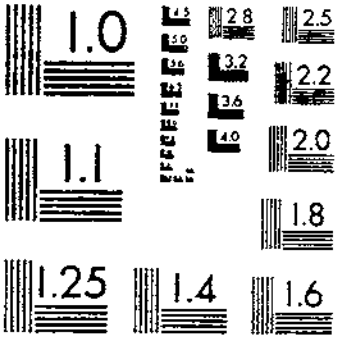
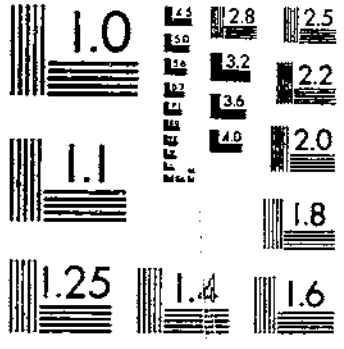
START



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

OUTPUT PER MAN-HOUR

IN DISTRIBUTING FOODS OF FARM ORIGIN

UNITED STATES DEPARTMENT OF AGRICULTURE
MARKETING ECONOMICS DIVISION
ECONOMIC RESEARCH SERVICE
TECHNICAL BULLETIN NO. 1335

Preface

Various legislative and economic groups concerned with agricultural policy have long been interested in the relation between charges for marketing farm foods and payments to the farmer-producer for his products. A marked decline in these payments to farmers relative to consumer expenditures for farm-originated foods since World War II has focused attention on the need for additional information on past and future trends in the factors underlying changes in marketing costs.

The productivity estimates in this report were developed as part of a larger investigation by the Economic Research Service of the U.S. Department of Agriculture of factors affecting the demand, the supply, and the productivity of farm food marketing services. A major objective of the investigation is to develop long-range projections of the farm food marketing bill (total charges for transporting, processing, wholesaling, and retailing farm foods) which will supplement long-range projections of the demand for and output of farm food products. Insight into productivity in food distribution compared with the demand for distribution services and with productivity in farm production will help explain the continuing decline of the farm share of consumer expenditures for foods.

Distribution costs for the farm-originated food products included in the study reported here were roughly one-third of the civilian expenditures for farm foods. This percentage has remained fairly constant during the three decades covered in this report.

Related Department of Agriculture reports on output and utilization of resources in marketing of farm food products are *Output of Factories Processing Farm Food Products in the United States, 1909–58*, Technical Bulletin 1223; *Output per Man-Hour in Factories Processing Farm Food Products*, Technical Bulletin 1243; and *Demand for Manufactured Foods, Manufacturers' Services, and Farm Products in Food Manufacturing*, Technical Bulletin 1317. A fourth report on the farm food marketing bill and its components is in preparation.

Acknowledgment is made to Jerome A. Mark, Bureau of Labor Statistics, U.S. Department of Labor, for review of technical aspects of this report.

Contents

April, 1965

Summary and Conclusions

Output per man-hour employed in distributing foods of domestic farm origin increased at an average rate of 2.5 percent per year from 1929 to 1958. For the wholesaling and retailing component, the increase was significantly greater, an average of 2.8 percent per year. The difference was due to a lower increase in output per man-hour in the other component of food distribution, away-from-home eating, coupled with a larger total increase in output, particularly during World War II. The rates of growth in output per man-hour for food distribution as a whole and for the wholesale-retail component were about the same in the postwar decade of the study, 1948–58, as in the entire study period, 1929–58. (Food distribution as defined in this report includes wholesaling, retailing, and away-from-home eating; it excludes for-hire transportation and assembling of farm-food products.)

Gains in output per person engaged in food distribution were much smaller than gains in output per man-hour. This resulted from sharp and continued declines in average weekly hours per person, which were down about one-fourth over the three decades. Output per person in food distribution grew at an average rate of 1.5 percent per year from 1929 to 1958. The average rate in the wholesale-retail component was 1.8 percent. Again, the postwar rates in food distribution as a whole and in the wholesale-retail component were about the same as the rates for the three decades as a whole.

Output as used in this report is measured *net* of foods entering the distribution sector; it includes only goods and services added in distribution. Total net ouput in food distribution grew at a substantially greater annual rate (2.9 percent) than output per man-hour from 1929 to 1958 (2.5 percent). As a result, labor requirements rose over the three decades. This increased requirement occurred in away-from-home eating places. The average yearly rate of growth of net output in food wholesaling and retailing (2.5 percent) was significantly smaller than the rate of growth (2.8 percent) in output per man-hour in this component. During the postwar decade, 1948–58, total net output in food distribution (including eating places) rose less than output per man-hour, and man-hour requirements consequently declined.

The most important factor in the rise in labor productivity was the shift from clerk to self-service stores. Thus, to some extent, the rise in labor productivity reflects a substitution of shoppers' labor for that of hired workers, the man-hour inputs that can be counted. The shift to self-service stores was accompanied by a phenomenal increase in the average size of food stores. Thus, economies of scale apparently also contributed to the rise in labor productivity. Substitution of

capital for labor may have also been a factor; however, data on capital in food distribution are so sparse that we cannot even surmise whether the quantity of fixed and working capital per man-hour increased, decreased, or remained the same during the period studied.

In the period 1929 to 1958, the estimated yearly rate of growth in output per man-hour for food distribution was 2.5 percent, compared with 2.1 percent for the total private nonfarm sector of the economy. The difference, however, is overstated. Because of limitations in the data, the estimated rate for food distribution tends to be on the high side, whereas the estimated rate for the private nonfarm sector tends to be on the low side. In the wholesale-retail component of food distribution, where output per man-hour increased more rapidly than in food distribution as a whole, the rate was significantly larger than in the total private sector. However, both in food distribution including eating places and in the wholesale-retail component alone, output per man-hour increased at a substantially lower rate than the 3.6 percent rate of increase in farming.

The rate of increase in output per man-hour during the postwar decade studied, 1948–58, was about the same in food distribution including eating places as in the total private nonfarm sector, although the rate of increase in food wholesaling and retailing was significantly larger. Nevertheless, output per man-hour in farming increased twice as fast during this period as output per man-hour in food wholesaling and retailing. The much greater rate in farm production was due to a large substitution of capital for labor in that sector. Even if we could take account of changes of capital stock in food distribution and in the wholesale-retail component, it is doubtful that the postwar growth rates in total factor productivity (net output per combined unit of labor and capital) would be as large as the rate in farming.

OUTPUT PER MAN-HOUR IN DISTRIBUTING FOODS OF FARM ORIGIN

by WILLIAM H. WALDORF and HAZEN F. GALE
Agricultural Economists
Marketing Economics Division
Economic Research Service

Introduction

Civilian consumers in the United States spent $66.4 billion for domestic farm food products in 1963; $45 billion went to marketing agencies for manufacturing and distributing the food, and $21.4 billion went to farmer producers for their products (*2*).[1] Since at least 1929, the earliest year for which comparable data are available, the bill for manufacturing and distributing farm foods has been increasing in relation to the payments received by farmers.

This report is concerned with the distribution of foods of farm origin. The bill for distributing these foods has accounted for a fairly constant proportion—roughly 40 percent—of total civilian spending for farm foods since 1929. In 1929, the farm value accounted for a somewhat larger percentage than the distribution bill but in 1963 the distribution bill accounted for the larger percentage.

The most important factor underlying the above trends is the change in the efficiency of resources used in the farm and marketing sectors. Because of data problems, the study was limited to construction of an index of output per man-hour, which at best is only a partial measure of changes in efficiency. This index is affected by substitutions among labor, capital, and other factor inputs; changes in the quality of factor inputs; and changes in efficiency resulting from economies of scale. Changes in the intensity of labor effort are also reflected.

Despite these limitations, an index of output per man-hour is a useful tool, along with others, for analyzing developments in labor inputs and labor costs. When consistently defined, unit labor costs are equal to average hourly earnings divided by output per man-hour. If labor accounts for a large share of combined labor and capital inputs and there has been little or no substitution between capital and labor, long-term trends in output per man-hour may be reasonable approximations of long-term trends in labor-capital productivity. During the postwar period, labor costs accounted for about 45 percent of the bill for distributing farm food products; the remainder included capital costs and costs of packaging, advertising, and other intermediate goods and services purchased by distribution agencies.

