

Productivity (1955)

# PRODUCTIVITY

A CRITIQUE OF  
CURRENT USAGE

LEWIS A.  
MAVERICK

CARBONDALE, ILLINOIS

[1955]

INSTITUTE OF INDUSTRIAL  
RELATIONS LIBRARY  
UNIVERSITY OF CALIFORNIA  
BERKELEY

DEC 29 1954

**PRODUCTIVITY  
A CRITIQUE OF CURRENT USAGE**

**Lewis A. Maverick  
Professor of Economics  
Southern Illinois University**

published by the author.  
Send orders to  
701 So. Oakland Ave.,  
Carbondale, Illinois

price 50¢ postpaid;  
in packages of ten or more, 40¢ each

Copyright 1955  
Lewis A. Maverick  
Carbondale, Illinois

## PRODUCTIVITY

### A CRITIQUE OF CURRENT USAGE

#### INTRODUCTION

"Productivity" is a concept that has been referred to for hundreds of years. Since the time of Adam Smith, economists have struggled to achieve clear thinking on the productivity of land, of labor, of capital and of enterprise.

Many students in the field interest themselves particularly in the productivity of labor. Moreover, they elect to study the average product or average productivity of that one factor of production. In recent decades, great and costly attempts have been made to calculate productivity according to a formula somewhat related to the average concept.

I have said that the currently used formula is related to the average. The calculation of averages follows clear rules. To secure an arithmetic mean -- in studying labor productivity -- the total product of labor should be divided by a figure for the quantity of labor, either by the number of workers or by the number of man hours. Clearly, therefore, if one wishes to calculate the average product of labor, he must first determine or estimate the total product of labor.

But the current procedure falls short of splitting the total product of the firm into four parts, and attributing one of those parts to the efforts of labor and the others to land, to capital, and to enterprise. Instead, the entire output is divided by the labor figure. It is sometimes explained that these figures are *available*, and that the estimates and calculations above suggested would be impossibly costly.

The quotient so obtained, total output divided by a figure for the quantity of labor, does not yield an average; indeed I cannot determine what meaning the quotient has. Is this another instance of the twentieth century passion to quantify everything, even the imponderables?

Permit me to offer an analogy for this reasoning about productivity. Suppose that three automobiles are to be rated as to their efficiency, as measured in miles per gallon of gasoline. To make the problem a little more difficult, suppose that the fuel to be used is not straight gasoline, but a mixture of ether, gasoline, and wood alcohol. To increase the complexity still further, suppose that each automobile is to be supplied with a *different* mixture of these fuels. Yet miles per gallon of gasoline is to be the measure of efficiency.

Let the Hudson automobile in this efficiency study correspond to the coal mines in a productivity study. Let the Hudson motor car be given a fuel mixture consisting largely of wood alcohol. With such fuel, it is easy to see that the consumption of gasoline will be very low, that is to say, the miles per gallon of gasoline will be very high. Let the Ford automobile represent the wheat farms (which have quite a different use of land, labor and capital from coal mines); let it operate on a fuel mixture consisting largely of ether. It, too, will have a high gasoline efficiency. But give the Cadillac automobile (representing the electric generating stations) a mixture that is largely gasoline. Then, as compared with the first two cars, its gasoline mileage will be low.

This would clearly be a misdirected investigation of motor car efficiency. For, unless gasoline is almost the sole element in the fuel, the "experiment" will reveal nothing at all.

To return from the analogy to the measurement of what is called the productivity of labor, would it not be a better use of language to refer to "the efficiency of the United States Steel Corporation in using labor"? Surely it is better to refer to the efficiency of the Ford automobile in the use of gasoline, rather than to the productivity of gasoline in the Ford automobile.

The analogy may be continued with an examination of the changing gasoline efficiency of one car, over a period of time. If the particular automobile was given, in 1940, a fuel mixture consisting largely of gasoline, then in that year its record undoubtedly showed an ordinary or low number of miles per gallon of gasoline. If then in 1947, after some mechanical changes, and a new driver, the three fuels were mixed in equal proportions, the gasoline mileage was surely improved. Now, in 1954, the fuel mixture is made to consist almost wholly of wood alcohol; we may expect nearly infinite gasoline efficiency.

This fantastic reasoning really constitutes a fair analogy to the current handling of the concept called labor productivity.

