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Chapter Title: Productivity and the Rise in Real Hourly Earnings

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costs, lower relative prices (as we shall see later), and therefore a better than average increase in its output (Chart 5). Better-than-average increases in output were usually accompanied by better than average increases in employment of workers and tangible capital, despite the more rapid rise in productivity. Correspondingly, less-than-average increases in productivity were usually accompanied by less-than-average increases (or even decreases) in output and in the use of labor and capital resources.<sup>20</sup>

These relations do not exhaust the channels through which productivity and the forces back of it caused diversity in growth of industries. The general increase in productivity and the increased income it brought per capita raised the demand for the output of industries that produce the goods and services on which people spend more freely as they grow richer, and thus helped push their output up more than that of other industries less favored — even when their productivity lagged behind that of other industries and their costs and prices rose. The service industries are examples.

No one concerned with the rise and fall of industries, or — to single out a currently discussed problem — with the effects of "automation" on employment, may ignore these basic facts.

### PRODUCTIVITY AND THE RISE IN REAL HOURLY EARNINGS

Productivity increase means more goods and services — more real income — available for distribution per unit of resources. Has the rise in productivity been reflected in the hourly real earnings of workers, as would be expected?

*Real earnings per hour of work in the private domestic economy rose over the period since 1889 at an average annual rate about equal to the rate of increase in product per manhour, and greater than the rate of increase in product per weighted unit of labor and capital combined.*

*During recent decades, real hourly earnings have increased more*

<sup>20</sup>Coefficients of rank correlation between the changes compared in Chart 5 are as follows: between productivity (output per unit of total input) and output, 0.64; productivity and employment, 0.34; productivity and tangible capital, 0.40.

It should be noted that "better than average" in the text above refers to a comparison with the unweighted median of the thirty-three industry changes covered in the correlation, not to a comparison with the weighted average for the entire private domestic economy.

*rapidly, on the average, than during earlier decades. The change in the trend of real earnings thus matches the change in the trend of productivity noticed earlier, though the data do not permit a confident conclusion on their relative timing.*

*Long-term trends in hourly earnings in individual industries roughly paralleled the trend in the general average of hourly earnings. There was little systematic difference in rate of increase in hourly earnings between industries in which productivity rose very rapidly and those in which productivity rose slowly; or between those industries with high or low, or relatively rising or falling, capital per manhour.*

These facts support the conclusion of generations of economists that over the long run the dominant factor in the general rise of real hourly earnings has been the increase in national productivity, and that the more rapid rise in earnings generally than in output per unit of labor and tangible capital combined has resulted largely from greater scarcity of labor relative to capital and from improved quality of labor.