[1] *Italic numbers in parentheses refer to literature cited, p. 15.*

As far as the authors know, there have been no previous attempts to measure output per man-hour in food distribution. The only comprehensive study we know for the United States is the painstaking work by Barger (*1*) for total distribution.[2] Considering both the conceptual and statistical problems in measuring output and employment in distribution, it is not surprising that there has been a dearth of such productivity studies.

The indexes of output presented in this report measure *net* output in food distribution. They are net of the quantity (and quality) of the farm products used as raw materials in foods; and they are also net of the assembly, transportation, and processing services added between the farmers' sale of the raw materials and the purchase of the foods by wholesalers. The output index is intended to measure *only* goods and services added by the food distribution sector as defined in this study.[3] The output indexes are "double-deflated" series based on estimates of the farm food distribution bill constructed by Gale in his study of the farm food marketing bill and its components.[4] Gale's series is based largely on data available from the *Census of Business*, which was begun in 1929. For that reason, our findings are based on data for only 5 census years, those from 1929 to 1958, the latest census year for which data were available at the time the indexes were computed. The indexes are based on weights for the given years, and reflect changes in the composition of output.

The major objectives of the report are to (1) gage trends from 1929 to 1958 in output per man-hour employed in distributing farm-originated foods for domestic civilian consumption; (2) analyze factors underlying these trends; and (3) compare developments in output per man-hour in food distribution with those in farming and in other sectors of the economy.

Coverage

The statistics used in this study conform to the Economic Research Service (ERS) farm food marketing bill concept.[5] They apply to the distribution of foods originating on U.S. farms and destined for U.S. civilian consumption. The time series used to analyze developments in food distributions are by agency, not by function. Thus, they

---

[2] There have, of course, been other attempts to measure productivity in distribution. Barger gives an excellent review of the literature in this area.

[3] For a detailed discussion of the sources and methods used in constructing the indexes, see the Appendix. For a review of measures of output in food distribution see: Waldorf, William H. LABOR PRODUCTIVITY IN FOOD WHOLESALING AND RETAILING. (Unpublished paper prepared September 1964.)

[4] Report in preparation.

[5] As defined by the Economic Research Service, U.S. Department of Agriculture, the "marketing bill is the difference between the total expenditures by civilian consumers for domestic farm food products and the farm value or payment that farmers received for the equivalent farm products. It is an estimate of the total charges for transporting, processing, wholesaling, and retailing farm foods. Food sold in the form of meals in restaurants and other eating places and that sold at less than retail prices is valued at the point of sale. These estimates do not include the value of food products not produced on farms in the United States, foods consumed on farms where produced, or foods not sold to civilian consumers in this country (*2*)."

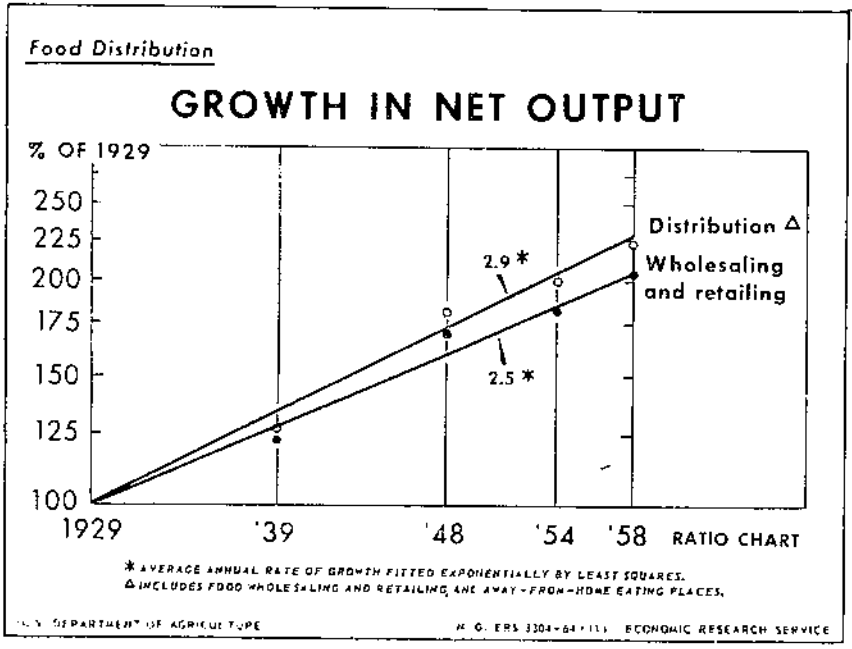
exclude distribution services provided directly by farmers or by food manufacturers, but include processing services performed by food distributors. However, this does not affect the productivity estimates, because the scope of the employment and man-hours data is the same as that of the output data. As used in this report, food distribution refers to the activities of wholesalers, retailers, and away-from-home eating places in handling foods of farm origin; it excludes assembling and for-hire transportation of farm food products.

Transportation by for-hire carriers is omitted because data on output and employment for the carriers are generally not available for foods separately. For example, in the case of railroads it generally is not possible to distinguish between labor employed in transporting foods and labor employed in transporting nonfood commodities. Assembling of farm products was also excluded because of inadequate data.

Output in Food Distribution

Net output in food distribution increased about 120 percent from 1929 to 1958, a rate of growth of 2.9 percent per year (tables 1 and 2; fig. 1). The annual rate was highest between 1939 and 1948, and largely, though not entirely, reflects a phenomenal growth in eating places during the wartime period. The growth in the postwar decade, 1948–58, was about the same as in the prewar decade, 1929–39. Our analysis of the data indicates that the net output series for distribution

FIGURE 1



probably has an upward secular bias. Thus, the estimated rates of growth may be somewhat overstated.[6]

TABLE 1.—*Output in distribution of farm-originated foods, United States, selected years, 1929–58*

(1929=100)

Item	1929	1939	1948	1954	1958
Foods entering distribution sector [1]	100.0	115.7	148.8	179.5	197.5
Food distribution [2]	100.0	124.8	180.8	199.0	222.0
Food wholesaling and retailing component	100.0	123.8	170.5	180.4	201.9

[1] Value (in 1947–49 dollars) of finished processed and unprocessed foods of farm origin entering the food distribution sector and destined for domestic civilian consumption.

[2] Includes net output by wholesalers, retailers, and away-from-home eating places in handling farm-originated foods. Excludes for-hire transportation and assembling of farm products.

TABLE 2.—*Average annual percentage increase in net output in distribution of farm-originated foods, United States, 1929–58 and 1948–58*

Series	1929–58 [1]	1948–58 [2]
	Percent	*Percent*
Net output, food distribution [3]	2.9	2.1
Net output, wholesaling and retailing component	2.5	1.7

[1] Based on a simple semilogarithmic trend equation using least squares and data for 1929, 1939, 1948, 1954, and 1958.

[2] Based on geometric rate using data for 1948 and 1958 only.

[3] For food wholesaling, retailing, and away-from-home eating places.

From 1929 to 1958, net output of distribution services increased relative to the quantity of foods entering the distribution sector. However, most of the relative increase occurred during the wartime period and largely reflects the sharp rise in away-from-home eating.

[6] Although consumer expenditures for foods included away-from-home eating, we had to use prices for foods sold in retail stores to deflate the value series. Also, errors in price deflation for costs of food entering the distribution sector tend to bias the net output index upward. The Bureau of Labor Statistics (BLS) began reporting prices for foods purchased away from home in January 1953. According to the BLS consumer price series, from 1954 to 1958 the index for all foods, including food purchased away from home, increased relative to the price index for food sold in retail stores. There is a strong presumption that BLS prices for both foods at home and foods away from home reflect "quality" and "service" increases per unit of product over time. Therefore, it is simpler to recognize the bias in the net output series and qualify our conclusions accordingly than to attempt to "correct" the series. If we did attempt to correct the series, we would still have a biased index, but we would not know the direction of bias. (See appendix.)

