Distribution of Gains from Rising Technical Efficiency in Progressing Economies

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⌐1956?⌐

⌐See Correction sheet at end⌐

Continuously rising efficiency of production has come to be one of the characteristic dynamic concepts of 20th century economics, as well as one of the outstanding phenomena in many parts of the world. Increasing physical output per worker is of course an essential condition for rising real standards of living in any nation (apart from outside help, which can only be temporary). How that increasing product is to be shared is the source of prolonged and recurring disputes among labor unions, farm organizations, suppliers of capital, professional groups, and workers in business management and in public employment. Yet little attention has been given in economic discussions to how this gain has actually been shared, what factors influence its sharing, or what should be the normative values considered in settling the conflicts involved. This paper presents a preliminary reconnaissance of this broad field, examines a few samples of the manifold phenomena involved, and suggests lines for more extensive and detailed investigations of the facts and issues.

The basic concept of efficiency of production is subject to different interpretations under different conditions. In highly industrialized countries, such as the U.S., the U.K., Sweden and Switzerland, it is commonly thought of as physical volume of output per unit of human labor applied, per day or per hour. "Automation" is merely the latest stage in their technical development. 1/ Such countries characteristically have scarce labor but abundant capital. In very underdeveloped countries with abundant man power but scarce capital and land, it is often thought of in agriculture more as output per acre of land, or in industry as output per thousand dollars investment of capital. India, China, Egypt, are all illustrations of countries of this type. This paper will be confined largely to changes in highly industrialized countries, as illustrated by the U.S. where data are most adequate, but will refer to the situation in other countries as appropriate.

The overall facts as to increase in productivity in the U.S. are well known. In agriculture, the physical volume of output per man hour has risen practically continuously, relatively slowly until about 1934, and since then much faster at a rate of about 4 1/2% per year. 2/ The increased output per hour was due both to more productive technological methods, as shown by increasing output per acre of land and per head of livestock since the mid-30's, and to a continuing substitution of machines for manpower. In manufacturing as a whole, there was a continuing gain in physical volume of output per man hour employed, faster

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1/ Automation in Perspective. The Economist, vol. CLXXX, No. 5892, London July 28, 1956, following page 328 (22 pp.)

2/ Specific references will not be given for statements based on regular statistical compilations of the U.S. Dept. of Agriculture and U.S. Bureau of Labor Statistics. References are to most recent series, as far as available.

than in agriculture up to 1934, but thereafter only about 2% per year. Railways, mines and electricity also show substantial rates of gain in labor productivity. In non-farm industries as well as on farms, improvement of methods and increased capital per man both contributed to the rising productivity.

Production of physical things makes only part of economic production, and represents the part where machinery may most readily be substituted for manpower. Over the economy as a whole, gain in average output per worker is slower. Total physical production in all forms and real national income, per capita for all persons gainfully employed in civilian activities, both rose by 1.7% per year from 1929 to 1950. This rate of increase in overall national output per capita, is, as expected, substantially below the rates for workers in agriculture and manufacturing industries engaged solely in physical production. 1/

These data are in part approximations, obtained by dividing indexes of output by indexes of manpower or employment. Much more detailed and accurate data on net changes in productivity in individual industries, after allowing for changes in input, are available from careful studies made by the Bureau of Labor Statistics and other bodies 2/; these will be considered later in this paper.

Distribution of Gains from Productivity

Traditional economic theory assumes that reductions in labor costs due to "progress in the arts" are promptly passed on to consumers as reductions in prices for the products concerned. General progress in labor productivity would thus lead to a general reduction in price levels and costs of living, distributing the resulting gains in buying power uniformly to all income receivers. Obviously this is a very unsatisfactory model for a world where monopolistic competition, labor unions, and government interventions all tend to modify the process. A slightly more realistic model would be for the gains to be distributed in part by a decline in prices, proportional to the gain in efficiency in each product; and in part by a rise in average wages. If reflected solely in lower prices, general price level would fall; if partly in lower and partly in higher prices, price level might hold substantially steady. It could even be passed on by rapid _rises_ in prices of those products and services with no gain in efficiency, less rapid rise in those with moderate gains; no increases in those with the greatest rates of gain — and a general increase in incomes in all groups to give increased overall buying power despite the overall rise in prices and living costs. This would, of course, reduce buying power of those dependent on pensions and other fixed incomes. In any case, if the gains were to be shared generally among the whole society, real prices should fall most for products and services with rapidly rising efficiency, and rise for those with little or no technological improvement, while real incomes of workers and investors would tend to increase generally among all industries and occupations. The actual behavior of productivity, wages, prices and profits in the real world may now be examined for indications of how far their behavior differs from that which would be expected from this simplified model.