Actually, labor, capital, enterprise and land -- all four -- contribute directly to the product, as do the three substances mixed to compose the automobile fuel. The four factors of production are combined in very different proportions in different industries. In each industry, moreover, the quantity and quality of the capital equipment -- machinery, engines, motors, earth-moving equipment, calculators, etc. -- is steadily rising. As a result, labor keeps finding it necessary to shift from the mechanized industries to service occupations.

Indeed, the increasing use of capital equipment and its steady improvement in quality, constitutes the distinguishing feature of Capitalism, the essence of the Industrial Revolution.

Permit me to point out how far from the customary use of language the productivity students have strayed. Within a few weeks of one another, in 1952, the daily press carried two contradictory news items. One dispatch told of the efforts of a railroad labor union to compel the roads to add a second and completely unnecessary fireman to the crew of each diesel locomotive. A few days later there appeared a report from the Bureau of Labor Statistics of the United States Department of Labor, to the effect that the productivity of railroad labor had *increased* in 1951, over 1950. The factual basis for the calculations of the BLS

was merely that the railroads had increased the quantity and improved the quality of their capital equipment: the powerful and efficient diesel locomotives, improved couplings, wheel bearings, signalling devices, etc. For the BLS to characterize improvements of this sort as increased labor productivity is a questionable practice. Should this be carried on at public expense?

In January, 1951, I had the privilege of attending the National Productivity Conference in Washington D.C. It had been called by the Department of Labor and the Bureau of the Budget. In the winter and spring of 1954, Southern Illinois University kindly granted me a sabbatical leave of absence to study the handling of figures on productivity. This study presents my findings.

## PART I: PRODUCTIVITY, THE CURRENT USAGE CRITICIZED

### *THE CONCEPT OF PRODUCTIVITY.*

Beginning at least two centuries ago, economists concerned themselves with production and productivity. We groped and fumbled a good deal at first. But to-day, after successive clarifications, most economists agree that any activity or contribution of one of the factors of production which increases the value of the materials worked upon, is productive, and that a helpful long-run explanation of the level of wages -- and also of rent and interest -- is the principle of marginal productivity, that the pay of each of these factors tends to equal the product of the marginal unit.

### *A NEW HETERODOXY.*

But every scientific principle is subjected to repeated testing. In the social fields, when a heterodox group rejects what it terms the dicta of the orthodox, the defection requires that the exposition of the principle be convincingly repeated. In the calculation of what is called productivity, a number of contemporary students have formed such a diverging or heterodox group. They pay little attention to marginal productivity, but turn instead to a ratio of output to the quantity of labor, which bears some resemblance to an average, yet is not a true average, as will be shown below. Several government departments, in the United States and abroad, participate. International bodies, including the International Labour Organisation and the Organisation for European Economic Cooperation, make statistical studies of this "productivity". Private economic research organizations of the highest type study this productivity in various industries, and across the decades. The figure has been applied in wage negotiations -- most dramatically in the 1948 and 1950 contracts between the General Motors Corporation and the United Automobile Workers.

In partial extenuation of the procedure, let me grant that a closely similar figure, based not on the number of workers but on the total population, and properly labeled -- not using the word "productivity" -- can be helpful in the study of national income and the standard of living. In the 1930s, when the National Research Project operated under the Works Progress Administration, it was charged to investigate the displacement of men by machines in various industries. The formula had legitimate uses in that study.

*HISTORY OF THE CONCEPTS OF PRODUCTION  
AND PRODUCTIVITY.*

Before turning to the current practices in calculating productivity, let me devote a few paragraphs to the history of the concepts involved:

(a) In the two decades after 1750, the physiocrats asserted that only *land* -- agriculture -- is productive; they called urban industry sterile. Henry George, who came a century later, belongs in the same general school of overemphasis on the land.

(b) In 1776, in the first sentence of *The Wealth of Nations*, as a direct challenge to his friends across the Channel, Adam Smith wrote:

"The annual *labour* of every nation is the fund which originally supplies it with all the necessaries and conveniences of life which it annually consumes . . ."

David Ricardo and Karl Marx adhered to the labor theory of value. Many modern economists, including those whom I here criticize, fall into the error of overemphasis upon the contribution of labor.