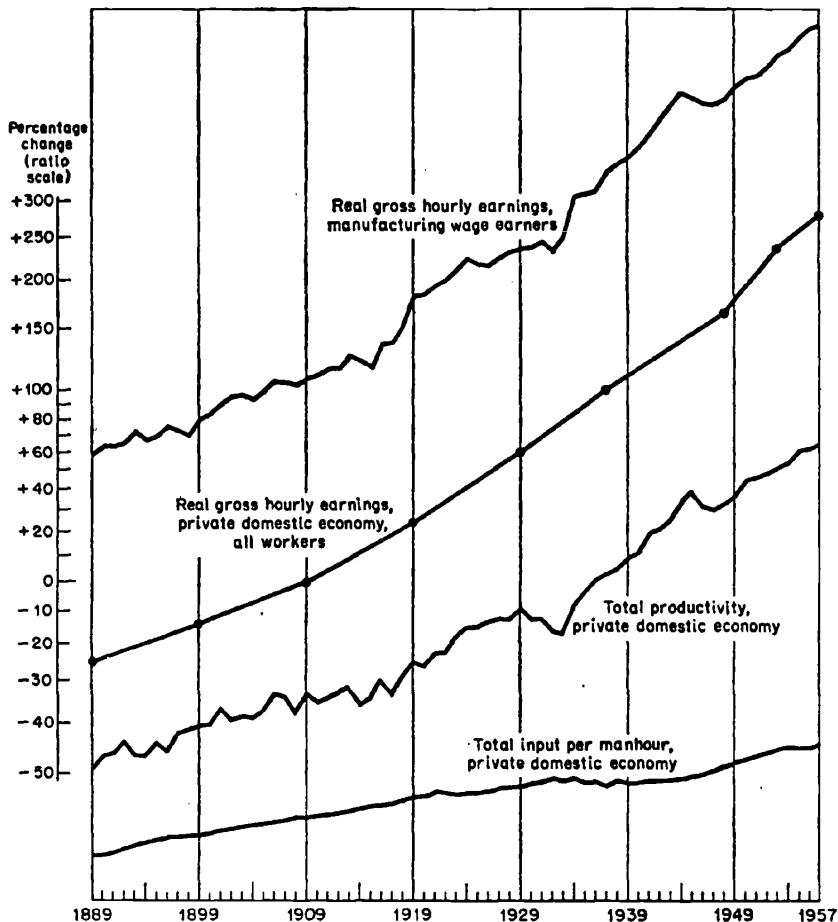
The facts on real earnings in the economy at large may be inferred from the information already presented, plus one other piece of evidence. This is an estimate of the percentage of national income received in the form of wages and salaries, including allowances for the labor of farmers and other proprietors. The percentage seems to have fallen somewhat between 1889 and 1899, moved along a horizontal trend over the period to 1929, and then returned to the 1889 level in recent decades.<sup>21</sup> The index of real earnings per hour of work is obtained simply by multiplying an index of this percentage by the index of real national product per manhour. The derived index of real hourly earnings is shown in Chart 6, and its rate of growth, in Table 6.

The same facts lead also, it should be noted, to the conclusion that the rate of return on capital — total non-labor income per dollar of tangible capital, both in constant prices — has fallen considerably in relation to the real hourly earnings of labor, but not absolutely. This is consistent with such other information as is available on trends in interest rates and in rates of return on property. Productivity increase thus offset the effects of the rise in capital per worker,

<sup>21</sup>See J. Burkhead, *Journal of the American Statistical Association*, June 1953; D. G. Johnson, *Review of Economics and Statistics*, May 1954; and Edward C. Budd, *Studies in Income and Wealth*, Volume 24, in preparation for press. The underlying data are those of W. I. King, Simon Kuznets, and the Department of Commerce.

## CHART 6

**Real Hourly Earnings Compared with Productivity  
and Total Input per Manhour, 1889-1957**  
Estimates for the Private Domestic Economy



and prevented the appearance of the absolute long-term decline in the rate of return on capital that might otherwise have been expected.

The upward drift of real earnings in relation to total productivity does not appear to be seriously in doubt, despite gaps in the under-

TABLE 6

Average Rates of Increase in Productivity, Total Input per Manhour, and Real Hourly Earnings, 1889-1957

	<i>Average Annual Percentage Rate of Change</i>		
	1889-1957	1889-1919	1919-1957
Output per unit of labor and capital combined, private domestic economy	1.7	1.3	2.1
Total input per manhour, private domestic economy	0.6	0.7	0.5
Real hourly earnings, private domestic economy, all workers (including proprietors and family workers)	2.4	1.7	3.0
Real hourly earnings, manufacturing, wage earners	2.3	1.9	2.6

Source: Tables A and C.

lying statistics, difficulties in distinguishing labor income from property income (as in agriculture), and differences of opinion on a variety of questions (such as whether income should be measured before or after income tax). But it is well to check the crudely derived data on earnings, available at best for occasional years only, with direct evidence on the annual movement of real hourly earnings.

For this purpose we make use of the index of real hourly earnings of manufacturing wage earners since 1889 shown in Chart 6 and summarized in terms of its average annual rate of increase in Table 6. The index, greatly improved over that previously available, we owe to Albert Rees and Clarence Long, who re-examined the available wage statistics for the period prior to World War I, reconsidered the methods and weights used in combining them into an index, and constructed a new cost of living index.