If output per man-hour rises in a given industry — steel, for example — the gains from that increased output may be distributed in a variety of ways, including the following:

1/ Data from mid-year Economic Report of the President, July, 1951.
2/ Productivity and Unit Labor Cost in Selected Manufacturing Industries, 1919-40 Bureau of Labor Statistics, February 1942, and later reports.

a) To workers in the industry, in increased leisure through reduced normal hours per week.

b) To workers in the industry in increased real income per week.

c) In changing payments for inputs of goods and services obtained from other industries, if larger or smaller physical inputs of purchased products are needed per unit of output in the industry concerned, or if real prices change for input factors.

d) In increased payments to owners of capital in the industry concerned –

    (i) for greater physical amounts of capital used per worker (if any); and

    (ii) in increased real income per unit of capital supplied.

e) To workers in other industries and occupations, through reduced real prices for the products of the industry concerned.

The last classification is very important. Some occupations — school teachers, government officials, barbers, doctors, for example -- can make only limited use of mechanization or of mass production to improve their output per hour, as opposed to the great mass-production industries such as steel, automobiles, electric power, agriculture, etc. If workers in the first group are to share in the increased product resulting from improvements in efficiency in the other industries, it must be through part of the gains in efficiency in the progressing industries being reflected in reductions in the real price of their products, or else through the payments or charges for the services of less favored industries increasing relative to prices of mass-produced products.

We may try to see what these five lines of distribution of gains mean by examining what has happened in some industries or industry groups.

Steel

In steel, physical productivity per hour not only trends upward with time, but tends to vary from year to year with the percent of capacity operated. [1] By comparing years of approximately peak-capacity operation, we can hold the percent of capacity effect reasonably constant. We will therefore take 1913, 1920, 1923, 1929, 1940, 1950 and 1955, as years to compare. The data published by the U.S. Steel Corporation for its own operations will be used, plus B.L.S. price indexes. The resulting derived data are given in Table I. Labor productivity as shown in the table is based upon tons of steel ingots and castings produced per man employed. The average selling price of U.S. Steel sales per ton of steel has in fact advanced substantially faster than the price indexes of iron and steel products. This indicates that the composition of the products

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[1] Kathryin H. Wylie and Mordecai Ezekiel, The Cost Curve for Steel Production. Jour. Pol. Econ. Vol. XLVIII , pp. 777–821, Dec. 1940.

sold has changed toward steadily higher degrees of fabrication and of more expensive alloys, and that the increase in real physical productivity must therefore have been somewhat higher than that indicated on the tonnage basis alone.

Table I.-   Productivity in steel, and its distribution

Year	a/ Productivity		Real Wages			Hours	Iron & Steel price de- flated	Purchases of products & services in % of sales	PROFITS	
	per hr.	per worker	per hr.	per week	$ per week	per week			% of sales	% of net worth a/
			1920 = 100		47-49= 100		1920 = 100	------Percentages--------		
1913	87	101	73	85	41	68.9	86	34	14.5	--
1920	100	100	100	100	49	59.4	100	34	8.5	--
1923	101	100	98	98	47	59.3	103	32	9.9	--
1929	154	119	115	89	43	46.2	86	32	18.0	11.2
1940	185	111	184	114	55	36.7	106	33	9.5	8.5
1950	213	134	218	139	67	37.8	92	38	7.3	15.3
1955	255	160	296	187	90	37.5	106	33	9.0	

Sources: Computed from data in Annual Report, 1955 U.S. Steel Corporation, pp.30-31; BLS indexes of cost of living, wholesale prices, and iron and steel prices.

a/   Figures for leading iron and steel corporations, from First National City Bank of New York Monthly Letter.

Over the long period, productivity per hour has trended steadily upward, almost tripling in the 42 years. 1/ This was a true gain in net productivity, since purchases of other goods and services in percent of sales, showed no

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1/ The increase in output per man hour estimated from US Steel data from 1920 to 1940, 85% compares with an increase of 105% calculated by the Bureau of Labor Statistics for the entire iron and steel industry (loc.cit. p.24). For output per worker, the change was 11% for US Steel, but 26% for the whole industry. US Steel apparently reduced hours per week more than did the industry as a whole. If US Steel production is estimated by deflating the value of sales by the new BLS price index of finished steel mill products (available only since 1939) the increase in productivity per man, 1940-1955, is materially greater (61% instead of 45) than when based on tonnage, with the increase larger 1940-50, but lower 1950-55. The operation of Federal Ship and Dry Dock Co. by the Corporation, prior to 1948, made the 1940 productivity figure especially doubtful.

significant trend. Almost half the increased productivity per hour went into greater leisure, to reduce the normal steel working week from the equivalent of almost 10 hours a day, 7 days a week, to an average of 7 1/2 hours for a 5-day week. This reduction in the working week was completed by 1940. Beyond the increased leisure, real wages per week varied generally around the same level from 1913 to 1929 (although declining in the '20's) and then advanced, gradually to 1950 and more sharply subsequently, exceeding the rise in output per week. None of the increased productivity went to steel purchasers, real prices of iron and steel fluctuating within a moderate range and generally trending slightly upward. Profits after taxes, measured in percent of sales, also showed no significant trend, and if anything averaged lower since 1929 than before, but profits per dollar of net worth trended up since 1929. How far real capital employed per worker or per ton increased or decreased cannot be estimated, in the absence of any effective method of deflating the reported values of plant and equipment at cost, and of taking into account varying depreciation charges. It does seem, however, that real capital per worker must have increased substantially.

