Fixed overhead costs.....	4.376	3.782	3.370	3.093	2.866	2.645	2.467	2.312
Total costs.....	2.090	2.090	2.090	2.090	2.090	2.090	2.090	2.090
600	2.133	1.599	1.280	1.066	.914	.799	.711	.639
Variable operating costs.....	2.218	1.665	1.331	1.110	.951	.832	.740	.666
Constant-unit operating costs.....	10.817	9.136	8.071	7.359	6.821	6.366	6.008	5.707
Fixed operating costs.....	4.012	3.448	3.098	2.848	2.640	2.441	2.289	2.144
Fixed overhead costs.....	2.040	2.040	2.040	2.040	2.040	2.040	2.040	2.040
Total costs.....	2.085	1.563	1.251	1.042	.894	.782	.696	.626
800	2.197	1.647	1.317	1.098	.941	.824	.733	.660
Variable operating costs.....	10.334	8.698	7.706	7.028	6.515	6.087	5.758	5.470
Constant-unit operating costs.....	3.725	3.238	2.911	2.680	2.486	2.313	2.157	2.032
Fixed operating costs.....	2.010	2.010	2.010	2.010	2.010	2.010	2.010	2.010
Fixed overhead costs.....	2.088	1.566	1.252	1.044	.895	.783	.695	.626
Total costs.....	2.023	1.518	1.215	1.013	.868	.762	.675	.608
1,000	9.846	8.332	7.388	6.747	6.259	5.868	5.537	5.276
Variable operating costs.....								
Constant-unit operating costs.....								
Fixed operating costs.....								
Fixed overhead costs.....								
Total costs.....								

Table 20.--Average cost per pound (ready-to-cook weight), by major cost groups and in total, for processing turkeys in model plants operating at various percentages of capacity for 144 days--(Continued)

Plant capacity (number of heavy young hens per hour) and cost groups 1/	Percentage of capacity									
	30	40	50	60	70	80	90	100		
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
<u>1,200</u>										
Variable operating costs.....	3.532	3.103	2.790	2.570	2.384	2.232	2.082	1.962		
Constant-unit operating costs.....	1.990	1.990	1.990	1.990	1.990	1.990	1.990	1.990		
Fixed operating costs.....	2.129	1.597	1.277	1.064	.912	.797	.710	.638		
Fixed overhead costs.....	1.943	1.457	1.166	.971	.833	.729	.648	.583		
Total costs.....	9.594	8.147	7.223	6.595	6.119	5.748	5.430	5.173		
<u>1,500</u>										
Variable operating costs.....	3.310	2.938	2.642	2.435	2.260	2.115	1.985	1.869		
Constant-unit operating costs.....	1.970	1.970	1.970	1.970	1.970	1.970	1.970	1.970		
Fixed operating costs.....	2.298	1.722	1.379	1.149	.985	.861	.765	.689		
Fixed overhead costs.....	1.881	1.412	1.128	.940	.807	.707	.626	.564		
Total costs.....	9.459	8.042	7.119	6.494	6.022	5.653	5.346	5.092		
<u>2,000</u>										
Variable operating costs.....	3.015	2.706	2.434	2.244	2.081	1.961	1.829	1.732		
Constant-unit operating costs.....	1.960	1.960	1.960	1.960	1.960	1.960	1.960	1.960		
Fixed operating costs.....	2.256	1.691	1.353	1.127	.967	.846	.752	.677		
Fixed overhead costs.....	1.780	1.336	1.068	.890	.763	.666	.593	.534		
Total costs.....	9.011	7.693	6.815	6.221	5.711	5.433	5.134	4.903		
<u>3,000</u>										
Variable operating costs.....	2.566	2.332	2.118	1.952	1.811	1.707	1.602	1.516		
Constant-unit operating costs.....	1.960	1.960	1.960	1.960	1.960	1.960	1.960	1.960		
Fixed operating costs.....	2.089	1.565	1.253	1.044	.896	.783	.697	.627		
Fixed overhead costs.....	1.708	1.279	1.024	.854	.732	.640	.569	.512		
Total costs.....	8.323	7.136	6.355	5.810	5.399	5.090	4.828	4.615		
<u>4,000</u>										
Variable operating costs.....	2.406	2.196	2.000	1.873	1.749	1.647	1.545	1.463		
Constant-unit operating costs.....	1.960	1.960	1.960	1.960	1.960	1.960	1.960	1.960		
Fixed operating costs.....	2.042	1.530	1.225	1.021	.875	.766	.680	.613		
Fixed overhead costs.....	1.651	1.239	.992	.825	.707	.620	.549	.495		
Total costs.....	8.059	6.925	6.177	5.679	5.291	4.993	4.734	4.531		

1/ 13 lbs. average weight for hens.

Table 2L.--Average cost per pound (ready-to-cook weight), by major cost groups and in total, for processing turkeys in model plants operating at various percentages of capacity for 243 days

Plant capacity (number of heavy young hens per hour) and cost groups 1/	Percentage of capacity																			
	30	40	50	60	70	80	90	100	Cents	Cents										
<u>200</u>																				
Variable operating costs.....	5.818	4.949	4.342	3.904	3.643	3.375	3.156	2.962												
Constant-unit operating costs.....	2.130	2.130	2.130	2.130	2.130	2.130	2.130	2.130												
Fixed operating costs.....	2.233	1.674	1.339	1.117	.957	.837	.745	.670												
Fixed overhead costs.....	1.745	1.309	1.047	.873	.748	.654	.581	.522												
Total costs.....	11.926	10.062	8.858	8.024	7.478	6.996	6.612	6.284												
<u>400</u>																				
Variable operating costs.....	4.707	4.036	3.581	3.288	3.045	2.823	2.642	2.482												
Constant-unit operating costs.....	2.130	2.130	2.130	2.130	2.130	2.130	2.130	2.130												
Fixed operating costs.....	1.888	1.416	1.134	.944	.810	.708	.629	.566												
Fixed overhead costs.....	1.445	1.085	.867	.724	.619	.542	.482	.435												
Total costs.....	10.170	8.667	7.712	7.086	6.604	6.203	5.883	5.613												
<u>600</u>																				
Variable operating costs.....	4.146	3.567	3.196	2.940	2.744	2.546	2.385	2.242												
Constant-unit operating costs.....	2.090	2.090	2.090	2.090	2.090	2.090	2.090	2.090												
Fixed operating costs.....	1.787	1.339	1.073	.893	.766	.670	.596	.536												
Fixed overhead costs.....	1.314	.987	.789	.657	.564	.492	.437	.394												
Total costs.....	9.337	7.983	7.148	6.581	6.164	5.798	5.508	5.262												
<u>800</u>																				
Variable operating costs.....	3.714	3.318	2.899	2.672	2.495	2.318	2.185	2.057												
Constant-unit operating costs.....	2.040	2.040	2.040	2.040	2.040	2.040	2.040	2.040												
Fixed operating costs.....	1.775	1.331	1.065	.888	.761	.665	.592	.532												
Fixed overhead costs.....	1.301	.977	.782	.650	.559	.489	.433	.390												
Total costs.....	8.830	7.666	6.786	6.250	5.855	5.512	5.250	5.019												
<u>1,000</u>																				
Variable operating costs.....	3.420	2.992	2.706	2.497	2.332	2.182	2.045	1.935												
Constant-unit operating costs.....	2.010	2.010	2.010	2.010	2.010	2.010	2.010	2.010												
Fixed operating costs.....	1.840	1.380	1.104	.921	.789	.691	.613	.551												
Fixed overhead costs.....	1.199	.899	.719	.601	.515	.450	.400	.361												
Total costs.....	8.469	7.281	6.539	6.029	5.646	5.333	5.068	4.857												