The agreement between the two indexes is surprisingly good. Of course, the index of real hourly earnings for the entire private economy covers also the real hourly earnings of manufacturing wage earners, and some degree of similarity must therefore be expected. However, wage earners in manufacturing have seldom numbered more than a fourth or fifth of all workers, and the parallelism is so close as to indicate virtual identity of the long-term percentage change in the real hourly earnings of manufacturing wage earners with the percentage change in the real hourly earnings of all other workers — that is, those in non-manufacturing and the salaried

workers and proprietors of manufacturing — except possibly in the recent period.<sup>22</sup>

The parallelism is all the more surprising because the economy-wide index reflects the increase in wages caused by the shift of workers from low-pay industries, such as agriculture, to high-pay industries, whereas the manufacturing index reflects such shifts only within the manufacturing sector. Further, the manufacturing index relates to wage earners alone, and thus cannot reflect adequately the rise in hourly earnings that might be expected to result from investment in education.<sup>23</sup> However, the index of hourly earnings of factory wage earners has undoubtedly been affected by factors peculiar to manufacturing, and these might have worked to push up relative earnings in factories. It is tempting to speculate further about the complex of factors that lies behind the similarities between the two indexes of hourly earnings, but this is hardly worth while before more work has been done to improve the estimates;<sup>24</sup> and in any case speculation can only prompt — not take the place of — the hard labor of unraveling and weighing the factors involved.

This much seems clear and is important: Both the manufacturing index and the index for the entire private economy show that real hourly earnings rose substantially more rapidly than productivity over the period 1889-1957.

<sup>22</sup>Even for the recent period the difference is less than appears in Chart 6 and the figures underlying it. The earnings index for the entire private economy includes certain supplementary wage benefits that the index for wage earners in manufacturing does not. (See the brief discussion in the last section of this paper.)

<sup>23</sup>On the other hand, it is possible that the portion of hourly earnings earned on investment in education has risen no more rapidly, on net balance, or perhaps even less rapidly, than the earnings of labor of a constant "quality" — just as the return to tangible capital has risen no more rapidly.

This possibility has been suggested by Gary Becker, who is in charge of the National Bureau's study of investment and the returns on investment in education. Becker will deal with many questions over which I must slur — the effect of education on length of working life, the fraction of earnings that represents amortization of invested capital, etc. Some of these questions have been discussed in the National Bureau's study of *Income from Independent Professional Practice* by Friedman and Kuznets (1945).

<sup>24</sup>The new index for manufacturing prior to 1914 is probably as good an estimate as we shall have. How much change will be made in the manufacturing index after 1914, which is being re-examined by Leo Wolman, remains to be seen.

The index for the private economy as a whole is quite rough, as has been indicated. One question not mentioned relates to the deflator, for which several alternatives are available. These move rather differently, as is shown in a note to Table C, although not so differently as to alter our main conclusions.

The new index of real hourly earnings in manufacturing, as well as the derived index of real hourly earnings for the entire private economy, leads to a substantial revision of prevailing impressions concerning the historical relation between productivity and real wages prior to World War I. It has long been thought, for example, that real hourly wages in manufacturing rose by only 8 per cent between 1890 and 1914, despite much greater concurrent increases in productivity. Rees's index for the twenty-four-year period shows a much larger gain in real wages, a rise that is much more in line with the productivity increase of the time.<sup>25</sup> The present data indicate that real hourly earnings have normally, not always, moved up more rapidly than national productivity — output per unit of labor and tangible capital — and that, as in the case of national productivity, the rate of increase in real hourly earnings was greater in recent decades than in earlier decades.

To help explain the greater rise in real hourly earnings than in productivity two factors were singled out at the beginning of this section: increasing scarcity of labor relative to capital, and improved quality of labor. The trend in both combined is suggested by the rise of total input (weighted manhours and tangible capital) per manhour, in Chart 6. On each of the two factors a comment is necessary:

First, the decline in labor input relative to capital (or to total input) is not unambiguous evidence of increasing labor scarcity. The technological and other changes that have played a part in raising efficiency might also have altered the relative usefulness of labor and capital — an essential ingredient in their scarcity — in favor of the one or the other. If the technological and other changes back of productivity increase were not neutral in this respect, they would have tended to push the rate of return for labor relative to that for capital in one or the other direction.