During the postwar decade, 1948–58, distribution services per unit of food entering the distribution sector declined. This reflects a decline in services per unit both in eating places and in wholesaling and retailing. The qualifications in the indexes because of data problems tend to strengthen this finding. Our estimates indicate that the quantity of distribution services per unit increased during the prewar decade, 1929–39.[7]

Net output in wholesaling and retailing of farm-originated foods doubled from 1929 to 1958. The average annual rate of growth was 2.5 percent. The estimated rate in the postwar period, 1.7 percent, was significantly smaller than in the prewar decade, 1939–48, when the fastest growth rate occurred. The inadequacies in the price deflators tend to be offsetting to some unknown extent; that is, we cannot say for the wholesaling and retailing component, as we can for food distribution including away-from-home eating, whether or not the output index is significantly biased upward or downward or at all.

Comparison of the indexes of net output in food distribution and in the wholesaling and retailing component indicates that output of away-from-home eating places increased significantly faster than output in wholesaling and retailing during the three decades, 1929–58. The faster rate of growth, however, was concentrated mainly in the wartime period. The two indexes showed the same percentage change during the prewar decade, and the larger percentage rise in distribution in the postwar decade was only slightly, if significantly, larger.

Persons Engaged in Food Distribution

The series on employment and man-hours in food distribution include paid full-time and part-time employees, unpaid family workers, and proprietors of unincorporated businesses (table 3). That is, we included all persons engaged in food distribution as defined in this report. The scope of the series is consistent with that of the output index for food distribution. The employment index excludes persons who handle nonfood items or foods not destined for domestic civilian consumption. Data on average hours of paid employees are estimated from BLS published data. We assume that average hours for unpaid family workers are the same as those for paid employees, and that proprietors of unincorporated businesses work 60 hours a week.[8]

According to our estimates, the number of persons engaged in distribution of farm products rose 43 percent from 1929 to 1958. There was a small but significant increase during the prewar decade, 1929–39;

[7] The quantity of food entering the distribution sector is measured in 1947–49 dollars and includes assembling, transporting, and processing services added between farm sales and wholesalers' purchases of foods as well as the upgrading in "quality" of food consumed. Thus, the findings do not refer to the distribution services per physical unit such as pound or quart. According to ERS estimates (8), total consumption of foods in *pounds* increased about 35 percent from 1929 to 1958 compared with our estimated increase of about 120 percent in food distribution services. Obviously, distribution services per pound increased considerably in each of the three decades.

[8] The sources and problems relating to the employment and man-hours data are discussed in greater detail in the appendix. It might, however, be noted here that alternative assumptions on levels and trends of average weekly hours of active proprietors did not significantly affect the final results.

a very large rise during the decade marked by the war, 1939–48; and a significant increase during the postwar decade, 1948–58.

TABLE 3.—*Persons and man-hours engaged in distribution of farm-originated foods, United States, selected years, 1929-58*

(1929=100)

Item	1929	1939	1948	1954	1958
Food distribution:					
Persons [1]	100. 0	108. 0	134. 9	137. 5	143. 1
Man-hours [2 3]	100. 0	96. 1	111. 1	108. 6	107. 6
Food wholesaling and retailing component:					
Persons	100. 0	103. 1	118. 5	116. 0	118. 0
Man-hours	100. 0	92. 2	98. 5	92. 0	89. 2

[1] Includes all persons (paid employees, unpaid family workers, and proprietors of unincorporated businesses) engaged in handling farm-originated foods in wholesaling, retailing, and away-from-home eating establishments. Excludes persons in food distribution agencies who are engaged in handling nonfood items and foods which are not destined for U.S. civilian consumption. Excludes for-hire transportation and assembling of farm products.

[2] Based on number of persons (as described in footnote 1) and estimates of average number of hours paid for, including paid vacations and sick leave. Estimates for paid employees are based on published BLS data on average number of hours in food and liquor stores, in total retail trade, and in total wholesale trade; the same averages were assumed to apply to unpaid family workers, and for proprietors of unincorporated businesses, a constant 60-hour week was assumed.

[3] Estimates of average weekly hours of persons engaged in distributing farm-originated foods:

	1929	1939	1948	1954	1958
Food distribution	55. 0	49. 0	45. 3	43. 5	41. 4
Food wholesaling and retailing component	54. 1	48. 3	45. 0	43. 0	41. 0

Total number of man-hours worked in food distribution increased considerably less than number of persons because of a sharp decline in average hours per person. According to our estimates, average weekly hours decreased about one-fourth from 1929 to 1958 and, consequently, total man-hours rose only about 8 percent. The man-hour series shows a decline from 1929 to 1939, a substantial rise from 1939 to 1948, and a continued decline between 1948 and 1958.

In the food wholesaling and retailing component, the relative increase in number of persons engaged was much smaller—18 percent over the three decades. All of this increase took place between 1929 and 1948; the number of persons remained fairly constant in the postwar decade. The number of man-hours, on the other hand, was about the same in 1948 as in 1929, but declined sharply from 1948 to 1958.

The above comparisons indicate that most of the increase in employment occurred in eating places. We made a heroic attempt to

adjust the total employment data, including unpaid family workers and proprietors of unincorporated businesses, to a full-time equivalent basis in order to compare the shifts in employment in retail trade, wholesale trade, and away-from-home eating places (table 4). For instance, if two part-time employees worked only half as many hours as a full-time employee, they were counted as equivalent to one full-time employee. Although the number of equivalent full-time workers has increased in each of the three sectors, there has been a startling change in the relative importance of eating places. In 1929, there were about twice as many equivalent full-time workers in retail food trade as in eating places, but by 1958 they both accounted for about the same percentage of all workers in food distribution. The number employed in wholesale trade remained a fairly constant percentage of the total. About two-thirds of the estimated increase in the total number of full-time equivalent workers from 1929 to 1958 was accounted for by the rise in number of eating places. The relative importance of employment in eating places showed a continued upward trend during the three decades.

TABLE 4.—*Distribution of persons (full-time equivalent basis) engaged in handling farm-originated foods in wholesaling, retailing, and away-from-home eating places, United States, selected years, 1929–58* [1]

Item	1929	1939	1948	1954	1958
	Percent	*Percent*	*Percent*	*Percent*	*Percent*
Food wholesaling	12.3	11.2	12.0	12.6	11.3
Food retailing	58.8	57.1	50.8	48.5	45.9
Eating places	28.9	31.7	37.2	38.9	42.8
Total	100.0	100.0	100.0	100.0	100.0

[1] See table 3, footnote 1, for definition of persons.

Output Per Man-Hour

Output per person in distributing farm-originated foods rose 55 percent or about 1.5 percent per year from 1929 to 1958 (tables 5 and 6). The rate for the postwar decade, 1948–58, was also 1.5 percent per year. During all three decades, output per person increased considerably less than total output, thus requiring a substantial increase in workers in order to produce the rise in services. This was especially true during the period 1939–48 marked by the war and the early postwar recovery. Output in food distribution grew at about the same rate in the prewar and postwar decades, but because of greater gains in output per worker after the war, employment rose less in that decade.

Output per man-hour in food distribution rose substantially faster than output per person, because of the sharp and continued declines in average weekly hours per person. From 1929 to 1958, output per man-hour more than doubled. The average annual rate of growth

was 2.5 percent per year, about two-thirds more than the rate of growth in output per person. The rate was about the same in each decade, indicating that labor productivity in food distribution apparently did not accelerate over the three decades.