Steel, as far as U.S. Steel Corporation data indicate, thus appears to be a case where the workers in the industry have retained in more leisure plus increasing buying power substantially all, or possibly even more than all, their own rapid increase in productivity, where owners of capital received some increase in return on capital invested, so far as indicated by net book assets, but where consumers of steel have received none of the gains.

Other manufacturing industries.

It is not possible in this brief paper to present similar separate analyses for other individual industries. Some general data are available, however, especially from a notable series of studies by Ross, Lester, Goldner, and Garbarino, published from 1948 to 1950. 1/ These last studies were directed to the more limited question of analyzing factors affecting wage-rates. Ross initially considered only the influence of the extent of union organization and of the degree of oligopoly present in each industry. The later studies added to this the extent of technical progress in the industry, either reported or inferred from rate of growth. While the final results were somewhat conflicting, all three major studies found some influence of the extent of unionization on the movement of wages, but indicated that oligopolistic market structure and productivity also had some effect. The results varied with the exact periods compared.

A reconnaissance overall analysis can be made for 34 manufacturing industries, using a table from Garbarino for 1940 compared to 1923, and covering percent changes in output per man hour and in hourly earnings, and concentration

1/ Arthur M. Ross, The Influence of Unionism upon Earnings, Quart. Journal of Economics Vol. LXII, No. 2, pp. 263-286, Feb. 1948. The Influence of Unionism upon Earnings: Richard A. Lester, Comment; Arthur M. Ross, Reply; Quart. Journal Econ. Vol. LXII No. 5, Nov. 1948, pp. 763-782. Arthur M. Ross and Wm. Goldner, The Interindustry Wage Structure, Quart. Journal of Economics, Vol. LXIV, No. 2, pp. 254-281, May 1950. Joseph W. Garbarino, A Theory of Interindustry Wage Structure Valuation, Quart. Journal Econ., Vol. LXIV, No. 2, pp. 282-305, May 1950.

in the industry as an indicator of extent of oligopoly. The percent changes in wholesale prices of the products of each industry over the same period, and the degree of unionization at the end of the period, have been added. 1/ The resultant data are shown in Appendix Table 1, tabulated in order of descending change in productivity. A positive relation between productivity and change in earnings, and a negative relation between productivity and wholesale prices, are quite marked. In general, a high degree of oligopoly as indicated by degree of concentration (percent of output produced by the 4 largest firms), and, to a lesser extent, a high degree of unionization, were most prevalent among industries showing high productivity.

Dividing the data into 4 groups according to productivity change, and taking simple averages of the relatives for prices and wages in each group, results are obtained as shown in Table 2.

Table 2.- <u>Relation between changes in productivity and in prices and earnings, according to productivity groups: 1940 in percent of 1923</u>

Productivity Group	No. of Industries	Average Productivity per man hour	Average Wholesale Prices	Average Earnings per hour	Average Concentration ratio
(Simple averages of relatives, unweighted)					
		(.........Per cent. of 1923.........)			(Per cent.)
204 to 486	9	286	a/ 66	141	51
161 to 187	10	173	a/ 84	124	29
142 to 159	8	151	83	121	26
112 to 137	7	126	b/ 86	113	27
Total	34	188	80.5	126	34

Data represent percent of total industry output produced by the 4 largest concerns.

a/ Based on 7 reports only — others not available.
b/ Based on 4 reports only — others not available.

The averages show a general but not uniform tendency for prices to be lower as productivity gains averaged higher; and a marked tendency for hourly wages to increase with productivity. A separate analysis within each productivity group reveals a slight but definite tendency for wages to rise more with greater oligopoly, little relation of prices to oligopoly, and no consistent relation of either wages or prices to degree of unionization. More careful analysis, including an adjustment of product prices for raw material price changes, might help clarify these relations.

1/ Where the industry depends on relatively expensive raw materials, with only slight additional processing, as for meat packing and sugar refining, the ratio of prices of finished products to raw materials have been used, instead of the latter prices. In many other industries more careful adjustment is needed to eliminate the effect of price changes in raw materials.

Earnings per hour rose by an average of 25% in the 34 industries considered, over a period when general wholesale prices, and prices of industrial and farm products, and cost of living, all fell about one-fifth. With an average gain of 88% in output per hour, real wages per hour advanced an average of just over 55%. From these comparisons, based on charges from 1923 to 1940, it appears that a substantial part of the greater productivity per hour was reflected in higher wages per hour. Part was distributed in higher increase in incomes in individual industries, in rough proportion to the increase in productivity in each industry; and part was distributed in lower prices generally, especially in the industries with the greatest technical progress. For each increase of 10 index points in output per man hour in the industry, wages per hour tended to advance by just over 1 1/2 index points, and prices of its products to decline by just under the same amount. Changes in hours of work, and in profits, have not been considered here for lack of data.