(c) To complete the round, there is another economic school -- that of technocracy or social credit -- which emphasizes *capital*. In 1933, at the bottom of the depression, Major C.H. Douglas in England, and the technocrats in the United States, called to the attention of the distressed public that capital equipment has become increasingly effective in production. Hand labor early gave place to simple machines and engines; these are now yielding place to machines and engines of increasing size, power, efficiency, complexity, and automatic character. The advocates of "social credit" assert that labor is needed less and less; indeed it has already become redundant. Wages will fall to the pre-capitalist starvation level, and many workers must die, unless their shrinking wage is supplemented by a "social dividend".

The thesis of these technocrats has moved governments and reformers. Probably the most extreme case of government response is that of the Province of Alberta, Canada, which applied social credit principles on an extensive scale. The productivity students, and many others of us, give ear seriously to social credit.

And what today of the three lines of emphasis? The stress on the productivity of the land has become socially and politically unimportant. In the United States, the local taxing authorities take away in taxes a large share of the income from real property. And in the socialist and communist countries, the land has been socialized.

All men are sympathetically inclined toward labor. We desire that the poor may be rescued from poverty and hardship, and that they may share in the growing product of capitalist industry. Many of us are inclined to attribute to human labor credit for producing a large share of the product of farm and industry. But, when alerted by the fear that men will be displaced by machines, we find that we appreciate the great productivity of capital.

*MARGINAL PRODUCTIVITY: AND THE SHORT RUN  
VS. THE LONG RUN.*

In general, economists find the principle of marginal productivity the most helpful exposition of the force that, in the long run, determines wages, interest and rent. But the productivity students have turned their faces away from marginal productivity. This presents a recurring difficulty, the clash between short-run and long-run considerations. An impatient observer is likely to see chiefly the short run; it may seem to him that the much advertised economic principles or tendencies do not operate with precision -- that marginal productivity does not have compelling power over wages, interest and rent. In the opinion of this writer, many economists, even, ignore the long-run effects.

To be sure, the long run brings disagreeable developments; else why should economics be dubbed "the dismal science"?

Maintain full employment, regardless how high the bricklayers, plasterers and airplane pilots push their wage demands; and bring on continuing inflation, to the early ruin of worthy but non-aggressive groups in the society, and to the eventual destruction of the economy.

Maintain the exchange value of the British pound sterling; and create for England a "dollar shortage".

Make labor conditions in this country better and better; and find it necessary to erect a high fence along our southern border to keep out Mexican laborers, the "wet-backs", who would slip across.

Keep everyone well-fed and marrying young; and deepen the overpopulation crisis of the world.

Produce greatly, increase the gross national product; and quickly deplete the natural resources.

*DISTRIBUTIVE JUSTICE SEEMS TO RESIDE IN THE  
AVERAGE CONCEPT.*

Productivity students in one stage of their reasoning approach the calculation of the average product of labor. And distributive justice would seem to smile on that effort. Workers *should* receive the value of what the total labor force produces; the average worker *should* receive his fraction of what the total labor force produces. But this is normative economics. It is touched with wishful thinking. It does not attempt to explain the market, nor does it accord with the way the market actually functions.

In Part II of this paper, I shall attempt to show how difficult it would be to calculate a true average.

*IMPOSSIBLE TO CALCULATE PRECISE SHARES OF  
THE TOTAL PRODUCT.*

It is impossible to determine the total product of any one of the four factors. If a firm turns out a million dollars of net product per year (the net figure obtained by subtracting from total product the cost of materials, fuel, etc., as will be discussed below), who can be found who is wise enough to calculate that \$420,000 was produced by labor, \$250,000 by capital, \$270,000 by land, and \$60,000 by enterprise? Until that attribution has been accomplished, and total figures established for the contributions to product by the four factors of production, it is idle to speak of calculating the average product of labor.

*THE PRODUCTIVITY STUDENTS ABANDON ALL IDEA  
OF AN AVERAGE.*

There now enters an important departure from statistical reasoning. It would be unfair to blame its invention on the contemporary group of economists whom I am criticizing, for it is much older than they. Many kindly philosophers, social thinkers, and conservative economists, have expressed this thought. The productivity students, in effect, attribute to labor *the entire output* of the farm, the factory, or the electric generating station. For the ratio they set up implies that attribution. Rather than take a figure like \$420,000 for the numerator of the labor productivity ratio, they take *the full million!* They divide this million by a figure for the quantity of labor -- either the number of workers, or the number of man hours of work -- and they call the quotient "the productivity of labor". To be sure, some of them prefer not to apply the full term. One of the most careful of the productivity students, Frederick C. Mills, avoids using either the word "average" or the word "labor"; he calls the quotient merely "productivity". But, like his colleagues in the field, he secures the figure on productivity by dividing total net output by a figure for the quantity of labor.