TABLE 5.—*Output per person and per man-hour in distribution of farm-originated foods, United States, selected years, 1929–58*

(1929=100)

Item	1929	1939	1948	1954	1958
Food distribution: [1]					
Output per person	100. 0	115. 6	134. 0	144. 7	155. 1
Output per man-hour [2]	100. 0	129. 9	162. 7	183. 2	206. 3
Food wholesaling and retailing component:					
Output per person	100. 0	120. 1	143. 9	155. 5	171. 1
Output per man-hour [2]	100. 0	134. 3	173. 1	196. 1	226. 3

[1] For food wholesaling, retailing, and away-from-home eating places. Excludes for-hire transportation and assembling of farm products.
[2] See table 3 footnotes for definitions of persons and man-hours.

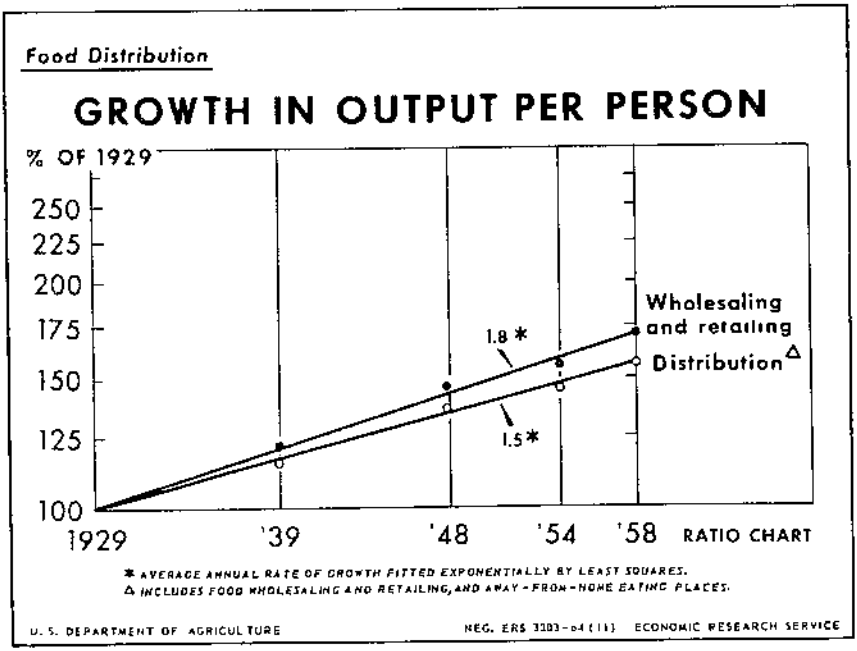
TABLE 6.—*Average annual percentage change in output per person and per man-hour in distribution of farm-originated foods, United States, 1929–58 and 1948–58*

Series	1929–58 [1]	1948–58 [2]
Food distribution: [3]	*Percent*	*Percent*
Output per person [4]	1. 5	1. 5
Output per man-hour [4]	2. 5	2. 4
Food wholesaling and retailing component:		
Output per person	1. 8	1. 8
Output per man-hour	2. 8	2. 7

[1] Based on a simple semilogarithmic trend equation using least squares and data for 1929, 1939, 1948, 1954, and 1958.
[2] Based on geometric rate using data for 1948 and 1958 only.
[3] For food wholesaling, retailing, and away-from-home eating places.
[4] See table 3 footnotes for definitions of persons and man-hours.

Gains in labor productivity in the wholesale-retail component were significantly greater than in distribution including eating places in each of the three decades. Output per person in food wholesaling and retailing increased about 70 percent from 1929 to 1958, an average annual rate of 1.8 percent (fig. 2). The rate was the same in the postwar decade. The increase reflects, in part, the shift from clerk to self-service supermarkets. The growth in output was relatively larger than the growth in output per person from 1929 to 1948, hence the rise in employment. However, from 1948 to 1958 the rise in output per person kept pace with the increase in output, so that the num-

FIGURE 2



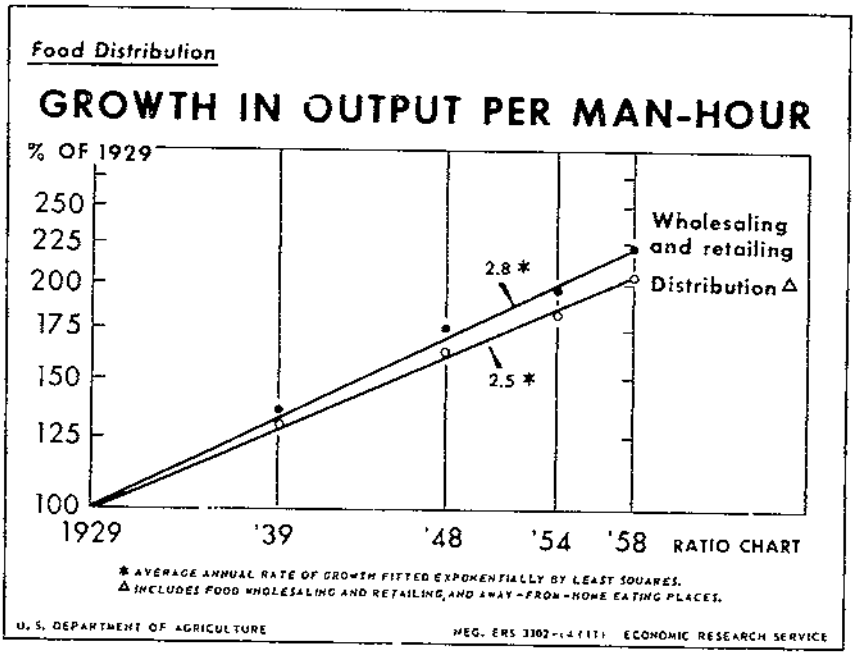
ber of workers in food wholesaling and retailing remained about the same.

Taking into account the decline in average hours per person, output per man-hour in the food retailing and wholesaling component rose about 125 percent over the three decades, or about 2.8 percent per year (fig. 3). The rate during the postwar period, 1948–58, was 2.7 percent. From 1929 to 1948, output per man-hour grew at about the same rate as total output. During the postwar period, 1948–58, output per man-hour rose relatively more than total output, resulting in a decline in man-hours spent in food wholesaling and retailing.

Smaller productivity gains were made in distribution as a whole than in the wholesale-retail component during each of the three decades, owing to the larger increase in net output and the smaller gains in productivity in eating places compared with wholesaling and retailing establishments. This was particularly true for the period, 1939–48, marked by the war and the large increase in eating out.

The increase in output per person and output per man-hour in total food distribution may be overstated because, as we have pointed out, our measure of net output in food distribution probably has a secular upward bias. The productivity measures for the food retailing and wholesaling component are, on the whole, on much firmer ground. There are more and better data for constructing the wholesale and retail food bill than for eating places. Also, the price deflators are, at least conceptually, the correct ones. The deflators probably reflect secular improvements in quality and additional services per unit, so

FIGURE 3



that to some extent the effects of these secular biases are offsetting. Also, data for average hours are available for the trade sector; for eating places we had to assume that average weekly hours paralleled those in food retailing.

The significant finding that productivity gains were substantially larger in food wholesaling and retailing than in eating places would not be vitiated if better data were available. Indeed, the conclusions would probably be strengthened because the inadequacy of the price deflators for measuring net output in food distribution tend to bias the results against this conclusion.[9]

[9] Our statistical efforts did yield separate measures of net output and productivity in away-from-home eating places which we considered too tenuous to include in the text. However, for other researchers in this area we include the following tabulation of the estimates of output and labor productivity in away-from-home eating places (1929=100):

	1939	1948	1954	1958
Output	125	200	233	257
Output per worker	103	112	120	123
Output per man-hour	118	141	156	169

TABLE 7.—*Sales per person in all grocery and combination stores and sales by self-service stores as a percentage of sales by all grocery and combination stores, by sales-size class, United States, 1948*

Stores with sales of—	Sales per person [1]	Sales by self-service stores as percentage of total
	Dollars	*Percent*
$500,000 or over	33, 678	93. 7
$300,000 to $499,999	32, 364	87. 9
$100,000 to $299,999	25, 565	66. 6
Under $100,000	13, 982	33. 8

[1] Includes paid employees, unpaid family workers, and proprietors of unincorporated businesses.