The period just considered, however, blankets together two unlike epochs — the 1920's, and the New Deal reforms after 1933. Other evidence has shown that from 1920 to 1929, the gain in real national income was accompanied by large increases in profits, but not by increases in real income of workers, and that this may have contributed to the subsequent Great Depression. 1/ Re-examination of the changes separately for 1920 or 1923 to 1929, and for 1929 to 1940, and inclusion of real wages per week and of profits in the examination, might reveal how the social distribution of productivity gains behaved during the 1929 boom and collapse, and how it was affected by subsequent reforms of the Roosevelt administrations.

Manufacturing industries, 1940-1955   Official data on productivity changes since 1940 are available for relatively few individual industries, with many important ones missing. 2/ Comparing overall indexes of production with employment, however, certain rough computations can be made. These are shown for durable and non-durable manufacturing as a whole, in Table 3. (see page 8) If time and space permitted, the same comparisons might be extended to various key industries or industrial groups.

Gross output per worker continued to expand during the period at about the same rate per year, in durable and non-durable manufacturing. Overall none went into increased leisure; in fact, weekly hours increased slightly after 1940, a year of continuing substantial under-employment. The index of real prices of all manufactured products, excluding farm products and foodstuffs, was substantially unchanged in 1950 from 1940. From 1947 to 1955, there was a sharp increase in real prices of durables, so none of the rising productivity there was passed on as reduced prices to consumers. Real prices of non-durables showed a slight decline — 4% — from 1947 to 1955, but that may have been due to declines in prices of farm products and other raw materials, and to the rise in durable goods prices, rather than to reduced manufacturing margins. Real wages per week rose rapidly, both in durable and non-durable manufacturing, by more than the gain in productivity. Profits after taxes, in proportion to book assets, soared sharply from

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1/ This shows up in the steel data in Table 1, with an increase of productivity per week of 19% from 1920 to 1929, but a decline of 11% in real wages per week over the same period.

2/ For the few manufacturing and non-manufacturing industries for which data comparable to Table 3 are available for 1940 and 1950, the averages show a substantial negative correlation between change in productivity and change in prices, but also some negative correlation between productivity change and real earnings per week.

Table 3.- <u>Changes in apparent productivity, hours per week,</u>
<u>real wages per week, wholesale prices, and profits,</u>
<u>for durable and non-durable manufactures</u>: <u>1940-1955</u>

		Output per man 1940 = 100	Hours per week	Real prices of products 1947-49 = 100 a/	Real gross wages per week 1955 dollars	Average profits after taxes Percent of book assets
			Hours	Index-1947-49 = 100	Dollars	Per cent
Durable						
Manufacturing	1940	100	39.3	n.a.	54	8.5
	1947	–	–	96	–	–
	1950	123	41.2	105	71	18.7
	1955	138	40.2	116	77	16.8
Non-durable						
Manufacturing	1940	100	37.0	n.a.	43	11.3
	1947	–	–	100	–	–
	1950	127	39.7	98	61	15.7
	1955	142	39.8	96	68	13.5
		Relatives, with 1950 = 100				
Durables	1940	81	–	–	76	–
	1947	–	–	91	–	–
	1950	100	–	100	100	–
	1955	112	–	110	108	–
Non-durables	1940	79	–	–	71	–
	1947	–	–	103	–	–
	1950	100	–	100	100	–
	1955	112	–	99	110	–

Sources: –Data tabulated in Economic Report of the President, Jan. 1956; and for
profits, Monthly Letters, First National City Bank of New York.
a/ –Data are prices of finished goods for producers and for consumers,
respectively, deflated by wholesale prices of all goods.
n.a. –Not available

1940 to 1950, and dropped slightly in 1955. In trying to determine the meaning
of these profit margins, it was noted that the reported value of assets of leading
corporations 1/ in each group about doubled from 1940 to 1950, and increased about
50% further from 1950 to 1955. It is difficult to tell what part represented new
investment, and what part re-valuation of existing assets; but comparison with
business expenditures for new plant and equipment, '50-55, suggests that most of
the increase in book assets in this period represented real new investment.

Apparently manufacturing of durable products, as a whole, contributed to the
general inflation in the 15-year period since 1940 by raising real earnings in
that group as fast as overall output per man increased, doubling profit rates,

1/ Undeflated values, from First National City Bank of New York Monthly Letters.

compared to 1940, also increasing costs of the products to consumers. Non-durable manufacturing, on the contrary, while similarly raising wages to workers, made lower increases in profits, and no increase in costs to consumers.