Table 21.--Average cost per pound (ready-to-cook weight), by major cost groups and in total, for processing turkeys in model plants operating at various percentages of capacity for 243 days--(Continued)

Plant capacity (number of heavy young hens per hour) and cost groups 1/	Percentage of capacity									
	30	40	50	60	70	80	90	100		
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
<u>1,200</u>										
Variable operating costs.....	3.201	2.832	2.562	2.365	2.210	2.082	1.951	1.847		
Constant-unit operating costs....	1.990	1.990	1.990	1.990	1.990	1.990	1.990	1.990		
Fixed operating costs.....	1.825	1.369	1.095	.912	.782	.684	.609	.548		
Fixed overhead costs.....	1.152	.864	.691	.576	.493	.432	.384	.346		
Total costs.....	8.168	7.055	6.338	5.843	5.475	5.188	4.934	4.731		
<u>1,500</u>										
Variable operating costs.....	2.911	2.603	2.358	2.175	2.033	1.916	1.806	1.736		
Constant-unit operating costs....	1.970	1.970	1.970	1.970	1.970	1.970	1.970	1.970		
Fixed operating costs.....	1.938	1.453	1.163	.969	.831	.726	.646	.582		
Fixed overhead costs.....	1.114	.837	.669	.559	.478	.418	.372	.334		
Total costs.....	7.933	6.863	6.160	5.673	5.312	5.030	4.794	4.622		
<u>2,000</u>										
Variable operating costs.....	2.654	2.403	2.180	2.011	1.882	1.785	1.673	1.593		
Constant-unit operating costs....	1.960	1.960	1.960	1.960	1.960	1.960	1.960	1.960		
Fixed operating costs.....	1.935	1.451	1.161	.968	.830	.726	.645	.582		
Fixed overhead costs.....	1.053	.792	.633	.529	.451	.395	.350	.317		
Total costs.....	7.602	6.606	5.934	5.468	5.123	4.866	4.628	4.452		
<u>3,000</u>										
Variable operating costs.....	2.339	2.161	1.973	1.823	1.708	1.620	1.530	1.457		
Constant-unit operating costs....	1.960	1.960	1.960	1.960	1.960	1.960	1.960	1.960		
Fixed operating costs.....	1.788	1.346	1.073	.894	.767	.670	.596	.536		
Fixed overhead costs.....	1.012	.762	.607	.506	.434	.380	.337	.304		
Total costs.....	7.099	6.229	5.613	5.183	4.869	4.630	4.423	4.257		
<u>4,000</u>										
Variable operating costs.....	2.156	1.996	1.835	1.726	1.628	1.546	1.458	1.389		
Constant-unit operating costs....	1.960	1.960	1.960	1.960	1.960	1.960	1.960	1.960		
Fixed operating costs.....	1.742	1.306	1.045	.872	.746	.653	.581	.523		
Fixed overhead costs.....	.978	.734	.588	.490	.419	.366	.327	.293		
Total costs.....	6.836	5.996	5.428	5.048	4.753	4.525	4.326	4.165		

1/ 13 lbs. average weight for hens.

Table 22.--Average cost per pound (ready-to-cook weight), by major cost groups and in total, for processing turkeys in model plants operating at various percentages of capacity for 144 days

Plant capacity (number of heavy young toms per hour) and cost groups 1/	Percentage of capacity												
	30	40	50	60	70	80	90	100	Cents	Cents			
<u>150</u>													
Variable operating costs.....	4.827	4.087	3.572	3.211	2.969	2.735	2.546	2.380					
Constant-unit operating costs.....	1.990	1.990	1.990	1.990	1.990	1.990	1.990	1.990					
Fixed operating costs.....	2.188	1.642	1.313	1.095	.938	.821	.729	.657					
Fixed overhead costs.....	2.320	1.740	1.392	1.161	.993	.869	.774	.697					
Total costs.....	11.325	9.459	8.267	7.457	6.890	6.415	6.039	5.724					
<u>300</u>													
Variable operating costs.....	3.893	3.322	2.938	2.692	2.478	2.288	2.132	1.995					
Constant-unit operating costs.....	1.990	1.990	1.990	1.990	1.990	1.990	1.990	1.990					
Fixed operating costs.....	1.818	1.364	1.092	.911	.780	.682	.606	.546					
Fixed overhead costs.....	1.922	1.442	1.153	.962	.824	.721	.641	.578					
Total costs.....	9.623	8.118	7.173	6.555	6.072	5.681	5.369	5.109					
<u>450</u>													
Variable operating costs.....	3.480	2.980	2.655	2.437	2.258	2.084	1.945	1.821					
Constant-unit operating costs.....	1.950	1.950	1.950	1.950	1.950	1.950	1.950	1.950					
Fixed operating costs.....	1.679	1.260	1.008	.841	.720	.629	.559	.504					
Fixed overhead costs.....	1.748	1.311	1.049	.874	.748	.656	.584	.523					
Total costs.....	8.857	7.501	6.662	6.102	5.676	5.319	5.038	4.798					
<u>600</u>													
Variable operating costs.....	3.161	2.716	2.439	2.243	2.080	1.922	1.804	1.690					
Constant-unit operating costs.....	1.910	1.910	1.910	1.910	1.910	1.910	1.910	1.910					
Fixed operating costs.....	1.641	1.232	.985	.822	.704	.616	.546	.494					
Fixed overhead costs.....	1.731	1.298	1.038	.865	.741	.649	.577	.519					
Total costs.....	8.443	7.156	6.372	5.840	5.435	5.097	4.837	4.613					
<u>750</u>													
Variable operating costs.....	2.935	2.552	2.293	2.112	1.959	1.821	1.698	1.602					
Constant-unit operating costs.....	1.880	1.880	1.880	1.880	1.880	1.880	1.880	1.880					
Fixed operating costs.....	1.645	1.233	.986	.822	.704	.617	.548	.493					
Fixed overhead costs.....	1.595	1.196	.957	.798	.683	.598	.532	.478					
Total costs.....	8.055	6.861	6.116	5.612	5.226	4.916	4.658	4.453					