Second, the shift of labor from lower- to higher-pay industries is at best a very rough measure of the improvement in the quality of the labor force. If more adequate allowance could be made for quality improvement, our measure of labor input would probably rise more than is now indicated; labor input relative to tangible capital would decline less; and productivity would rise less. Our inability — as yet — to measure quality of labor adequately thus probably leads us to overemphasize in some degree the contribution of productivity and labor scarcity to the rising trend of real hourly

<sup>25</sup>See his comment in the National Bureau's *38th Annual Report*, p. 60.

earnings, and correspondingly to underemphasize the contribution of investment in education and other forms of personal capital.

The information we have on the economy as a whole provides strong evidence of the competition in the markets for goods, labor, and capital that causes real hourly earnings to rise with national productivity and the other factors mentioned. Additional important evidence is provided by the developments in individual industries (Chart 7).

As we should expect to find in a competitive economy, the trends in productivity in individual industries and the trends in their hourly earnings are only weakly correlated. That is, hourly earnings in different industries moved up at fairly similar rates. The parallelism we noticed between the trend of real hourly earnings in manufacturing and in the economy at large is a fairly general phenomenon.

We find also, as we should expect, that there is a stronger relation between an industry's trend in productivity and the trend in its product prices.<sup>20</sup> As a rule, in industries with high rates of productivity increase, product prices fell in relation to the prices of other goods, while in industries with low rates of productivity increase, relative prices of products usually increased.

To find *closely* parallel changes in the average rates of wages and salaries paid by different industries would be surprising. The American economy is one in which economic advance has brought not only greater efficiency but also other changes — in the type of labor used by different industries, in the relative scarcity of the skills they employ, in the values placed on the various noneconomic advantages and disadvantages of working in them, and in other determinants of demand and supply. So continuous has the flow of changes been that adjustment to them has never stopped. The exceptions to the rule are therefore many in Chart 7, and they invite study.