Agriculture

Physical output per man hour increased on farms over the period 1913-1955 as a whole at almost exactly the same rate as in steel, but more of the increase came after 1929 (See Table 4). Hours actually worked per week showed

Table 4.- Productivity in agriculture and its distribution

Year	Productivity per hr. (estimated)	per worker	Real earnings per week Index: 1947-49 No.	$	Average hours worked a/ (estimated)	Normal working day	Purchased input in % of output value b/	Farm prices deflated c/
			1920=100	dollars	hours	hours	percent	47-49 = 100
1913	88	85	118	15.9	32		21	83
1920	100	100	100	13.5	34		21	78
1925	100	105	121	16.3	35		21	87
1929	108	112	128	17.2	35		22	89
1935	118	108	115	15.6	36		21	79
1940	138	146	135	18.3	36	10.8	27	73
1950	224	206	230	31.0	31	10.2	25	92
1955	252	(250)	210	28.3	34	9.8	31	81

Sources: USDA Yearbooks & Statistics, plus "Changes in Farm Production & Efficiency", Agr. Research Service, USDA, June 1955, and "Farm Income Situation", Agr. Marketing Service USDA, October 1955.

a/   Deflated by index of farm living cost
b/   Includes expenditures for fertilizer, pesticides, equipment, etc., but not farm-produced products, such as feedstuffs & seeds
c/   Deflated by wholesale prices, all commodities.

relatively little change over the period and actually seemed to have a slight upward trend for a time — due possibly to more effective utilization of time round the year, as farms were organized more efficiently. Standard hours of full-time daily work continued long, though, declining only from 10.8 hours in 1940 to 9.8 by 1955. Farmers thus took little of the gain in productivity in increased leisure. With rising use of fertilizers, power machinery, and purchased fuels, purchases of non-farm production goods increased relative to gross income, rising from 25% of value of product in 1913 to 35% in 1955. Capital investment per worker also increased rapidly over the period, due both to more acres per man, and more equipment per acre. The gain in output per man was thus partially achieved at the cost of increased real inputs, and the net gain in productivity was hence not as marked as in steel. Real weekly incomes to farm workers (farmers and their family members, and hired labourers, all combined) showed a percentage increase from 1913 to 1955 only two-thirds as large as that in steel. Despite the large relative increase, the actual real income per week in agriculture

(including the return on the capital invested) remained low compared to industrial earnings, attaining only $28 in 1955 (in 1947-49 dollars), as compared to $90 in steel. The increase in real earnings per week from 1913 to 1955 was only $12 in agriculture, as compared to $49 in steel. The farmers real share in the country's rising productivity thus remained quite modest. In steel, the fastest and largest increase in real incomes per week came after 1950 with an advance of one-third, whereas on farms, real income per week declined about 10% from 1950 to 1955.

Selling prices of farm products, adjusted to constant dollars, advanced slightly from 1913 to 1929, and subsequently varied around that level, reaching a high shortly after the war, and since declining one-fifth. From 1913 to 1929, none of the increased farm efficiency was passed on to consumers — in fact, during that period, most of that went into increased real incomes to farmers. Thereafter, and especially with the continued rapid advance in technology since World War II, consumers shared substantially in the results of increased farm efficiency, with real prices of farm products in 1955, 10% below the 1929 level, despite all the governmental farm support measures.

As a whole, increased efficiency in agriculture went only slightly into more leisure, substantially into increased real incomes of farmers and farm workers, which still remained low compared to other industries, and since the 1920's, partly into reduced real prices to consumers. [1]

Other industries and occupations

Other occupations in general offer less opportunity for increase in output per worker. How far have they gained in real income from the increased productivity in agriculture and manufacturing?

Changes in hours per week may be ignored, as the 40-hour week, or slightly less, has now become standard in almost all occupations, and changes since 1935 in weekly hours worked have reflected changes in business activity, except for a slight downward trend in trades and services. The data are therefore presented solely in terms of real incomes per week. (Note Appendix Table 2). This shows gross incomes, in terms of 1955 dollars, for four selected years — 1929, 1940, 1950 and 1955 — for various non-manufacturing industries and occupations, and also average real income paid to individuals, per person gainfully employed. Data are also given for manufacturing and for steel.

In bituminous coal mining, real weekly wages in 1929 were substantially below the overall national average. They advanced sharply after 1940, and in 1950 and 1955 exceeded both durable manufacturing and the national average. [2] Wages of

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[1] For a more detailed review of shifts in farm & non-farm income, see John D. Black, Agriculture in the Nation's Economy, Amer. Econ. Rev. Vol. XLVI, Mar. 1956, pp. 1-43.

[2] The calculated national average income per person gainfully employed slightly overstates the true figure, as it also indicates income received by pension recipients, annuitants, and others not gainfully employed. In the absence of any adequate figure on the total number of income recipients, gainfully employed and otherwise, the average shown must be taken as an upper limit. The figure on average disposable income per person gainfully employed, after deducting taxes paid, may serve as a lower limit for the true average income per income recipient.

construction workers paralleled the national average in 1940 and 1950, but sharply exceeded it in 1955, about equalling those of bituminous miners.