Table 22.--Average cost per pound (ready-to-cook weight), by major cost groups and in total, for processing turkeys in model plants operating at various percentages of capacity for 144 days--(Continued)

Plant capacity (number of heavy young toms per hour) and cost groups 1/	Percentage of capacity									
	30	40	50	60	70	80	90	100	Cents	Cents
<u>900</u>										
Variable operating costs.....	2.783	2.444	2.198	2.026	1.879	1.759	1.639	1.546		
Constant-unit operating costs.....	1.860	1.860	1.860	1.860	1.860	1.860	1.860	1.860		
Fixed operating costs.....	1.677	1.257	1.006	.839	.719	.630	.559	.504		
Fixed overhead costs.....	1.532	1.148	.920	.766	.656	.574	.509	.459		
Total costs.....	7.852	6.709	5.984	5.491	5.114	4.823	4.567	4.369		
<u>1,125</u>										
Variable operating costs.....	2.609	2.314	2.082	1.919	1.780	1.667	1.562	1.473		
Constant-unit operating costs.....	1.830	1.830	1.830	1.830	1.830	1.830	1.830	1.830		
Fixed operation costs.....	1.809	1.358	1.085	.906	.777	.678	.602	.544		
Fixed overhead costs.....	1.483	1.111	.890	.741	.636	.556	.494	.445		
Total costs.....	7.731	6.613	5.887	5.396	5.023	4.731	4.488	4.292		
<u>1,500</u>										
Variable operating costs.....	2.374	2.131	1.917	1.767	1.640	1.545	1.442	1.365		
Constant-unit operating costs.....	1.820	1.820	1.820	1.820	1.820	1.820	1.820	1.820		
Fixed operating costs.....	1.777	1.333	1.066	.889	.762	.667	.592	.534		
Fixed overhead costs.....	1.402	1.052	.842	.701	.602	.526	.466	.421		
Total costs.....	7.373	6.336	5.645	5.177	4.824	4.558	4.320	4.140		
<u>2,250</u>										
Variable operating costs.....	2.021	1.837	1.669	1.538	1.427	1.345	1.262	1.196		
Constant-unit operating costs.....	1.820	1.820	1.820	1.820	1.820	1.820	1.820	1.820		
Fixed operating costs.....	1.645	1.234	.987	.823	.705	.617	.548	.493		
Fixed overhead costs.....	1.346	1.009	.808	.671	.577	.505	.449	.405		
Total costs.....	6.832	5.900	5.284	4.852	4.529	4.287	4.079	3.914		
<u>3,000</u>										
Variable operating costs.....	1.896	1.732	1.576	1.475	1.378	1.298	1.218	1.153		
Constant-unit operating costs.....	1.820	1.820	1.820	1.820	1.820	1.820	1.820	1.820		
Fixed operating costs.....	1.608	1.206	.965	.805	.690	.603	.536	.483		
Fixed overhead costs.....	1.301	.976	.780	.650	.559	.488	.433	.391		
Total costs.....	6.625	5.734	5.141	4.750	4.447	4.209	4.007	3.847		

1/ 22 lbs. average weight for toms.

Table 23.---Average cost per pound (ready-to-cook weight), by major cost groups and in total, for processing turkeys in model plants operating at various percentages of capacity for 243 days

Plant capacity (number of heavy young toms per hour) and cost groups 1/	Percentage of capacity												
	30	40	50	60	70	80	90	100	Cents	Cents			
<u>150</u>													
Variable operating costs.....	4.584	3.900	3.422	3.077	2.870	2.658	2.487	2.334					
Constant-unit operating costs.....	1.990	1.990	1.990	1.990	1.990	1.990	1.990	1.990					
Fixed operating costs.....	1.759	1.320	1.055	.880	.754	.659	.586	.528					
Fixed overhead costs.....	1.376	1.031	.824	.688	.590	.517	.459	.413					
Total costs.....	9.709	8.241	7.291	6.635	6.204	5.824	5.522	5.265					
<u>300</u>													
Variable operating costs.....	3.708	3.179	2.822	2.592	2.399	2.225	2.082	1.956					
Constant-unit operating costs.....	1.990	1.990	1.990	1.990	1.990	1.990	1.990	1.990					
Fixed operating costs.....	1.488	1.116	.893	.744	.638	.558	.496	.447					
Fixed overhead costs.....	1.139	.855	.684	.569	.488	.426	.379	.340					
Total costs.....	8.325	7.140	6.389	5.895	5.515	5.199	4.947	4.733					
<u>450</u>													
Variable operating costs.....	3.264	2.811	2.518	2.316	2.161	2.006	1.879	1.766					
Constant-unit operating costs.....	1.950	1.950	1.950	1.950	1.950	1.950	1.950	1.950					
Fixed operating costs.....	1.407	1.056	.845	.705	.603	.528	.468	.423					
Fixed overhead costs.....	1.035	.777	.621	.517	.444	.389	.345	.311					
Total costs.....	7.656	6.594	5.934	5.488	5.158	4.873	4.642	4.450					
<u>600</u>													
Variable operating costs.....	2.926	2.517	2.284	2.106	1.966	1.827	1.721	1.620					
Constant-unit operating costs.....	1.910	1.910	1.910	1.910	1.910	1.910	1.910	1.910					
Fixed operating costs.....	1.398	1.050	.839	.699	.600	.524	.465	.420					
Fixed overhead costs.....	1.025	.769	.616	.514	.440	.385	.343	.207					
Total costs.....	7.259	6.246	5.649	5.229	4.916	4.646	4.439	4.257					
<u>750</u>													
Variable operating costs.....	2.695	2.356	2.132	1.967	1.837	1.720	1.612	1.525					
Constant-unit operating costs.....	1.880	1.880	1.880	1.880	1.880	1.880	1.880	1.880					
Fixed operating costs.....	1.449	1.087	.870	.725	.622	.544	.482	.435					
Fixed overhead costs.....	.978	.708	.566	.473	.405	.356	.315	.285					
Total costs.....	7.002	6.031	5.448	5.045	4.744	4.500	4.289	4.125					

Table 23.--Average cost per pound (ready-to-cook weight), by major cost groups and in total, for processing turkeys in model plants operating at various percentages of capacity for 243 days--(Continued)