I contend that the fraction, total output divided by the labor input, does not yield a true average, since the numerator is much too large to be associated with the small denominator. In the Bibliography will be found Raymond Pearl's treatment of rates and ratios, which applies at this point. To remind the reader that the calculation is not statistically sound, I shall refer to this quotient as the "over-average" product of labor.

*NORMATIVE ECONOMICS VS. THEORETICAL  
OR OBJECTIVE ECONOMICS*

Many productivity students are not so much interested in theory as in the welfare of the workers. Surely we cannot oppose that interest! It is only in the theoretical side of their presentation that I find cause to take exception -- the attributing of productivity and the use of a ratio which to me is meaningless.

*A NEW CONFUSION! THE FACTORS OTHER THAN  
LABOR ARE PRODUCTIVE.*

To introduce this section permit me to quote four examples of what I have come to call "the standard disclaimer":

From a report by a group of Europeans under the sponsorship of the O.E.E.C. (the Organization for European Economic Cooperation), *Measurement of Productivity: Methods Used by the Bureau of Labor Statistics in the U. S. A.*, Paris, 1952. The selection is from pages 16 and 17:

"In spite of the widely held impression to the contrary, such measurements cannot be used to determine the efficiency of the workman himself -- that is to say, his degree of skill or the application with which he works. On the contrary, much of the significance of such measurements consists in relating production to that factor of production which is less likely to change but which is probably most sensitive to any alteration in any other factor. Experience shows that most improvements in productivity are due not to greater effort on the part of the workman, but to better use of this effort, and to other factors of production. Human effort is always limited in itself, but the influence of the organization of work, the quality of materials, the type of product manufactured, the capital invested, management efficiency, etc., is a deciding factor in the level of productivity. Analysis of results is entirely directed towards determining the relative importance of these factors."

From the United States Steel Corporation pamphlet, *U. S. Steel's Policies on Costs, Prices, Plants, Productivity*; testimony by officials of the U. S. Steel Corporation before the Joint Committee on the Economic Report, Washington D. C., Jan. 24, 1950. The selection is from page 56, where the officers of the Steel Corporation are quoting from U. S. Department of Labor, Bureau of Labor Statistics, *Major Sources of Productivity Information*, 1941, page 1:

"In the words of the United States Department of Labor, Bureau of Labor Statistics, 'Changes in the ratio between output and labor input reflect the joint effect of a large number of separate though interrelated influences, such as technical improvements, the rate of operations (this means the proportion of plant capacity), the relative contributions to production of plants at different levels of efficiency, the flow of materials and components, the skill and effort of the work force, the efficiency of management, the state of labor relations, and many other factors.'"

A translation from J. Gouin, "Les Problèmes Sociaux Posés par la Politique de Productivité", *Revue Française du Travail*, vol. 5, no. 11-12, 1950, pages 516-525:

"The word 'productivity' is served with many sauces."

"We must not confuse the technical task of increasing the productivity with systems devised primarily to get more out of the workers, like the Taylor system. There is no intention to make the speed or rhythm of the workers excessive. To say that each should produce more wealth does not mean that each should work harder."

From O.E.E.C. (the Organization for European Economic Cooperation), *Terminology of Productivity*, Paris, 1950, pp. 15; the selection taken from page 4:

"It should be noted that productivity of labor is a measurement of general efficiency in the use of labor, and not of the effort of labor. It is influenced by the combined effect of a large number of separate though interrelated factors, such as the amount and quality of equipment employed, technical improvements, managerial efficiency, the flow of materials and components, the relative contributions of units (plants) at different levels of efficiency, as well as the skill and effort of the workers."

Similar "disclaimers" may be found in publications of the National Bureau of Economic Research, the National Industrial Conference Board, the Brookings Institution, and others.

These workers recognize that what they have called the productivity quotient is affected by causes other than the contribution of labor to the product -- indeed that almost none of the effect comes from labor. Why then do they continue to divide the total net output of a firm by a labor figure, and to call the quotient "productivity"?

#### WAGE THEORIES

For further background to my discussion, permit me to list some of the theories or explanations of the level of wages, which, during two centuries, have commanded the interest of economists:

- the iron law -- starvation wages;
- supply and demand -- that labor is a commodity;
- the wages fund;
- marginal productivity;
- that the wicked employers have a monopoly of access to the tools of production;
- that the wicked labor unions have a monopoly of the supply of workers.