Wages in wholesale and retail trade show divergent tendencies, those in wholesale trade roughly equalling those in durable manufacturing from 1940 to 1955, and lagging somewhat behind the overall national average; earnings in retail trade lagged far behind, both in amounts and in rate of increase; while workers in laundries fell even further behind. Earnings in railways advanced somewhat more, and in telephone, somewhat less.

White collar workers, in federal government also failed to maintain their 1929 position of equalling the national per capita average of real incomes, and by 1950 fell sharply behind the advance in average real income. School teachers and other employees in state and local government, who averaged well below the national average in 1929, fared little better in 1950.

Professional workers, self-employed, did better especially doctors. Doctors more than maintained their position of incomes averaging around three times the national average from 1929 to 1950, while dentists and lawyers fared less well, dropping from 2 1/2 times the national average in 1929 to twice for dentists and 2.3 times for lawyers by 1950. (Doctors' earnings, of course, are after a preparatory period far longer than for almost any other occupation.)

In comparison with these miscellaneous occupations, farmers' real incomes (including returns on capital) continued relatively low, at just a little over 1/3 of the national average, except in the boom period of 1950, when they reached almost 1/2; while those of factory workers advanced relatively far more rapidly than the national average, and nearly equalled it by 1955. 1/

Possibilities for further study

This preliminary reconnaissance has many shortcomings. 1) Not all relevant factors have been considered. Changes in non-labor inputs per unit of output, changes in real capital used per worker, taxation changes, and changes in share of national income used for defence and other economically unproductive purposes, have not been examined. Even so, the number of factors involved in the distribution of productivity gains is so large that it is difficult to see the pattern clearly. After experimenting with ways of tabulating the data to appraise the various factors affecting the single aspect of wage levels alone, Ross concluded earlier that "these separate effects cannot be entirely disentangled by statistical methods".

2) The methods of analysis used are very elementary. One approach to a more exact analysis would be to treat it as a problem in multiple correlation, with the changes in labor productivity per hour analysed as a simultaneous function of concurrent changes in (1) hours per week, (2) real weekly incomes per worker, (3) real prices of the product adjusted for raw material costs, (4) real input of non-labor factors per unit of output, and (5) real profits

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1/ All real wage comparisons here deal with gross wages, without adjustment for the effects of overtime, or allowances for social security contributions, benefits, or other non-current additions. With these added, the long-time gains in real wages would be even larger than shown here, on the average.

per unit of capital employed. If each variable were stated in logarithms and a
linear equation was fitted to the values for all the industries represented,
that would yield both a measure of the average net change in labor productivity
associated with a unit change in each factor while holding the relation to the
other factors constant, and a measure of how much of the total variance in labor
productivity could be distributed to all the other factors on this basis. It
would also give some indication, for all the industries represented, of the
relative importance of each of the ways of distribution of the gains in the
period concerned. By using residuals between the actual values of labor
productivity for each industry and those estimated from the equation, one could
then judge which industries had distributed more than their gain in productivity,
and which less. Relating these residuals based on the whole battery of factors
to institutional elements in each industry, such as degree of unionisation or
prevalence of oligopoly, one might then obtain a more exact indication of the
relation of these elements to the distribution of the gains. An alternative
approach would be to solve the equation with wages per hour as the dependent
variable, and then relate the residuals as just suggested.

3) The study has been limited to data for the U.S. Time has not permitted
even a reconnaissance of changes in other countries along the lines attempted
here. Recent developments in the United Kingdom, Sweden, and possibly even in
Germany, suggest that the distribution of the gains from increasing productivity
there may, at least recently, show some parallels with the situation as here
roughly sketched for the U.S. 1/ Application of this type of analysis to those
countries and also (as far as factual data permit), to less developed economies
such as those of Italy, Greece, Mexico, India, etc., might throw new light on
the differences in the varying distribution of the gains, as between countries
with varying social economic systems and in different stages of economic de-
velopment, as well as on how the farmer has shared in the process compared to the
city dweller.

4) The analysis for the U.S. itself considered only a small part of the
evidence available. Examination of all years over the whole period, including
years of medium and low activity as well as of high activity, and of all industries
for which data are available or might be obtained, and comparison of changes in
distribution of the gains over periods selected after such a more detailed
analysis, would throw much more light on what has really happened.

General Summary

Despite these imperfections, which further research could correct, some
attempt to pull together what is suggested by the data considered may be of
interest.