Plant capacity (number of heavy young toms per hour) and cost groups 1/	Percentage of capacity									
	30	40	50	60	70	80	90	100		
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
<u>900</u>										
Variable operating costs.....	2.523	2.230	2.020	1.863	1.741	1.640	1.538	1.455		
Constant-unit operating costs.....	1.860	1.860	1.860	1.860	1.860	1.860	1.860	1.860		
Fixed operating costs.....	1.438	1.078	.862	.720	.616	.539	.479	.431		
Fixed overhead costs.....	.908	.679	.545	.452	.389	.342	.302	.272		
Total costs.....	6.729	5.747	5.287	4.895	4.606	4.381	4.179	4.018		
<u>1,125</u>										
Variable operating costs.....	2.294	2.051	1.858	1.713	1.603	1.510	1.423	1.368		
Constant-unit operating costs.....	1.830	1.830	1.830	1.830	1.830	1.830	1.830	1.830		
Fixed operating costs.....	1.526	1.145	.915	.764	.655	.573	.509	.459		
Fixed overhead costs.....	.878	.660	.526	.438	.377	.329	.292	.264		
Total costs.....	6.528	5.686	5.129	4.745	4.465	4.242	4.054	3.921		
<u>1,500</u>										
Variable operating costs.....	2.090	1.894	1.716	1.585	1.483	1.407	1.319	1.257		
Constant-unit operating costs.....	1.820	1.820	1.820	1.820	1.820	1.820	1.820	1.820		
Fixed operating costs.....	1.525	1.144	.915	.763	.654	.572	.508	.457		
Fixed overhead costs.....	.832	.622	.499	.416	.356	.312	.277	.249		
Total costs.....	6.267	5.480	4.950	4.584	4.313	4.111	3.924	3.783		
<u>2,250</u>										
Variable operating costs.....	1.844	1.696	1.554	1.436	1.345	1.278	1.205	1.148		
Constant-unit operating costs.....	1.820	1.820	1.820	1.820	1.820	1.820	1.820	1.820		
Fixed operating costs.....	1.407	1.057	.845	.704	.604	.527	.469	.423		
Fixed overhead costs.....	.797	.598	.478	.399	.343	.300	.265	.239		
Total costs.....	5.868	5.171	4.697	4.359	4.112	3.925	3.759	3.630		
<u>3,000</u>										
Variable operating costs.....	1.700	1.573	1.446	1.360	1.283	1.217	1.148	1.094		
Constant-unit operating costs.....	1.820	1.820	1.820	1.820	1.820	1.820	1.820	1.820		
Fixed operating costs.....	1.372	1.030	.823	.687	.589	.514	.457	.413		
Fixed overhead costs.....	.771	.578	.463	.386	.331	.289	.257	.231		
Total costs.....	5.663	5.001	4.552	4.253	4.023	3.840	3.682	3.558		

1/ 22 lbs. average weight for toms.

Table 24.--Average cost per pound (ready-to-cook weight), by major cost groups and in total, for processing turkeys in model plants operating at various percentages of capacity for 144 days

Plant capacity (number of fryer-roaster per hour) and cost groups 1/	Percentage of capacity									
	30	40	50	60	70	80	90	100	Cents	Cents
250										
Variable operating costs	8.295	6.953	6.064	5.488	4.988	4.581	4.254	3.965		
Constant-unit operating costs ..	2.290	2.290	2.290	2.290	2.290	2.290	2.290	2.290		
Fixed operating costs.....	3.395	2.546	2.036	1.698	1.455	1.274	1.132	1.018		
Fixed overhead costs	4.376	3.283	2.626	2.188	1.875	1.640	1.459	1.312		
Total costs	18.356	15,072	13.016	11.664	10.608	9.785	9.135	8.585		
500										
Variable operating costs	6.616	5.587	4.935	4.486	4.112	3.789	3.523	3.289		
Constant-unit operating costs ..	2.290	2.290	2.290	2.290	2.290	2.290	2.290	2.290		
Fixed operating costs	2.803	2.101	1.681	1.401	1.200	1.051	.934	.840		
Fixed overhead costs	3.626	2.719	2.175	1.813	1.555	1.359	1.209	1.090		
Total costs	15.335	12.697	11.081	9.990	9.157	8.489	7.956	7.509		
750										
Variable operating costs	5.844	4.948	4.408	4.012	3.711	3.414	3.174	2,963		
Constant-unit operating costs ..	2.240	2.240	2.240	2.240	2.240	2.240	2.240	2.240		
Fixed operating costs	2.627	1.971	1.576	1.314	1.125	.986	.875	.788		
Fixed overhead costs	3.295	2.471	1.978	1.648	1.412	1.235	1.098	.988		
Total costs	14.006	11.630	10.202	9.214	8.488	7.875	7.387	6.979		
1,000										
Variable operating costs	5.277	4.482	4.030	3.673	3.398	3.130	2,930	2.736		
Constant-unit operating costs ..	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200		
Fixed operating cost	2.578	1.934	1.546	1.299	1.105	.967	.859	.773		
Fixed overhead costs	3.264	2.448	1.957	1.633	1.399	1.225	1.088	.980		
Total costs	13.319	11.064	9.733	8.795	8.102	7.522	7.077	6.689		
1,250										
Variable operating costs	4.892	4.210	3.787	3.458	3.201	2,968	2.763	2,598		
Constant-unit operating costs ..	2.160	2.160	2.160	2.160	2.160	2.160	2.160	2.160		
Fixed operating costs	2.648	1.985	1.588	1.324	1.135	.993	.883	.794		
Fixed overhead costs	3.010	2.256	1.805	1.504	1.289	1.127	1.003	.903		
Total costs	12.710	10.611	9.340	8.446	7.785	7.248	6.809	6.455		

Table 24.--Average cost per pound (ready-to-cook weight), by major cost groups and in total, for processing turkeys in model plants operating at various percentages of capacity for 144 days --(Continued)

Plant capacity (number of fryer-roaster per hour) and cost groups 1/	Percentage of capacity							
	30	40	50	60	70	80	90	100
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
<u>1,500</u>								
Variable operating costs	4.655	4.053	3.648	3.332	3.087	2.883	2.682	2.522
Constant-unit operating costs ..	2.130	2.130	2.130	2.130	2.130	2.130	2.130	2.130
Fixed operating costs	2.723	2.042	1.634	1.361	1.167	1.021	.908	.816
Fixed overhead costs	2.887	2.164	1.733	1.442	1.239	1.083	.963	.866
Total costs	12.395	10.389	9.145	8.265	7.623	7.117	6.683	6.334
<u>1,875</u>								
Variable operating costs	4.350	3.833	3.449	3.155	2.921	2.729	2.556	2.404
Constant-unit operating costs ..	2.110	2.110	2.110	2.110	2.110	2.110	2.110	2.110
Fixed operating costs	2.969	2.228	1.781	1.485	1.273	1.114	.990	.891
Fixed overhead costs	2.795	2.096	1.678	1.398	1.198	1.049	.932	.838
Total costs	12.224	10.267	9.018	8.148	7.502	7.002	6.588	6.243
<u>2,500</u>								
Variable operating costs	3.980	3.550	3.196	2.925	2.710	2.548	2.373	2.244
Constant-unit operating costs ..	2.100	2.100	2.100	2.100	2.100	2.100	2.100	2.100
Fixed operating costs	2.902	2.176	1.741	1.451	1.243	1.088	.967	.871
Fixed overhead costs	2.644	1.984	1.585	1.323	1.134	.992	.881	.794
Total costs	11.626	9.810	8.622	7.799	7.187	6.728	6.321	6.009
<u>3,750</u>								
Variable operating costs	3.466	3.138	2.854	2.615	2.425	2.284	2.138	2.024
Constant-unit operating costs ..	2.100	2.100	2.100	2.100	2.100	2.100	2.100	2.100
Fixed operating costs	2.648	1.986	1.590	1.324	1.136	.994	.882	.795
Fixed overhead costs	2.538	1.902	1.524	1.268	1.087	.952	.845	.762
Total costs	10.752	9.126	8.068	7.307	6.748	6.330	5.965	5.681
<u>5,000</u>								
Variable operating costs	3.176	2.887	2.635	2.453	2.290	2.155	2.018	1.907
Constant-unit operating costs ..	2.100	2.100	2.100	2.100	2.100	2.100	2.100	2.100
Fixed operating costs	2.601	1.951	1.560	1.300	1.114	.975	.867	.780
Fixed overhead costs	2.454	1.841	1.472	1.227	1.051	.920	.819	.735
Total costs	10.331	8.779	7.767	7.080	6.555	6.150	5.804	5.522