Factors Affecting Output Per Man-Hour

Undoubtedly the most important factor causing the rise in labor productivity in food distribution was the growth in number of self-service stores. This technological change in food retailing was coupled with an increase in economies of scale as reflected by the growth in the average size of stores. Although we cannot measure the numerical importance of these factors, data from the 1948 *Census of Retail Trade* (*10*) for combination and grocery stores do dramatize the relationship between size, degree of self-service, and productivity (sales per person). Not surprisingly, large stores tend to have more self-service; and, at least up to a certain point, sales per person increase with size of store (table 7). The number of persons used to compute sales per person in table 7 was based on a simple count of paid part-time and full-time employees, proprietors of unincorporated businesses, and unpaid family workers. Part-time and full-time employees were given equal weight.

The sales-size classes in table 7 have too wide a range to reveal much of interest about the relationship of size and productivity. Also, larger stores tend to hire relatively more part-time workers than do smaller stores, so that changes in productivity of stores in the various sales-size classes would, in part, reflect the increased importance of part-time workers.

Data in the 1954 *Census of Retail Trade* (*10*) show grocery-store size by number of paid employees. Data on paid employees and payrolls are available for estimating the number of full-time equivalent paid employees in stores grouped by size class according to number of paid employees. The following tabulation, obtained by adjusting these paid employees to a full-time equivalent basis and simply adding the number of proprietors, indicates that labor productivity tends to decline above a certain size:

Stores with specified number of paid employees	*Sales per full-time equivalent worker*
1	$28,020
2	28,736
3	29,615
4–5	31,810
6–7	35,251
8–9	39,613
10–14	43,867
15–19	47,388
20–49	50,321
50–99	46,503
100 or more	34,347

Technological improvements in checkout counters, automatic wrapping, conveyorized handling of materials, and other innovations have probably tended to increase the optimal size of store since 1954.

The same general pattern of growth in size of store and amount of self-service over time is obvious to even the most casual observer. Indeed, the growth in average size of retail food stores has been no less than phenomenal. In 1958, the average size measured by sales in 1947–49 dollars was more than 3⅓ times the average in 1929. During the postwar decade, sales per store nearly doubled. The *Census of Retail Trade* (*10*) reported sales by self-service groceries and combination stores for 1939 and 1948. Using this information, and data from trade journals for extrapolation, we estimated that the proportion of total foods sold in combination and grocery stores that was sold in self-service markets increased from 15 percent in 1929 to 70 percent in 1958. Sales in combination and grocery stores accounted for about 50 percent of total retail sales in 1929 and about 75 percent in 1958. In 1948, about half the total sales in combination and grocery stores were made in self-service stores.

The dramatic shift from clerk to self-service stores bears evidence that consumers preferred self-service stores. Nevertheless, the rate of growth of labor productivity was due, in part, to shoppers performing more of their own clerk and delivery services, although their actual shopping time may have decreased. We cannot, of course, measure the hours of labor effort of shoppers. Thus, in the broader sense, our estimates of the gains in labor productivity in food distribution do not account for changes in all labor inputs.

Changes in capital inputs in food retailing may have also contributed to the rise in labor productivity; but the data are too intractable to support even this broad statement. Data available for measuring the stock of capital are for owned capital only. According to estimates made by Allen B. Paul of ERS, more than half of net durable capital (land and depreciable assets) used by corporate food retailers in 1958 was leased.[10] Thus, even if we defined capital stock

[10] Paul used two methods to estimate the net value of durable capital leased by corporate food retailers in 1958: (1) a cumulated expenditures method and (2) a capitalized rent method. The approaches and data were essentially independent. Using method (1) he estimated lease capital at $2.9 billion; using method (2) he estimated it at $2.3 billion. Owned durable capital amounted to $1.5 billion. Paul also points out that, "Allowing for extreme values of the amortization period and the interest rate in the second estimate, the share of

narrowly to include land, depreciable assets, and inventories but ignored the leased capital we would be omitting about 40 percent of total capital stock used in corporate food retailing in 1958.

Inventories account for a substantial fraction of the capital in food retailing, and the evidence indicates that this portion of the capital-output ratio declined during most of the 1929–58 period. Data from the 1948 *Census of Retail Trade* (*10*) show that the ratio of year-end inventories to annual sales definitely declines with increasing size of establishment (table 8.) On the basis of data from *Census of Business*, the ratio for all retail food stores was 6.2 percent in 1939, declined to 4.4 percent in 1948, and remained at 4.4 percent in 1958.

Important technological improvements in food warehousing occurred during the three decades included in the study. The handlift truck was largely displaced by the forklift truck, which in turn is being displaced by automatic conveyors. The pallet, a load-carrying platform, was introduced and widely adopted during the period. There was also a tendency to build more efficient single-story warehouses (*9*), which complemented the new mechanical devices for loading and sorting goods. Toward the end of the period, improved control systems contributed to increased labor productivity.

TABLE 8.—*Year-end inventories as a percentage of annual sales, by size of retail establishment, United States, 1948*

Establishments with sales of—	Year-end inventories as percentage of annual sales
	Percent
$1,000,000 or more	2.76
$500,000 to $999,999	3.22
$300,000 to $499,999	4.07
$100,000 to $299,999	5.55
Under $100,000	8.23

Comparison With Other Sectors

According to estimates made by the Bureau of Labor Statistics (*13*), the average annual rate of growth of output per man-hour from 1929 to 1958 for the total private sector of the economy was 2.6 percent (table 9). This is about the same as the estimated average rate for food distribution as a whole, but somewhat smaller than for the food wholesaling and retailing component. The rate in food distribution may be somewhat smaller than in the total private nonfarm sector

durable capital that was leased does not fall below 57 percent." Despite Paul's need to use indirect methods, there is little doubt from his conclusions that leased capital accounts for a substantial fraction of the capital stock in food retailing and food distribution. (Unpublished paper, MEASUREMENT OF LEASED CAPITAL.)

if we take into account the limitations of the data.[11] During the postwar decade, 1948–58, output per man-hour grew at a significantly faster yearly rate in the total private sector (3.0 percent) than in either the food distribution sector or its wholesale-retail component.

Output per man-hour in the private nonfarm sector of the economy increased at an average rate of 2.1 percent per year from 1929 to 1958. This was significantly less than the rate in food wholesaling and retailing. Our estimates indicate that it was also smaller than in food distribution as a whole, but, given the limitations in the data, it seems safer to conclude that the yearly rate in food distribution was probably no smaller than in the private nonfarm sector of the economy. The same general comparisons also apply to the postwar period, 1948–58.

TABLE 9.—*Average annual percentage change in output per man-hour in food distribution and in other sectors of the economy, United States, 1929–58 and 1948–58*

Series	1929–58 [1]	1948–58 [2]
	Percent	*Percent*
Distribution of farm-originated foods [3]	2.5	2.4
Food wholesaling and retailing component	2.8	2.7
Farm sector [4]	3.6	6.1
Private nonfarm sector [4]	2.1	2.3
Total private economy [4]	2.6	3.0

[1] Based on a simple semilogarithmic trend equation using least squares and data for 1929, 1939, 1948, 1954, and 1958.

[2] Based on geometric rate using data for 1948 and 1958 only.

[3] For food wholesaling, retailing, and away-from-home eating places.

[4] Based on BLS estimates of net output per man-hour computed on an establishment basis (*13*), which are based on approximate hours paid (including paid vacations, sick leave, and so on) rather than hours worked.