And there is another, the so-called "bargaining theory". Properly speaking, this is not a theory -- not an explanation of the wage level -- but a negation of all attempts to explain the level of wages. Those who hold to this "theory" consider that the wage level is set simply by bargaining. The proximate step governs! Acting under the broad license to set wages at any desired level, the negotiator is free to work for a wage rate that satisfies him -- whether he is acting in a drive to achieve justice for the workman, or for a more selfish reason.

Many observers have commented on the cynicism with which one or the other party approaches the bargaining table. See for example W. H. Schmidt and Charles Robinson, "A Year of Labor Turmoil and Wage Boosts", *Railway Age*, vol. 22, pages 8-11, Jan. 4, 1947; and Charles Lindblom, *Unions and Capitalism*, Yale University Press, 1949. These writers emphasize the cynicism of the union representatives; but others speak of that on the side of management.

The productivity (which term, I remind the reader, I regard as a misnomer) of the American railroads increased greatly under the tremendous demands of World War II. Not only was the demand for their services very high, but competing means of transportation -- trucks, especially -- were sharply limited in consumption of gasoline. Men and freight had to take to the rails. Freight cars and passenger cars were loaded beyond capacity. Train rolled after train at close frequency. We may estimate that the railroads operated at 125% of their rated capacity, rather than the usual 50%. Under the formula which I am criticizing, the productivity of labor on the railroads accounted for all this improvement. Let someone else speak of the wearing out of roadbed and rollingstock.

Under this great stress and accomplishment, the railroad brotherhoods demanded and secured their share of the "increased productivity".

With the close of the war, the slackening of government demands, the reappearance of trucks and passenger cars on the highways, the railroads felt a decline in freight and passenger traffic, to something like 60% of capacity. By the formula, "labor productivity" on the railroads declined drastically. The unions turned to other arguments than productivity in demanding wage increases.

#### THE RATE OF INCREASE IN PRODUCTIVITY.

Most productivity students refrain from demanding that the worker be given "the full value of his product", as that product would seem to be ascertained under the application of their productivity formula. They are fully aware of the contributions of the other factors of production.

Instead, they take a stand which seems mystical to this critic. They consider that the figure on the amount of labor, which they use in the denominator of the ratio, is "representative" of the aggregate bundle of factors of production. Consequently, they consider that the ratio of total output to labor moves in a time pattern similar to that being described by the conjectured ratio of total *output* to *the sum of all the factors of production*.

This belief or preconception seems based on a static concept of industry, that capital equipment is *not* steadily and rapidly being increased and improved, and is *not* displacing labor in production. Under no other premise could the ratio of output to labor *continue* to be representative of the ratio of output to all four factors of production. (At this point, the productivity students are in conflict with the technocrats, as will be discussed below.)

But, in the modern scene, in ninety per-cent of the cases in which "increased productivity of labor" is reported, the cause of the "increase" will be found in either capital or enterprise -- the diesel engine replaces the steam locomotive, or the Ford Motor Company management arranges a new layout of the plant.

Possibly I am wrong in attributing to the productivity students this idea of time correlation or similarity of pattern between the ratio of output to labor and the ratio of output to a more complete but vague figure on all the factors of production. Possibly the situation is merely that they hold to an "ability to pay" principle for the determination of the wage rate -- that if an increase is shown by the ratio of output to labor, that means better income for the employer, and it is sufficient warrant to ask an increase of wages at the same proportionate rate. If this is their stand, they are not to be classed as disinterested students of productivity, but as partisan, as special pleaders for labor at the bargaining table.

I have not presented many details here on wage negotiations. The reader may profitably turn to the Bibliography for a few references, for example to Charles E. Wilson on the wage contract between General Motors and the United Automobile Workers.

In Part II, I shall offer several formulas, by which one or another kind of "productivity" may be calculated. Two of those formulas yield figures

resembling the "global" productivity that would be obtained if all four factors of production were fully represented. But, as is there pointed out, the value of such global figures is dubious; they may approach unity.

#### FEATHERBEDDING AND MAKEWORK.

The reader is probably well aware of the featherbed efforts of the railroad employees, to compel the roads to put an extra fireman on each diesel locomotive -- of Caesar Petrillo's exaction that stand-by musicians must be employed when recorded music is broadcast -- of the typographers' demand, appealed to and confirmed by the Supreme Court, for pay for setting "bogus type", when advertising copy comes to the paper already set in type -- of bricklayers restricting their output to 400 bricks a day. Yet we keep hearing of *increases* in the productivity of labor!