1/ 7 lbs. average weight for fryer-roasters.

Table 25.--Average cost per pound (ready-to-cook weight), by major cost groups and in total, for processing turkeys in model plants operating at various percentages of capacity for 243 days

Plant capacity (number of fryer-roaster per hour) and cost groups \downarrow	Percentage of capacity							
	30	40	50	60	70	80	90	100
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
<u>250</u>								
Variable operating costs	7.873	6.635	5.812	5.278	4.832	4.464	4.167	3.903
Constant-unit operating costs ..	2.290	2.290	2.290	2.290	2.290	2.290	2.290	2.290
Fixed operating costs	2.652	1.988	1.590	1.325	1.136	.995	.884	.795
Fixed overhead costs	2.594	1.945	1.556	1.296	1.111	.973	.864	.777
Total costs	15.409	12.858	11.248	10.189	9.369	8.722	8.205	7.765
<u>500</u>								
Variable operating costs	6.301	5.350	4.745	4.326	3.997	3.694	3.452	3.234
Constant-unit operating costs ..	2.290	2.290	2.290	2.290	2.290	2.290	2.290	2.290
Fixed operating costs	2.286	1.714	1.371	1.144	.984	.857	.762	.686
Fixed overhead costs	2.149	1.611	1.289	1.075	.920	.806	.716	.645
Total costs	13.026	10.965	9.695	8.835	8.191	7.647	7.220	6.855
<u>750</u>								
Variable operating costs	5.508	4.693	4.205	3.839	3.580	3.314	3.097	2.906
Constant-unit operating costs ..	2.240	2.240	2.240	2.240	2.240	2.240	2.240	2.240
Fixed operating costs	2.196	1.647	1.317	1.097	.940	.823	.732	.658
Fixed overhead costs	1.954	1.465	1.173	.977	.837	.732	.650	.585
Total costs	11.898	10.045	8.935	8.153	7.597	7.109	6.719	6.389
<u>1,000</u>								
Variable operating costs	4.923	4.210	3.811	3.485	3.253	3.015	2.840	2.665
Constant-unit operating costs ..	2.200	2.200	2.200	2.200	2.200	2.200	2.200	2.200
Fixed operating costs	2.175	1.632	1.305	1.088	.932	.816	.725	.652
Fixed overhead costs	1.933	1.452	1.164	.967	.827	.725	.645	.580
Total costs	11.231	9.494	8.480	7.740	7.212	6.756	6.410	6.097
<u>1,250</u>								
Variable operating costs	4,540	3,937	3,566	3,266	3,051	2,848	2,664	2,519
Constant-unit operating costs ..	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160
Fixed operating costs	2,218	1,664	1,331	1,109	.950	.832	.739	.665
Fixed overhead costs	1,783	1,339	1,070	.892	.765	.668	.594	.535
Total costs	10,701	9,100	8,127	7,427	6,926	6,508	6,157	5,879

Table 25.--Average cost per pound (ready-to-cook weight), by major cost groups and in total, for processing turkeys in model plants operating at various percentages of capacity for 243 days --(Continued)

Plant capacity (number of fryer-roaster per hour) and cost groups 1/	Percentage of capacity									
	30	40	50	60	70	80	90	100	Cents	Cents
<u>1,500</u>	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Variable operating costs	4.278	3.759	3.407	3.124	2.919	2.746	2.570	2.429		
Constant-unit operating costs ..	2.130	2.130	2.130	2.130	2.130	2.130	2.130	2.130		
Fixed operating costs	2.258	1.694	1.354	1.129	.967	.847	.753	.677		
Fixed overhead costs	1.711	1.284	1.026	.855	.736	.641	.570	.513		
Total costs	10.377	8.867	7.917	7.238	6.752	6.364	6.023	5.749		
<u>1,875</u>	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents		
Variable operating costs	3.963	3.527	3.199	2.936	2.744	2.584	2.435	2.303		
Constant-unit operating costs ..	2.110	2.110	2.110	2.110	2.110	2.110	2.110	2.110		
Fixed operating costs	2.420	1.814	1.451	1.210	1.037	.908	.807	.726		
Fixed overhead costs	1.657	1.243	.992	.827	.708	.621	.552	.496		
Total costs	10.150	8.694	7.752	7.083	6.599	6.223	5.904	5.635		
<u>2,500</u>	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents		
Variable operating costs	3.577	3.228	2.929	2.689	2.516	2.405	2.235	2.127		
Constant-unit operating costs ..	2.100	2.100	2.100	2.100	2.100	2.100	2.100	2.100		
Fixed operating costs	2.432	1.817	1.454	1.211	1.039	.909	.807	.727		
Fixed overhead costs	1.567	1.175	.941	.783	.674	.587	.522	.470		
Total costs	9.667	8.320	7.424	6.783	6.329	6.001	5.664	5.424		
<u>3,750</u>	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents		
Variable operating costs	3.045	2.793	2.565	2.355	2.205	2.093	1.973	1.877		
Constant-unit operating costs ..	2.100	2.100	2.100	2.100	2.100	2.100	2.100	2.100		
Fixed operating costs	2.241	1.680	1.345	1.121	.960	.840	.747	.672		
Fixed overhead costs	1.504	1.127	.902	.752	.646	.564	.501	.451		
Total costs	8.890	7.700	6.912	6.328	5.911	5.559	5.321	5.100		
<u>5,000</u>	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents		
Variable operating costs	2.824	2.607	2.408	2.250	2.124	2.019	1.902	1.809		
Constant-unit operating costs ..	2.100	2.100	2.100	2.100	2.100	2.100	2.100	2.100		
Fixed operating costs	2.174	1.630	1.304	1.088	.932	.815	.725	.651		
Fixed overhead costs	1.454	1.089	.871	.726	.623	.545	.486	.436		
Total costs	8.552	7.426	6.683	6.164	5.779	5.479	5.213	4.996		

1/ 7 lb. average weight for fryer-roasters.