Conceptually, the BLS method of computing *net* output in agriculture (*13*) is approximately the same as that used here for food distribution. According to the BLS estimates, the average rate of growth of output per man-hour in farming was 3.6 percent per year from 1929 to 1958, substantially greater than in food distribution or in its food wholesaling and retailing component. The most rapid expansion in farming occurred in the post-World War II period. According to our estimates, output per man-hour rose relatively more both in food distribution and in its retailing and wholesaling component than in farming between 1929 and 1939, but fell behind between 1939 and 1948, and lagged far behind the dramatic climb in agricultural productivity between 1948 and 1958. From 1948 to 1958, output per man-hour in farming rose about 6.1 percent per year,

[11] Because of statistical problems in capturing "quality" improvements in measuring net national product in constant prices, there is a common presumption that the rate of growth in output per man-hour for the total private economy may be understated. On the other hand, as we have indicated, the rate of growth in output per man-hour in food distribution is probably overstated.

more than twice the rate in either food distribution as a whole or in the food wholesaling and retailing component.

Much of the rise in output per man-hour in farming resulted from a large substitution of capital for labor. According to ERS estimates, the stock of capital per man-hour used in farm production rose about 160 percent from 1930 to 1958; during the period 1948–58, it rose about 75 percent. This reflects an absolute increase in the stock of capital coupled with a decline in labor inputs. Unfortunately, we have no comparable data for food distribution, but the evidence that is available hardly points to a similar rate of growth in capital per worker.

Kendrick has estimated total factor productivity (output per combined unit of labor and capital) in agriculture based on a measure of net output (4). According to his estimates, total productivity in farming increased at an average yearly rate of about 2.5 percent between 1929 and 1957. This is the same as our estimated rate for output per man-hour in food distribution, but is less than our estimated rate for the wholesale-retail component of food distribution. Given the problems of measuring capital inputs, particularly changes in the "quality" of the capital stock, these comparisons do not indicate that total productivity gains in farming were greater than those in the food trade sector during the 1929–58 period as a whole. However, for the postwar decade, 1948–58, Kendrick's estimates do point to significantly larger gains of total productivity in farming than were likely to have occurred in food wholesaling and retailing. According to Kendrick's estimates, total productivity in farming increased 3.7 percent per year from 1948 to 1957. Judging from our estimate of a yearly rate of growth in output per man-hour in food wholesaling and retailing of 2.7 percent for 1948–58, capital per man-hour would have had to decline substantially in order to yield a total productivity rate equal to that in farming.[12]

Literature Cited

(1) Barger, Harold.
1964. DISTRIBUTION'S PLACE IN THE AMERICAN ECONOMY SINCE 1869. Natl. Bur. Econ. Res., Princeton Univ. Press, Princeton, N.J.

(2) Findlay, Jeannette.
1964. THE BILL FOR MARKETING FARM PRODUCTS. U.S. Dept. Agr., Econ. Res. Serv., Mktg. Transportation Situation MTS–154, Aug.

(3) Geary, R. C.
1944. THE CONCEPT OF THE NET VOLUME OF OUTPUT WITH SPECIAL REFERENCE TO IRISH DATA. Roy. Statis. Soc. Jour. New Series, Vol. 107: 251–261.

(4) Kendrick, John W.
1961. PRODUCTIVITY TRENDS IN THE UNITED STATES. Natl. Bur. Econ. Res., Princeton Univ. Press, Princeton, N.J.

[12] Assuming that the weights used for labor and capital in measuring total productivity in food wholesaling and retailing are about the same as those used for the total private economy—.8 to .2 respectively (4)—it would have required a 5-percent per year decrease in capital per man-hour in the food wholesaling and retailing component to yield a yearly rate of 3.7 percent in total factor productivity.

(5) KING, WILFORD I.
1923. EMPLOYMENT, HOURS AND EARNINGS IN PROSPERITY AND DEPRESSION. Natl. Bur. Econ. Res., New York.
(6) MILLS, FREDERICK C.
1952. PRODUCTIVITY AND ECONOMIC PROGRESS. Natl. Bur. Econ. Res., Occas. Paper 38, New York.
(7) NATIONAL BUREAU OF ECONOMIC RESEARCH.
1961. THE PRICE STATISTICS OF THE FEDERAL GOVERNMENT. Prepared by Price Statis. Rev. Com. for Office Statis. Standards, Bur. of the Budget, Hearings Joint Econ. Com. of Cong. of U.S., 1st sess. 87th Cong. Jan. 24.
(8) U.S. DEPARTMENT OF AGRICULTURE.
1963. AGRICULTURAL STATISTICS 1962. 741 pp., Washington, D.C.
(9) ———
1952. TECHNOLOGY IN FOOD MARKETING, A SURVEY OF DEVELOPMENTS AND TRENDS IN THE PROCESSING AND DISTRIBUTION OF FARM-PRODUCED FOODS. Agr. Monog. 14.
(10) U.S. DEPARTMENT OF COMMERCE.
1929–58. U.S. CENSUS OF BUSINESS: RETAIL TRADE—SUMMARY STATISTICS. Bur. of Census. Washington, D.C.
(11) ———
1929–58. U.S. CENSUS OF BUSINESS: WHOLESALE TRADE—SUMMARY STATISTICS. Bur. of Census. Washington, D.C.
(12) U.S. DEPARTMENT OF LABOR.
1963. EMPLOYMENT AND EARNINGS STATISTICS FOR THE UNITED STATES 1909–62. Bur. Labor Statis. Bul. 1312, Washington, D.C.
(13) ———
1959–64. TRENDS IN OUTPUT PER MAN-HOUR IN THE PRIVATE ECONOMY, 1909–58 (AND ANNUAL SUPPLEMENTS). Bur. Labor Statis. Bul. 1249, Washington, D.C.
(14) ———
1964. RESTAURANTS AND OTHER FOOD SERVICE ENTERPRISES. Bur. Labor Statis. Washington, D.C. Jan.

Appendix

Measuring Net Output in Food Distribution

Conceptually, the measure of output should include services in eating places, clerk and delivery services provided by retail food stores, packaging and storage of foods by food wholesalers and retailers, parking services provided by food markets, and the host of other goods and services provided by food distributors. Such a measure of net output might be obtained by dividing value added in distributing farm food products by an index measuring changes in prices of goods and services provided by the food distribution sector. This index would include implicit prices of waitress services, clerk services, delivery services, packaging services, and a representative sample of other goods and services provided by food distributors; these prices would be weighted by quantities of the respective services in some base period. Since there is obviously no reasonable possibility of constructing such a price index at this time, we have had to resort to another more workable method.

The index of net output in food distribution used in this report is designed to measure changes in the quantity of *goods* and *services* added in distributing farm-originated food products for domestic civilian consumption. The index is net of purchased foods only; it includes packaging materials and other purchased supplies used by

food distributors. The series is constructed by commodity and by agency. It includes only distribution services associated with farm foods and performed by distribution agencies; it does not include the distribution services associated with nonfood items nor with foods not originating on U.S. farms (for example, coffee and fish). It also excludes wholesaling of farm-originated foods destined for export and for military and other noncivilian uses.

The index of net output does not include the distribution services performed by food manufacturers. This omission does not affect the index of output per man-hour because the employment data and output data are for the same universe. In terms of measuring output of distribution services wherever performed, however, this could be a significant omission. The Bureau of the Census in taking the census of manufactures for 1939 asked respondents to report separately the number of persons employed in manufacturing establishments who were primarily engaged in distribution activities. More than 100,000 such persons were reported by manufacturers specializing in processing domestic farm food products. This is about 4 percent of the number of full-time equivalent persons we estimate were engaged in food distribution in 1939 and about 5 percent of those in food retailing and wholesaling. During the three decades reviewed in this report, there was a shift in packaging from retail stores to factories; however, in the opposite direction, there was a decline in home delivery services by bakery and milk manufacturers in favor of retail stores. Output in distribution also includes a small amount of manufacturing activities by food distributors. Unfortunately, data are not available for estimating the importance of these intersector shifts.