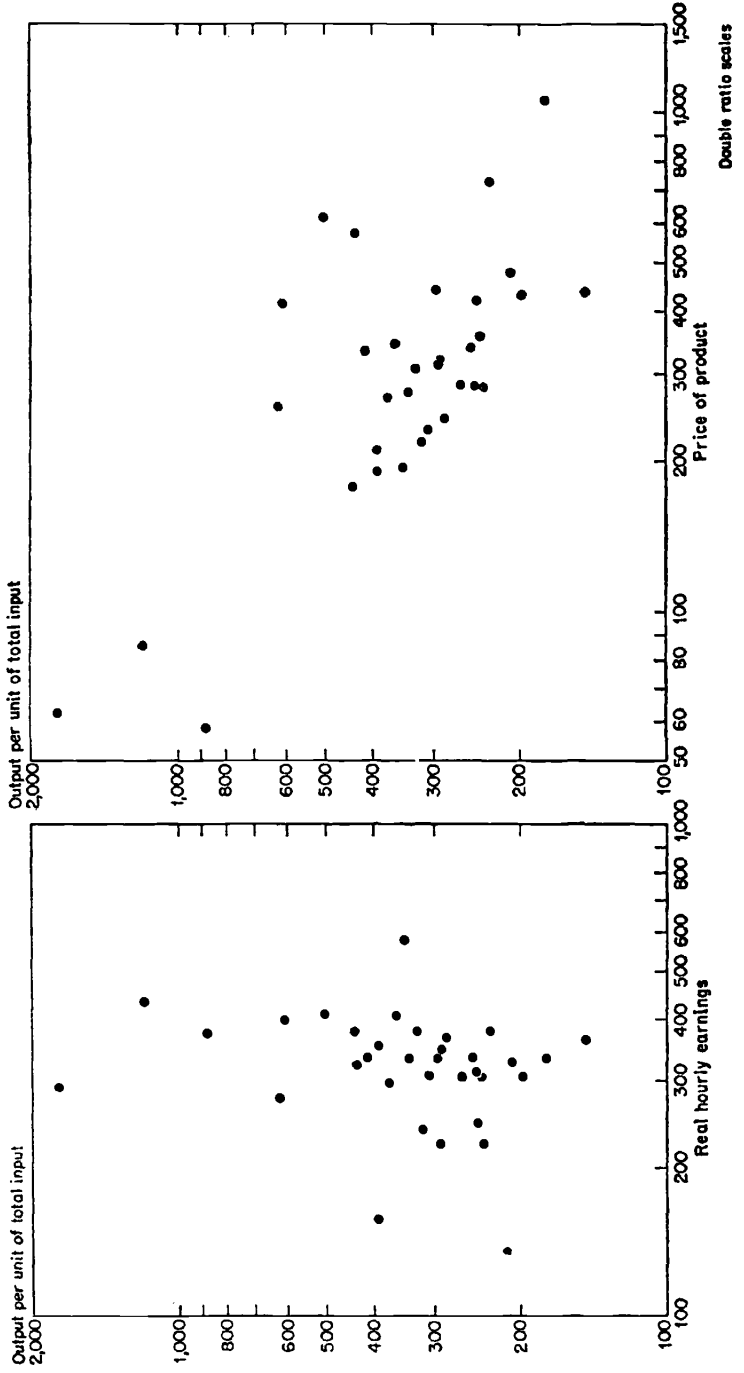
As for the general level of real wages, a fuller explanation of its historical changes must take account also of the behavior of money wages, retail prices, and productivity during the business cycles and periods of inflation and deflation that are found in the record of the past seven decades. And it is hardly necessary to add that it must take account of still other factors peculiar to particular periods, as well as of the more or less gradual changes in the markets for labor, goods, and capital that have taken place over the years.

<sup>20</sup>The strength of each of the relations is measured by the coefficient of rank correlation. Between change in productivity and in hourly earnings, it is +0.23, according to Kendrick's calculations. Between change in productivity and in price, the coefficient of correlation is much higher, -0.56.



# CHART 7

## Relation between Change in Productivity and Real Hourly Earnings, and Productivity and Price of Product, 33 Industry Groups Indexes for 1953 Relative to 1899



But the chief determinants of the longer-run trends in the general level of real wages and in the level of real wages in individual industries appear to be those with which we began our discussion.

### RECENT PRODUCTIVITY TRENDS IN PERSPECTIVE

Recent events are always of special interest. We therefore now take a closer look at productivity and a few related changes since World War II, viewing them in the perspective of the full record. For the private domestic economy we find that:

*Output per manhour (and much the same may be said of output per weighted manhour) rose between 1945 and 1957 at an average rate that was high, though not unprecedently so, for a twelve-year period. The postwar rate was significantly higher than the average rate over the full period 1919-57, and still more so than the rate over 1889-1957.*

*Tangible capital was pushed up at an extraordinarily high rate — faster than in any preceding period of similar length. Since output rose at a rate only moderately better than average, output per unit of tangible capital fell.*

*Output per unit of labor and capital combined rose during 1945-57 at a rate slightly better than the long-run average and about the same as the average for 1919-57.*

*Real hourly earnings in manufacturing — not including certain types of supplementary employee remuneration — rose about as rapidly as over the full period 1919-57, and therefore less rapidly over the postwar period than output per manhour and more rapidly than total productivity. The postwar difference between the annual rates for real hourly earnings in manufacturing and total productivity appears to have been about the same as the difference over the longer period 1919-57 and between 1889 and 1919.*

Most of these facts have already been presented in the charts above. The set of calculations provided in Table 7 may be helpful. It should be emphasized that because of cyclical and other fluctuations in the figures, the average rates of change over the postwar period were calculated by comparing the average level in 1945-48 with the average in 1953-57; and that we are focusing on output, input, and earnings expressed only in real terms (that is, adjusted