Table 26.--Average cost per pound (ready-to-cook weight), by major cost groups and in total, for processing turkeys in model plants operating at various percentages of capacity for 144 days

Plant capacity (number of breeders per hour) and cost groups ✓	Percentage of capacity							
	30	40	50	60	70	80	90	100
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
<u>120</u>								
Variable operating costs	7.560	6.336	5.526	5.002	4.548	4.175	3.878	3.615
Constant-unit operating costs ..	2.020	2.020	2.020	2.020	2.020	2.020	2.020	2.020
Fixed operating costs	3.094	2.320	1.857	1.547	1.326	1.161	1.031	.928
Fixed overhead costs	3.989	2.992	2.393	1.995	1.709	1.496	1.031	.928
Total costs	16.663	13.668	11.796	10.564	9.603	8.852	8.258	7.760
<u>240</u>								
Variable operating costs	6.028	5.093	4.497	4.089	3.749	3.455	3.212	2.997
Constant-unit operating costs ..	2.020	2.020	2.020	2.020	2.020	2.020	2.020	2.020
Fixed operating costs	2.554	1.915	1.532	1.276	1.095	.958	.852	.767
Fixed overhead costs	3.306	2.479	1.983	1.653	1.416	1.239	1.103	.991
Total costs	13.908	11.507	10.032	9.038	8.280	7.672	7.187	6.775
<u>360</u>								
Variable operating costs	5.327	4.511	4.018	3.656	3.383	3.112	2.893	2.702
Constant-unit operating costs ..	1.990	1.990	1.990	1.990	1.990	1.990	1.990	1.990
Fixed operating costs	2.395	1.795	1.436	1.197	1.026	.899	.798	.719
Fixed overhead costs	3.003	2.253	1.803	1.503	1.288	1.126	1.002	.902
Total costs	12.715	10.549	9.247	8.346	7.687	7.127	6.683	6.313
<u>480</u>								
Variable operating costs	4.810	4.086	3.673	3.348	3.097	2.852	2.670	2.494
Constant-unit operating costs ..	1.940	1.940	1.940	1.940	1.940	1.940	1.940	1.940
Fixed operating costs	2.350	1.762	1.409	1.175	1.007	.882	.783	.705
Fixed overhead costs	2.976	2.231	1.785	1.486	1.276	1.116	.992	.893
Total costs	12.076	10.019	8.807	7.949	7.320	6.790	6.385	6.032
<u>600</u>								
Variable operating costs	4.459	3.837	3.452	3.151	2.917	2.706	2.518	2.368
Constant-unit operating costs ..	1.900	1.900	1.900	1.900	1.900	1.900	1.900	1.900
Fixed operating costs	2.412	1.808	1.447	1.206	1.034	.904	.804	.724
Fixed overhead costs	2.742	2.057	1.647	1.372	1.174	1.027	.913	.823
Total costs	11.513	9.662	8.446	7.629	7.025	6.537	6.135	5.815

Table 26.—Average cost per pound (ready-to-cook weight), by major cost groups and in total, for processing turkeys in model plants operating at various percentages of capacity for 144 days --(Continued)

Plant capacity (number of breeders per hour) and cost groups $\frac{1}{2}$	Percentage of capacity							
	30	40	50	60	70	80	90	100
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
<u>720</u>								
Variable operating costs	4.235	3.689	3.319	3.033	2.809	2.624	2.441	2.298
Constant-unit operating costs ..	1.880	1.880	1.880	1.880	1.880	1.880	1.880	1.880
Fixed operating costs	2.478	1.858	1.487	1.239	1.062	.929	.826	.745
Fixed overhead costs	2.627	1.971	1.576	1.313	1.127	.984	.876	.791
Total costs	11.220	9.398	8.262	7.465	6.878	6.417	6.023	5.714
<u>900</u>								
Variable operating costs	3.965	3.492	3.145	2.876	2.663	2.489	2.430	2.190
Constant-unit operating costs ..	1.860	1.860	1.860	1.860	1.860	1.860	1.860	1.860
Fixed operating costs	2.707	2.030	1.625	1.354	1.160	1.016	.903	.812
Fixed overhead costs	2.548	1.911	1.529	1.274	1.092	.955	.850	.765
Total costs	11.080	9.293	8.159	7.364	6.775	6.320	6.043	5.627
<u>1,200</u>								
Variable operating costs	3.628	3.236	2.912	2.666	2.470	2.323	2.163	2.045
Constant-unit operating costs ..	1.850	1.850	1.850	1.850	1.850	1.850	1.850	1.850
Fixed operating costs	2.644	1.983	1.586	1.322	1.134	.992	.882	.794
Fixed overhead costs	2.410	1.808	1.446	1.206	1.033	.905	.804	.722
Total costs	10.532	8.877	7.794	7.044	6.487	6.070	5.699	5.411
<u>1,800</u>								
Variable operating costs	3.159	2.861	2.601	2.384	2.211	2.081	1.949	1.845
Constant-unit operating costs ..	1.850	1.850	1.850	1.850	1.850	1.850	1.850	1.850
Fixed operating costs	2.414	1.811	1.449	1.207	1.034	.906	.804	.725
Fixed overhead costs	2.312	1.735	1.387	1.158	.990	.868	.771	.695
Total costs	9.735	8.257	7.287	6.599	6.085	5.705	5.374	5.115
<u>2,400</u>								
Variable operating costs	2.896	2.633	2.401	2.235	2.089	1.965	1.840	1.740
Constant-unit operating costs ..	1.850	1.850	1.850	1.850	1.850	1.850	1.850	1.850
Fixed operating costs	2.371	1.778	1.421	1.185	1.016	.889	.791	.712
Fixed overhead costs	2.236	1.676	1.342	1.117	.958	.838	.746	.671
Total costs	9.353	7.937	7.014	6.387	5.913	5.542	5.227	4.973

$\frac{1}{2}$ 16 lbs. average weight for breeders.