U.S. data on productivity since 1940 are so scanty that it has not been
possible to obtain very firm conclusions as to the relations between recent
productivity changes by industries and the distribution of its gains to workers,
business, and general consumers. The more adequate data for the earlier years
1923 to 1940 indicate that a substantial part of the increase in productivity in
that period was distributed generally in lower prices, shorter hours of work, and
rising real wages, but with a proportionally more rapid improvement in real wages

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1/ W. Ropke, The Price of Prosperity, The Neue Zuricker Zeitung, March 16 and
   17, 1956.

and reduction in real prices in the industries with the highest real produc-
tivity. No marked influence of unionisation or of oligopoly on the process
was evident. Since 1940, and especially since 1950, real wages have advanced
much more rapidly than overall national output in the steel industry — one
industry characterised by both <u>heavy unionisation</u> and oligopoly — and also in
other industries of heavy unionisation but low oligopoly, such as bituminous
coal and building construction. Proverbial low-wage industries, such as retail
trade, telephones, and laundries, while increasing their real incomes, have
lagged relative to the national average, and so have white-collar employees in
state and local governments. Farmers and farm workers have also lagged slightly
behind their previous low share of the national average, except in the boom
period immediately after the war. Professional men, however, have generally
managed to maintain most or all of their relatively favorable position, and so,
apparently, have other high-income receivers as a whole. Meantime since 1940
real prices have increased in durable goods as a whole, so that rather than
passing any of their gain in productivity on to consumers, higher wages and
higher profit rates there have been attained at the cost of workers in other
lines of employment.

There is a natural <u>suspicion</u> that industries which are both strongly
oligopolistic and heavily unionised may be in a position to take a lion's share
of increasing productivity for themselves, both in pay to workers and in profits
to equity owners, at the expense of the real incomes enjoyed by workers in less-
favored industries, in less protected mercantile and white-collar employment,
and in the low-income industry of agriculture. The data examined here suggest
that there has been an increasing tendency this way since 1940, and especially
since 1950. Much more collection of missing evidence and careful and detailed
analysis industry by industry will be needed, however, before this suspicion can
be either confirmed or dispelled.

It is <u>easy to say</u> that a process is unfair by which some occupational groups
continually receive a larger and larger share per capita of the expanding
national product, while others continually receive a smaller and smaller share.
But it would be much more difficult to reach agreement on what would be fair.
Certainly the services of teachers, policemen, nurses, dressmakers, textile
factory operatives, and farmers are just as essential to human well-being and
standards of living as are those of operatives in steel mills or auto factories,
or workers in coal mines or building construction. <u>A better system might be</u>
one in which each kind of employment would return about the same real income,
for a worker of the same ability and industry, with the same investment in
education and training, and with the same degree of responsibility; where the
whole set of real wages and incomes tended in general to move up in step with
the increasing average output of goods and services per worker for society as a
whole; and where the value of money remained relatively constant with no marked
upward or downward trend. In such a system occupational shifts between industries
might need to be brought about by other arrangements than the push or pull of
income differences — though the effectiveness of such differences in guiding
shifts under existing conditions is already open to question. Others may feel
that some other guide to the distribution among workers of the gains from in-
creasing productivity would be more desirable.

<u>Similarly</u> the <u>profit system</u> fails to work to guide investment allocations
when the lucky investors in the most profitable oligopolistic corporations can
maintain a perpetual monopoly of their favored position, with new capital coming

mainly through plowing a part of profits back in while maintaining a profit margin for ample dividends above taxes and corporate savings, and restricting the rare new stock issues to previous stock owners. Under such conditions the theory that the high profits are justified because they attract needed investment seems at wide variance with the facts. It would seem instead that industries with productivity rising more rapidly than the average should follow both price and profit policies which result in the real prices of their products falling rather than rising, and should raise capital required for expansion by the sale of new stock rather than using current profits for capital investment.

Beveridge many years ago in his "Full Employment in a Free Society", and more recently, Lindblom in his article "The Union as a Monopoly" 1/ emphasized that in democratic societies with conditions of substantially full employment and widespread oligopoly, there are no effective economic restraints on the power of unions and managements to push up wages and prices in a gradual but continuous spiral of inflation. This means that workers and owners in such industries may continuously improve their relative position at the expense of less protected elements of the society — workers in other industries, white-collar-employment and farmers.

Full exploration of all these issues of theory and of fact is impossible here.

Thorough re-examination of the distribution of the gains from increasing productivity along the lines suggested here should contribute to a better under-standing of what has been happening. Further, it might help in time to develop more restraint by those who hold or influence these great powers, leaders of labor, business, farmers, and government, and more consideration of the general welfare in their use.