The series on net output in food distribution was constructed by major food groups—meats, manufactured diary products, and so on—and then added to obtain the total for all foods. The constant dollar figures were then put on an index number basis. The Geary (*3*) formula for measuring double-deflated net output was used:

$$(1) \qquad \sum_i X^*_{it} = \sum_i \left[\frac{V^c_{it}}{P^c_{it}} - \frac{V^m_{it}}{P^m_{it}} \right]$$

where,

X^*_{it} = quantity of goods and services (in 1947–49 dollars) added in distributing the ith food group in period t,

V^c_{it} = value of domestic civilian consumption (in current consumer prices) of the ith farm food group in period t,

V^m_{it} = costs of farm-originated foods (in wholesalers' purchase prices) entering distribution sector for ith food group in period t,

P^c_{it} = index of retail prices (1947–49=100) for ith food group consumed in period t,

P^m_{it} = index of wholesale prices (1947–49=100) for ith food group in period t.

Since our price deflators use base period weights, the double-deflated measure of net output is based on current weights.

It was possible to double-deflate all food groups except fluid milk and cream, for which adequate deflators were lacking. The distribution bill for fluid milk and cream by retail stores, however, never accounted for more than 2 percent of the total distribution bill for the years included in the study. Much of the distribution was done by fluid milk processors, which are not within the scope of this study. A coverage adjustment developed by Mills (*6*) was used for this excluded group. The adjustment assumes that the unit distribution bill for fluid milk and cream varied in the same way as the average unit distribution bill for all the covered commodities.

In effect, the index of net output in the wholesaling and retailing of farm-originated foods was constructed in the same way as the index for food distribution as a whole. A double-deflated value series using equation (1) was developed for away-from-home eating places and this in turn was subtracted from the double-deflated value series for total distribution services.

The value data used to construct the net output indexes are from Gale's estimates of the farm-food marketing bill by commodity group and agency. These estimates were constructed using Kuznets's commodity-flow method for years in which census data were available. Essentially, this involved channeling the value of "finished" commodities (commodities in their "ultimate" form for purchase by households) through different kinds of wholesalers, retailers, and away-from-home eating places and raising these "through-puts" by the respective agency markup. Gale's estimates are based on data from the *Census of Manufactures*, *Census of Retail Trade*, and *Census of Wholesale Trade;* from publications of the Internal Revenue Service and the Statistical Reporting Service of the Department of Agriculture; and from trade journals; and on data available from special and continuing studies made by the Marketing Economics Division of ERS.

Although some of the basic data, especially on markups, leave much to be desired, we know of no secular biases in the final value series.[13] We would, however, underline the fact that the information used to measure the bill for away-from-home eating places is indeed sketchy and tenuous.

The errors in the price deflators used in constructing the net output series are in some ways easier to evaluate than the errors in the value series. The retail cost (price) series which is constructed as part of the ERS farm-food market basket series was used to deflate the value of consumer expenditures for farm-originated foods. The ERS retail cost (price) series is based on U.S. average food prices reported by the BLS as part of the food component of the BLS Consumer Price Index. The scope of the ERS series used to deflate the minuend of the double-deflated distribution bill is consistent with the data on civilian food expenditures in that they are both for farm-originated foods only; they both exclude imported foods (coffee) and nonfarm

[13] Gale's estimates of the total farm-food marketing bill showed about the same decennial trends as the regularly computed ERS farm-food marketing bill between 1929 and 1958. Other comparisons of Gale's estimates with related published series are included in his report on the farm-food marketing bill and its components, now in preparation.

foods (fish). However, as we have pointed out, the problem in using the ERS series (or any other consumer price series available for the period) is that it does not reflect prices of foods eaten in restaurants and other away-from-home eating places nor does it reflect the greater importance of eating out by single persons. The civilian expenditures series does reflect these factors. The BLS began collecting information on prices for meals away from home in 1953, and according to these data, our use of ERS retail cost (price) data could significantly overstate the rise in the minuend of the double-deflated net output series for food distribution. From 1954 to 1958, BLS prices for all foods (including foods purchased away from home) increased 0.6 percent more than the price index for foods at home.

The same problem does not arise in constructing the minuend of the net output index for the food wholesaling and retailing component of food distribution. The value series for foods purchased for home consumption is deflated by the ERS retail cost (price) series. This is, at least conceptually, the correct deflator. There is a good presumption, however, that in practice the collected BLS retail food prices tend to overstate the "true" price increases because they reflect quality improvements in foods as well as additional services per unit (7). To the extent that this is true, it results in an understatement in the rise of the minuend.

The price series used to deflate the subtrahends for both the distribution bill and its wholesale-retail component were constructed from BLS wholesale prices for foods. As with retail prices, there is a good presumption that the reported wholesale price series have upward secular biases because they may reflect quality improvements in foods and additional processing services per unit of product.[14] To that extent, the deflated costs of foods entering distribution and the deflated costs of foods entering the wholesaling and retailing component will both tend to be understated. Thus, the secular biases in the deflated subtrahend and minuend are in the same direction in measuring net output in food distribution, but they are in the opposite direction in measuring net output in the food wholesaling and retailing component.

To summarize, there is no evidence that the value data used to construct the net output indexes are subject to secular errors. The general presumptions about the errors in the price deflators point to a very likely upward secular bias in our measure of net output in food distribution. However, the secular errors in the price deflators are probably offsetting to some unknown extent in our measure of net output in the food wholesaling and retailing component of food distribution.

Man-hours

The scope of the man-hours series used to measure output per man-hour is, for practical purposes, the same as the scope of the output series. The man-hours index was designed to measure changes in man-hours worked by all persons engaged in distributing farm foods.

[14] Waldorf, W. H. DEMAND FOR MANUFACTURED FOODS, MANUFACTURERS' SERVICES, AND FARM PRODUCTS IN FOOD MANUFACTURING. U.S. Dept. Agr. Tech. Bul. 1317.

Nearly all of the employment data are from the *Census of Business*, which reports the statistics on an establishment basis (*10*, *11*). Allocations based on sales by commodity lines were made in order to estimate employment on a commodity basis. The information on average weekly hours was estimated largely from BLS published sources and is approximately for hours paid for, including paid vacations and sick leave.

Employment

Our measure of employment in food distribution includes paid full-time employees, paid part-time employees, proprietors of unincorporated businesses, and unpaid family workers. Each of these groups accounts for a sizable fraction of the total number of workers. Also, there has been a significant shift among the groups, so that omission of any one could significantly affect the trend in output per man-hour. Unfortunately, the Bureau of the Census reported the number of unpaid family workers in 1939 and 1948 only. In 1948, unpaid family workers accounted for about 11 percent of all persons engaged in food distribution and food wholesaling and retailing. The figure was extrapolated to 1954 and 1958 using the ratio of unpaid family workers to proprietors for 1948; it was extrapolated backward to 1929 using the ratio for 1939.

The employment estimates also follow the *Census of Business* classification of kind of business, except for the adjustments described below to bring them in line with the scope of the output index. In food retailing, we included workers in retail food stores (except fish and seafood stores), nonstore retailing, and administrative offices and warehouses servicing retail food stores (*10*). Workers engaged in home delivery of bakery products and milk employed by food manufacturers were excluded. In food wholesaling, we included all persons classified under merchant wholesalers, manufacturers' sales branches (with and without stocks), and agents and brokers wholesaling groceries and related products (*11*). Fish and seafood distributors and wholesalers of farm products (raw materials) were excluded. Finally, in workers in eating places we included all persons working in restaurants, lunchrooms, cafeterias, refreshment stands, and catering establishments, and those working for in-plant food contractors. Workers in drinking places (places in which half of the total revenue is for alcoholic beverages) were excluded. For lack of data, no attempt was made to separate the proportion of employees in eating-and-drinking places who handled foods from those handling alcoholic beverages. However, for purposes of our aggregate productivity measures this would probably not be a significant adjustment.

The basic employment data are from the *Census of Business* for each census year between 1929 and 1958. These data are for all persons working in establishments specializing in food distribution. Therefore, the employment series excludes persons distributing foods who are employed by establishments primarily engaged in other activities. The effect of this omission, however, is probably negligible. According to the *Census of Retail Trade* for 1948, general stores,

department stores, and variety stores were the only nonfood outlets selling any significant quantities of food (*10*). Sales of foods by these three groups together accounted for less than 3 percent of total retail food sales in that year.