Table 27.—Average cost per pound (ready-to-cook weight), by major cost groups and in total, for processing turkeys in model plants operating at various percentages of capacity for 243 days

Plant capacity (number of breeders per hour) and cost groups L/	Percentage of capacity									
	30	40	50	60	70	80	90	100		
120	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Variable operating costs	7.177	6.048	5.298	4.810	4.405	4.069	3.799	3.557		
Constant-unit operating costs ..	2.020	2.020	2.020	2.020	2.020	2.020	2.020	2.020		
Fixed operating costs	2.416	1.812	1.449	1.208	1.036	.906	.805	.725		
Fixed overhead costs	2.365	1.774	1.419	1.181	1.013	.887	.788	.710		
Total costs	13.978	11.654	10.186	9.219	8.474	7.882	7.412	7.012		
240	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Variable operating costs	5.744	4.875	4.324	3.943	3.644	3.369	3.146	2.948		
Constant-unit operating costs ..	2.020	2.020	2.020	2.020	2.020	2.020	2.020	2.020		
Fixed operating costs	2.084	1.562	1.249	1.041	.893	.781	.695	.625		
Fixed overhead costs	1.959	1.469	1.176	.978	.840	.734	.653	.587		
Total costs	11.807	9.926	8.769	7.982	7.397	6.904	6.514	6.180		
360	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Variable operating costs	5.020	4.278	3.832	3.500	3.263	3.019	2.824	2.649		
Constant-unit operating costs ..	1.990	1.990	1.990	1.990	1.990	1.990	1.990	1.990		
Fixed operating costs	2.000	1.500	1.200	1.000	.858	.750	.667	.600		
Fixed overhead costs	1.781	1.333	1.067	.891	.762	.668	.593	.534		
Total costs	10.791	9.101	8.089	7.381	6.873	6.427	6.074	5.773		
480	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Variable operating costs	4.485	3.837	3.473	3.177	2.966	2.747	2.588	2.430		
Constant-unit operating costs ..	1.940	1.940	1.940	1.940	1.940	1.940	1.940	1.940		
Fixed operating costs	1.982	1.486	1.189	.991	.850	.744	.661	.595		
Fixed overhead costs	1.763	1.323	1.058	.881	.755	.662	.588	.529		
Total costs	10.170	8.586	7.660	6.989	6.511	6.093	5.777	5.494		
600	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Variable operating costs	4.137	3.587	3.250	2.977	2.780	2.595	2.430	2.296		
Constant-unit operating costs ..	1.900	1.900	1.900	1.900	1.900	1.900	1.900	1.900		
Fixed operating costs	2.021	1.516	1.212	1.011	.867	.758	.674	.607		
Fixed overhead costs	1.624	1.218	.975	.813	.696	.608	.541	.488		
Total costs	9.682	8.221	7.337	6.701	6.243	5.861	5.545	5.291		

Table 27.---Average cost per pound (ready-to-cook weight), by major cost groups and in total, for processing turkeys in model plants operating at various percentages of capacity for 243 days --(Continued)

Plant capacity (number of breeders per hour) and cost groups 1/	Percentage of capacity									
	30	40	50	60	70	80	90	100		
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
<u>720</u>										
Variable operating costs	3.900	3.425	3.105	2.846	2.660	2.503	2.342	2.214		
Constant-unit operating costs ..	1.880	1.880	1.880	1.880	1.880	1.880	1.880	1.880		
Fixed operating costs	2.058	1.542	1.234	1.029	.882	.773	.686	.618		
Fixed overhead costs	1.559	1.137	.936	.780	.668	.584	.520	.467		
Total costs	9.397	7.984	7.155	6.535	6.090	5.740	5.428	5.179		
<u>900</u>										
Variable operating costs	3.612	3.214	2.916	2.675	2.502	2.356	2.220	2.099		
Constant-unit operating costs ..	1.860	1.860	1.860	1.860	1.860	1.860	1.860	1.860		
Fixed operating cost	2.205	1.654	1.323	1.103	.945	.827	.736	.662		
Fixed overhead costs	1.512	1.133	.906	.754	.647	.565	.504	.452		
Total costs	9.189	7.861	7.005	6.392	5.954	5.608	5.320	5.073		
<u>1,200</u>										
Variable operating costs	3.260	2.942	2.669	2.452	2.294	2.175	2.038	1.939		
Constant-unit operating costs ..	1.850	1.850	1.850	1.850	1.850	1.850	1.850	1.850		
Fixed operating costs	2.209	1.657	1.325	1.104	.946	.828	.736	.663		
Fixed overhead costs	1.427	1.071	.856	.716	.612	.534	.475	.430		
Total costs	8.746	7.520	6.700	6.122	5.702	5.387	5.099	4.882		
<u>1,800</u>										
Variable operating costs	2.775	2.546	2.338	2.147	2.010	1.908	1.799	1.712		
Constant-unit operating costs ..	1.850	1.850	1.850	1.850	1.850	1.850	1.850	1.850		
Fixed operating costs	2.042	1.531	1.225	1.021	.876	.768	.681	.613		
Fixed overhead costs	1.371	1.028	.823	.684	.587	.515	.457	.409		
Total costs	8.038	6.955	6.236	5.702	5.323	5.041	4.787	4.584		
<u>2,400</u>										
Variable operating costs	2.575	2.377	2.192	2.051	1.937	1.838	1.733	1.650		
Constant-unit operating costs ..	1.850	1.850	1.850	1.850	1.850	1.850	1.850	1.850		
Fixed operating costs	1.981	1.486	1.189	.991	.850	.743	.661	.594		
Fixed overhead costs	1.325	.994	.796	.663	.567	.496	.443	.398		
Total costs	7.731	6.707	6.027	5.555	5.204	4.927	4.687	4.492		

1/ 16 lbs. average weight for breeders.

Table 28.--Average total costs per pound (ready-to-cook weight), for processing turkeys in model plants operated at various percentages of capacity for 144 days

Plant capacity (head per hour) and market class	Percentages of capacity									
	30	40	50	60	70	80	90	100		
	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.
Heavy young hens 1/										
200	16.345	13.545	11.779	10.570	9.699	8.975	8.402	7.913		
400	13.558	11.337	9.977	9.054	8.346	7.759	7.291	6.896		
600	12.298	10.330	9.143	8.314	7.707	7.175	6.756	6.399		
800	11.571	9.726	8.644	7.867	7.291	6.795	6.418	6.082		
1,000	11.022	9.321	8.287	7.550	7.001	6.551	6.168	5.865		
1,200	10.709	9.098	8.088	7.367	6.832	6.411	6.042	5.744		
1,500	10.461	8.915	7.914	7.205	6.679	6.266	5.918	5.626		
2,000	9.934	8.508	7.556	6.883	6.383	6.008	5.665	5.404		
3,000	9.113	7.849	7.014	6.399	5.944	5.602	5.305	5.065		
4,000	8.782	7.584	6.788	6.239	5.816	5.486	5.194	4.963		
Heavy young toms 2/										
150	13.187	10.985	9.541	8.596	7.954	7.382	6.932	6.549		
300	10.993	9.251	8.172	7.447	6.888	6.424	6.057	5.746		
450	9.992	8.442	7.507	6.857	6.374	5.957	5.627	5.343		
600	9.418	7.966	7.111	6.500	6.047	5.655	5.359	5.095		
750	8.981	7.640	6.825	6.245	5.811	5.454	5.156	4.917		
900	8.730	7.460	6.665	6.098	5.675	5.344	5.049	4.818		
1,125	8.521	7.301	6.515	5.956	5.541	5.214	4.939	4.713		
1,500	8.099	6.978	6.228	5.699	5.118	4.810	4.538	4.314		
2,250	7.455	6.462	5.897	5.316	4.959	4.691	4.455	4.269		
3,000	7.195	6.252	5.622	5.192	4.860	4.597	4.368	4.188		
Breeders 3/										
120	19.823	16.259	14.044	12.563	11.406	10.493	9.773	9.160		
240	16.245	13.437	11.738	10.562	9.671	8.940	8.358	7.860		
360	14.641	12.146	10.691	9.627	8.872	8.207	7.682	7.237		
480	13.733	11.397	10.063	9.073	8.360	7.738	7.272	6.853		
600	13.086	10.926	9.648	8.703	8.017	7.450	6.989	6.603		
720	12.718	10.676	9.422	8.500	7.834	7.306	6.843	6.481		
900	12.417	10.457	9.218	8.312	7.652	7.136	6.704	6.338		
1,200	11.761	9.961	8.780	7.925	7.302	6.835	6.405	6.076		
1,800	10.788	9.207	8.165	7.383	6.811	6.386	6.010	5.712		
2,400	10.316	8.812	7.828	7.133	6.610	6.197	5.837	5.547		