1/ Quarterly Journal of Econ. Vol. LXII, No. 5, pp. 671-697, Nov. 1948

Changes in productivity and related factors, 1940 in relation to 1923

Industry	Productivity per man hour	Prices	Earnings average per hour	Concentration ratio[1]	Unionisation in 1942[2]
	----------------Per cent of 1923------------------				
Rayon	486	19	156	74	III
Silk & rayon	362	n.a.	105	16	I
Tires & tubes	341	53	145	81	[3] IV
Petroleum	280	60	153	38	I
Pulp	271	88	137	23	I
Glass	215	n.a.	142	45	III
Tobacco	210	100	134	74	II
Agri.implements	209	94	135	72	II
Chemicals	204	84	164	40	I
Group average	286	71	141	51	
Knit goods	187	n.a.	130	5	[4] II
Iron & Steel	183	81	146	52	III
Motor vehicles	173	89	136	69	IV
Cotton,New England	179	57	103	8	I
Cement	178	84	126	30	I
Canning & Preserving	171	n.a.	128	23	I
Non-ferrous metals	168	82	127	38	III
Boots & shoes	167	108	96	26	II
Newspapers & periodicals	165	n.a.	126	20	III
Leather	161	89	126	23	II
Group average	173	84	124	29	
Paper	159	[6] 88	123	14	I
Fertilizers	157	68	121	26	[5] I
Cane sugar	155	99	132	70	II
Paint & Varnish	153	85	137	32	n.a.
Flour	151	78	116	29	I
Lumber	149	92	111	5	I
Woolen & Worsted	146	80	122	24	II
Furniture	142	70	103	6	II
Group average	151	83	121	26	

Industry	Productivity per man hour	Prices	Earnings average per hour	Concentration ratio	Unionisation in 1942
	------------------Per cent of 1923------------------------				
Slaughter & meat pkg.	137	96	127	56	II
Planing mills	133	n.a.	91	5	n.a.
Coke	130	89	103	49	4/ III
"Other" rubber	129	n.a.	133	33	IV
Cotton, South	123	57	114	8	3/ I
Clay prod.	121	n.a.	106	19	I
Bread & bakery	112	101	120	18	II
Group average	126	86	113	27	
GRAND AVERAGE	188	60.5	126	34	

Source: Garbarino, Quart. Journ. Econ. May 1950, p. 282; except as noted

1/ Percent of industry's production in 4 largest concerns

2/ From Ross and Goldner, Quart. Journ. Econ. May, 1950, p. 258. 1 = 0-40% unionized

3/ "Rubber products" in 1945

4/ Data for 1945; earlier years unavailable

5/ From "chemicals except rayon"

6/ Pulp and paper

n.a. = not available

Real Gross Incomes per Week, in 1955 dollars, overall and in selected
occupations

(deflated by city cost of living index, except for farmers)

	1929	1940	1950	1955
Per capita gross personal income, all gainfully occupied workers 1/	54	61	79	88
Disposable income, after taxes, per gainfully occupied worker 1/	51	58	72	78
Workers in Physical production				
Non-durable manufacturing	36	43	61	68
Durable manufacturing	43	54	71	77
Employees, U.S. Steel Corporation 2/	49	64	78	101
Bituminous coal	40	47	82	95
Building construction	n.a.	61	82	96
Workers in distribution and services				
Class I railways	n.a.	62	72	82
Wholesale trade	n.a.	58	67	77
Retail trade	n.a.	45	53	59
Telephones	n.a.	63	61	72
Laundries	n.a.	34	40	41
White-collar workers				
Federal employees	54	83	67	
School teachers	41	47	62	
Other state and local government	42	49	52	
Professional occupations				
Physicians	150	163	264	
Dentists	123	122	158	
Lawyers	138	166	183	
Farmers				
Average, all farm workers 2/	20	21	36	32

1/ Including persons in military employment

2/ From Tables 1 and 2, in the text.

Sources: Economic Report of the President,
        January 1956.
        Historical Statistics of the U.S.,
        1789-1945
        Statistical Abstract of the U.S.,
        1954

Corrections for Advance Copy of
"Distribution of Gains from Rising Efficiency in Progressing Economies"

Page 4, Table 1: Change last line of table, last 2 columns to (% of sales)
7.8; (% of net worth) 15.2

Page 7, line 5: Change 7th word from "charges" to "changes"

Page 9, Table 4: Change last line of table, 1st 2 columns,
                        (per hr)   - 252 to 264;
                        (per worker)- 250 to 252

        In heading of Table 4, insert "a/" after heading "real earnings
per week," and strike out "a/ after "average hours worked."

Page 11, lines 11-12: Strike out "and by 1950 fell sharply behind the ad-
  vance in real income." At end of same paragraph, add "of 1955."

Page 13: At end of 1st paragraph, add the following "Galbraith's
  'countervailing power' instead of reducing the effectiveness of
  'original power,' may thus at times join it in exploiting the rest
  of the society. (See John Kenneth Galbraith, American Capitalism,
  Houghton Miflon Co., 2nd ed., 1956)."

Appendix Table 1, 2nd page: In footnote 2/, add: II, 40-60%; III, 60-80%;
  IV, 80-100%.

Appendix Table 2: Change data to read as follows:

White collar workers	1929	1940	1950	1955
Federal employees	54	68	75	82
School teachers	40	47	61	70
Other state and local government	42	49	51	61

        1955 data for professional occupations are not available.