At the National Conference on Productivity, held in Washington in 1951, I still naively thought of productivity in the dictionary sense, as it is used in economics. I was not then familiar with the power and following of the new formula. I ventured to ask the attitude of labor unions toward productivity. The chairman of the session, a union officer, assured me that the unions favor the increase of productivity! I was silenced by this startling assertion, that seemed to fly in the face of so many facts. It was some time before I came to appreciate that he was speaking the simple truth, though of course his comment referred to the new formula.

This attitude of some unions -- principally of unions organized on an industrial basis -- must be recognized as genuine progress. Early industrial history is full of instances of resistance on the part of workers to the introduction of machines. But, of course, the unions do not want the men to work harder.

#### THE PRODUCTIVITY STUDENTS DO NOT GO THE WHOLE WAY WITH THE SOCIAL CREDIT GROUP.

There is an important difference in the tenets of the technocrats and the productivity students. As one studies historical reports on productivity, as by Solomon Fabricant, he learns that, in the past, wages have tended to increase in much the same proportion as productivity has increased. (Clark Kerr raises questions: the two variables fail to move together in the business cycles.) The productivity students project this correlation into the future, and contend, not only that wages *will* rise with increasing productivity, but also that wages *should* rise with productivity. (We need to remember that an increase in "productivity" is usually merely an increase or improvement in mechanisation.)

But the technocrats conclude that wages already tend to *fall*, because of the accelerated displacement of men by machines. Wages will soon become shockingly depressed. Something radical must be done to help labor in its income crisis.

Both groups belong in the category of normative economists; both want the workers to receive more income than they would receive under the harsh workings of a free market. The technocrats, standing close to straight socialism, call on *the government* to distribute a social dividend. The productivity students urge that, as "productivity" increases, the workers should receive *from the employer* an unchanging fraction of the total net product, a

constant proportion of the increasing pie. If the national figure on productivity increases by about 2% per year, on the average, then, say these productivity students, the real income of the workers should increase by 2% per year.

*BUT WHAT WILL HAPPEN TO THE EMPLOYER AND TO THE WORKER?*

The following quotation from Ludwig von Mises deals first with the provision in many wage contracts that the wage rate shall vary with the cost of living; this is commonly called the escalator clause. Then he turns to the claim for wage increases based on increases in so-called "productivity". The selection is from page 605 of *Human Action*, New Haven, Yale University Press, 1949:

"The labor unions pretend that nominal wage rates at least must always be raised in accordance with the changes occurring in the monetary unit's purchasing power, in such a way as to secure to the wage earner the unabated enjoyment of the previous standard of living. They raise these claims also with regard to wartime conditions and the measures adopted for the financing of the war expenditure. In their opinion, even in wartime, neither inflation nor the withholding of income taxes must affect the worker's take-home real wage rates. This doctrine tacitly implies the thesis of the *Communist Manifesto* that 'working men have no country', and have nothing to lose but their chains; consequently they are neutral in the wars waged by the bourgeois exploiters, and do not care whether their nation conquers or is conquered.

"It is not the task of economics to scrutinize these statements. It only has to establish the fact that it does not matter what kind of justification is advanced in favor of the enforcement of wage rates higher than those the unhampered market would have determined. If, as a result of such claims, real wage rates are really raised above the height consonant with the marginal productivity of the various types of labor concerned, the unavoidable consequence must appear, without any regard to the underlying philosophy.

"The same is valid with regard to the confused doctrine that wage earners are entitled to claim for themselves all the benefits derived from what union officers call 'the productivity of labor'. On the unhampered labor market, wage rates always tend toward the point at which they coincide with the marginal productivity of labor. The concept of 'the productivity of labor in general' is no less empty than all the other universal concepts of this kind, e.g., the concept of the value of iron or gold in general. To speak of the productivity of labor in a sense other than that of the marginal productivity is meaningless. What these union officers have in mind is an ethical justification of their policies. However, the economic consequences of the policies are not affected by the pretexts advanced in their favor.