Table 28.--Average total costs per pound (ready-to-cook weight), for processing turkeys in model plants operated at various percentages of capacity for 144 days --(Continued)

Plant capacity (head per hour) and market class	Percentage of capacity							
	30	40	50	60	70	80	90	100
Fryer-roasters 1/	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.
250	21.824	17.914	15.483	13.857	12.587	11.584	10.796	10.122
500	17.899	14.815	12.952	11.661	10.684	9.881	9.243	8.700
750	16.120	13.382	11.774	10.619	9.788	9.059	8.483	7.993
1,000	15.138	12.576	11.112	10.028	9.243	8.562	8.050	7.590
1,250	14.436	12.063	10.659	9.624	8.874	8.250	7.734	7.320
1,500	14.040	11.793	10.420	9.403	8.673	8.093	7.585	7.177
1,875	13.691	11.544	10.182	9.188	8.464	7.898	7.424	7.023
2,500	12.974	11.000	9.703	8.765	8.081	7.567	7.095	6.734
3,750	11.908	10.169	9.030	8.167	7.544	7.078	6.663	6.338
5,000	11.389	9.740	8.659	7.899	7.321	6.869	6.474	6.154

- 1/ 13 lbs. average weight.
- 2/ 22 lbs. average weight.
- 3/ 16 lbs. average weight.
- 4/ 7 lbs. average weight.

Table 29.--Average total costs per pound (ready-to-cook), for processing turkeys in model plants operated at various percentages of capacity for 243 days

Plant capacity (head per hour) and market class	Percentage of capacity							
	30	40	50	60	70	80	90	100
	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.
Heavy young hens 1/								
200	14.856	11.909	10.469	9.461	8.778	8.181	7.707	7.298
400	11.873	10.077	8.962	8.205	7.627	7.137	6.747	6.414
600	10.760	9.165	8.211	7.532	7.045	6.602	6.251	5.951
800	10.054	8.686	7.718	7.084	6.629	6.218	5.910	5.631
1,000	9.617	8.250	7.424	6.820	6.379	6.008	5.693	5.441
1,200	9.252	7.985	7.186	6.602	6.178	5.841	5.538	5.295
1,500	8.905	7.715	6.939	6.371	5.960	5.634	5.358	5.149
2,000	8.502	7.397	6.657	6.116	5.723	5.431	5.151	4.944
3,000	7.859	6.922	6.255	5.759	5.403	5.134	4.892	4.700
4,000	7.541	6.634	6.024	5.580	5.218	5.009	4.778	4.591
Heavy young toms 2/								
150	11.474	9.696	8.560	7.777	7.229	6.758	6.385	6.064
300	9.667	8.251	7.373	6.776	6.322	5.934	5.627	5.363
450	8.777	7.525	6.771	6.336	5.853	5.507	5.228	4.993
600	8.223	7.049	6.384	5.887	5.525	5.203	4.960	4.739
750	7.907	6.796	6.145	5.668	5.322	5.031	4.782	4.587
900	7.583	6.480	5.955	5.492	5.160	4.897	4.655	4.464
1,125								
1,500	6.967	6.104	5.521	5.095	4.786	4.556	4.355	4.171
2,250	6.467	5.715	5.203	4.813	4.533	4.322	4.130	3.978
3,000	6.210	5.503	5.022	4.572	4.429	4.223	4.039	3.894
Breeders 3/								
120	16.972	14.122	12.338	11.140	10.211	9.466	8.876	8.367
240	14.094	11.822	10.449	9.484	8.772	8.158	7.674	7.255
360	12.693	10.680	9.511	8.653	8.050	7.502	7.068	6.694
480	11.812	9.953	8.909	8.108	7.548	7.039	6.661	6.313
600	11.217	9.517	8.520	7.759	7.222	6.763	6.379	6.070
720	10.854	9.235	8.295	7.555	7.034	6.617	6.240	5.937
900	10.485	8.997	8.044	7.323	6.817	6.413	6.071	5.775
1,200	9.928	8.572	7.662	6.968	6.500	6.138	5.793	5.536
1,800	9.050	7.876	7.092	6.468	6.034	5.708	5.412	5.173
2,400	8.657	7.556	6.820	6.285	5.888	5.572	5.289	5.059

Table 29.--Average total costs per pound (ready-to-cook), for processing turkeys in model plants operated at various percentages of capacity for 243 days --(Continued)

Plant capacity (head per hour) and market class	Percentage of capacity							
	30	40	50	60	70	80	90	100
	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.	Cts./lb.
Fryer-roasters $\frac{4}{1}$								
250	18.694	15.566	13.609	12.296	11.275	10.458	9.810	9.252
500	15.536	13.044	11.538	10.482	9.694	9.024	8.493	8.034
750	13.984	11.777	10.494	9.549	8.889	8.288	7.810	7.399
1,000	13.031	10.993	9.850	8.967	8.349	7.794	7.380	6.996
1,250	12.385	10.522	9.424	8.587	8.000	7.498	7.073	6.735
1,500	11.977	10.238	9.168	8.357	7.788	7.327	6.913	6.581
1,875	11.572	9.940	8.892	8.104	7.546	7.105	6.729	6.406
2,500	10.965	9.474	8.479	7.728	7.204	6.825	6.426	6.142
3,750	10.000	8.710	7.851	7.169	6.691	6.332	6.007	5.747
5,000	9.568	8.858	7.550	6.964	6.530	6.186	5.873	5.619

$\frac{1}{1}$ 13 lbs. average weight.
 $\frac{2}{2}$ 22 lbs. average weight.
 $\frac{3}{3}$ 16 lbs. average weight.
 $\frac{4}{4}$ 7 lbs. average weight.





NATIONAL AGRICULTURAL LIBRARY



1022831127