Food wholesalers and retailers sell nonfood items and foods not originating on U.S. farms. We therefore had to adjust the employment series for these sales in order to make it comparable to the scope of the output series. The adjustments were based on a simple percentage allocation of sales by commodity line reported in the Censuses of Business. As far as we could tell from the data, the trend to nonfood sales by food distributors first became significant in the postwar period. Therefore, we adjusted the figures for 1954 and 1958 only. According to our estimates, food sales as a proportion of total sales of retail food stores declined about 4 percent from 1948 to 1954 and about 3 percent from 1954 to 1958. For food wholesalers, the proportion declined only about 1 percent from 1948 to 1954 and about 3 percent from 1954 to 1958. The adjusted employment and man-hours figures for food distribution are about 4 percent below the unadjusted figures in 1958; for the wholesaling and retailing component the adjusted figures are 6 percent lower. Thus, these adjustments alone raise our estimated relative productivity gains for the postwar period, 1948–58, by 4 percent for food distribution and 6 percent for the food-trade component. These adjustments are obviously significant.[15]

In order to adjust the employment data for non-farm-originated foods, we omitted employment in fish and seafood markets. These are not reflected in the net output index. We did not adjust the employment in establishments of other food retailers and wholesalers of fish and seafoods because the adjustment would have been virtually within a rounding error. Our estimates indicate that in retail food stores (not including fish and other seafood markets), farm foods sold as a percentage of total food sold remained about constant during the postwar period, 1948–58. This presumably would be equally true for food wholesalers and away-from-home eating places.

There is still one more adjustment needed to bring the scope of the employment series and the output indexes in line. The employment series including the above adjustments reflect distribution services related to farm-originated foods destined for all uses. Since we are only interested in foods destined for civilian consumption, we also had to adjust employment in food wholesaling to allow for handling imported foods and foods for noncivilian consumption. The allocation was based on utilization data developed by ERS. According to our estimates, farm-originated foods destined for civilian consumption declined as a percentage of total sales of foods by wholesalers from 1939 to 1958. The decline was nearly 4 percent and therefore raised the relative increases in productivity in food wholesaling by about 4 percent over the two decades. The effect of the adjustment was there-

[15] These adjustments are best avoided in constructing productivity indexes by measuring both output and labor inputs on an agency basis rather than a commodity basis. As we have pointed out, our starting point was Gale's estimate of the farm-food distribution bill, which was necessarily by commodity. Therefore, we had to adjust the employment and man-hours data to a commodity basis also.

fore insignificant, both for distribution as a whole and for its wholesaling and retailing component.

Besides adjustments for scope, it was also necessary to correct the reported census employment data for comparability over time. As far as we can tell, the most significant changes in coverages in the *Census of Business* occurred in 1954, and even these were not highly significant for purposes of this study. The Bureau of the Census transferred their data on milk pasteurizing and bottling plants from the *Census of Wholesale Trade* to the *Census of Manufactures* in 1954. In the same year, they transferred data on retail bakery stores with baking on premises and operated as multiunit establishments from the *Census of Manufactures* to the *Census of Retail Trade*. The *Census of Wholesale Trade* and *Census of Retail Trade* for 1954 reported data for 1948 which were comparable with the 1954 coverage. The difference in the total number of persons in wholesale and retail trade in 1948 caused by the change in coverage was about 4 percent. Since the employment data from 1929 through 1948 were comparable under the old definitions (except for minor adjustments), and the data from 1948 to 1958 were comparable under the new definitions, the two series were simply linked in the overlapping year. Also, beginning in 1948 employment has been reported for the "work week ended nearest November 15," whereas for 1929 through 1939 the employment data were given only on an average annual basis. Employment data were reported on both bases for 1948, and this was another reason for linking the series.

Finally, the only changes in scope of the *Census of Business* that could possibly significantly affect the comparability of the series were made in 1954. The *Census of Business* for 1954 excluded establishments with no paid employment in 1954 and with sales volume of less than $2,500 in that year. The *Census of Business* for 1948 excluded establishments which operated the entire year but had a sales volume of less than $500. However, comparable figures for the new cutoff for 1948 were published in the 1954 *Census of Business*. This was still another reason for simply linking the series in 1948.

To summarize, we had to make various adjustments in the employment data to bring them in line with the scope of the output series and to take account of historical changes in the coverage and scope of the *Census of Business*. None of the errors introduced by making these adjustments are likely to be significant in gaging productivity gains over the three decades, 1929–58, covered by the study. However, they could be significant in gaging the postwar gains for 1948–58.

Average Hours

The difficulty of measuring average weekly hours per person engaged in food distribution is underlined by the fact that the only available series specifically applicable to food distribution workers (average hours for nonsupervisory employees in food and liquor stores) accounted for less than 25 percent of the total employment in 1948. And the data for this specific group are available only since 1939. Although it would be more comforting to have a better coverage of hours, the picture is not as dim as the above figure suggests. Closely

related series are available in some cases and, in general, average hours worked by paid employees among different parts of the nonfarm sector of the economy tend to move together.

For food retailing, data on average hours worked by nonsupervisory paid employees in food and liquor stores are available beginning with 1939. The series was extrapolated back to 1929 using King's data on average hours of all employees in total retailing for 1920–22 (*5*) and BLS data for average hours in manufacturing (*12*). This linked series for nonsupervisory employees was applied to all paid employees (including executives of corporations and supervisory workers) and to unpaid family workers. For lack of any better information we simply followed Barger (*1*) and assumed a 60-hour work week for proprietors of unincorporated businesses for the entire period.

Data on average weekly hours for food wholesaling are available only since 1958. For the period 1939–58, BLS published data on average weekly hours of paid nonsupervisory employees in all wholesaling were adjusted to the 1958 average for food wholesaling (that is, increased about 6 percent). We extrapolated back to 1929 using King's data on average weekly hours for employees in total retailing for 1920–22 and BLS statistics on average hours in manufacturing. This linked series for all wholesaling was applied to all employees in food wholesaling, including supervisors and corporate executives; according to data reported in the *Census of Wholesale Trade* there were no unpaid family workers in food wholesaling during the period studied. We assumed a constant 60-hour week for proprietors of unincorporated wholesaling establishments.

For eating places, there are no continuing series reported on average weekly hours for any group of employees in restaurants or other away-from-home eating places. Using data obtained in a special survey made by the BLS in 1964 (*14*) we estimated that average hours worked by paid employees in away-from-home eating places were 8 percent greater than average hours worked by paid employees in retail food stores. On the assumption that trends in average hours per person have been the same in both kinds of distribution outlets, we simply inflated the average weekly hours data for retail food stores by 8 percent and applied this to the total number of paid employees and unpaid family workers in away-from-home eating places. For proprietors of unincorporated eating places, we again used the 60-hour week assumption.

The above description of our estimates of average weekly hours in food distribution indicates how sparse the data are for this sector and the difficulties of measuring or even guessing the direction of errors in the man-hours index. We did experiment with different assumptions about weekly hours worked by proprietors, and the results indicated that our conclusions about trends in labor productivity are not likely to be significantly affected by using the 60-hour assumption.[16]

[16] If we had assumed the same average hours for active proprietors as for paid employees, certainly an "extreme" assumption, average hours in food distribution would have decreased only 2 percent more from 1939 to 1958 than in our estimate using the 60-hour assumption. The effect would have been more significant for 1929 to 1939, but it is doubtful that the percentage decline for proprietors could have been as great as that for paid employees (11 percent over the decade).

This at least suggests that our estimated series on average weekly hours may not be too unsatisfactory unless we have been so unlucky that all of the errors are in the same direction. Less conjecturally, however, the above description of the estimates for each kind of distributor indicates that we can have more confidence in the accuracy of the man-hours series in the food wholesaling and retailing component than of the series for food distribution including eating places, and that the series for the postwar years are better than those for the prewar years.

U.S. GOVERNMENT PRINTING OFFICE: 1965 O—762-675

END