"Wage rates are ultimately determined by the value which the wage earner's fellow citizens attach to his services and achievements. Labor is appraised like a commodity, not because the entrepreneurs and capitalists are hardhearted and callous, but because they are unconditionally subject to the supremacy of the pitiless consumers. The consumers are not prepared to satisfy anybody's pretensions, presumptions and self-conceit. They want to be served in the cheapest way."

Let us recall to our dissident colleagues that in the long run the principle of marginal productivity will enforce the wage rate (and the interest rate, and rent). In each serious depression, firms paying wages higher than would be set by the free forces of the market, will go bankrupt. Extensive unemployment will result. This will occur whether the cause of the high wage was a productivity clause, a cost of living clause, or some other formula.

In the short run, to be sure, so long as the employer has financial reserves, he can continue to pay the high wage. But, as his reserves disappear, he must cut wages or close his business. And he will surely cut the work force.

But, the partisans of labor may say, there is also the government to fall back on. Yes, in the short run, the government will provide unemployment relief and other aids. But the government, too, can go bankrupt. Already, the United States governments, national and local, owe a third of a trillion dollars.

When the reserves of the private employers and of the government -- which can but temporarily postpone and obstruct the working of a free market -- have been nearly exhausted, no applicant for work will be able to secure a job until he can convince the prospective employer that the value he will add to the product will be at least as great as his wage. So the worker, and his friend the welfare economist, would do well to begin, earlier than that fateful year of starvation, to act with the marginal productivity theory of wages in mind.

#### INTERNATIONAL AND INTERREGIONAL COMPARISONS OF PRODUCTIVITY.

Allyn A. Young (he was my first class-room teacher in economics, Washington University 1912-1913) was beginning to examine the subject of productivity when he was cut off from further service by death. He introduced G. T. Jones and Colin Clark to that study. The selection below is from an address he delivered in Scotland. His remarks on cause and effect and his statement that productivity and scarcity are synonyms, merit attention:

Young, "Increasing Returns and Economic Progress", *Economic Journal*, vol. 38, no. 152, December 1928, page 531:

"Now I grant that at any given time, routine and inertia play a very great part in the organisation and conduct of industrial operations. Real leadership is no more common in industrial than in other pursuits. New catchwords or slogans like mass production and rationalisation may operate as stimuli; they may arouse men from routine and lead them to scrutinize the organisation and processes of industry, and to try to discover ways in which they can be bettered. . . . There is a danger, however, that we shall be led to expect too much from these 'rational' industrial reforms. Pressed beyond a certain point, they become the reverse of rational.

"I have naturally been interested in British opinions respecting the reasons for the relatively high productivity (per labourer, or per hour of labour) of representative American industries. The error of those who suggest that the explanation is to be found in the relatively high wages which prevail in America is not that they confuse cause and effect, but that they hold that what are really only two aspects of a single situation, are, the one cause, and the other effect. Those who

hold that American industry is managed better, and that its leaders study its problems more intelligently and plan more courageously and more wisely, can cite no facts in support of their opinion save the difference in the results achieved. . . . Sometimes the fact that the average American labourer works with the help of a larger supply of power-driven labour-saving machinery than the labourers of other countries is cited as evidence of the superior intelligence of the average American employer. But this will not do, for, as every economist knows, the greater the degree in which labour is *productive or scarce* -- the words have the same meaning -- the greater is the relative economy of using it."

Population is sparse in America (relative to land and capital) and dense in India. Other elements in the situation permitting -- such as good government, enforcement of contract, and freedom -- it follows that in America great effort is made to conserve labor. Labor-saving machinery is installed in quantity. Human labor is employed sparingly, and only for very productive tasks.

In India, where labor is so disastrously plentiful and cheap, it would be both uneconomic and anti-social to install so much machinery per worker as in America. Factories *should* be arranged to give employment to labor on a more extensive scale than in America. This means that many relatively unimportant tasks must be performed by labor, rather than by machinery. Necessarily, the wages must be low. The marginal productivity of labor is low in India and so is the "over-average" productivity, as it is calculated by the standard formula.

An Indian worker transported to America would probably show a personal productivity nearly as high as that of the American, simply because, under the prevailing scarcity of workers, he would be assigned to perform important and valuable work. ✓

Following the citation from Dr. Young, let me mention a related comment by Dr. C. Oswald George, of the British Census Bureau.

At the meeting of the Royal Statistical Society, held in June 1948, Hans Wolfgang Singer and C.E.V. Leser presented a joint paper on "Industrial Productivity in England and Scotland." This was published in the *Journal of the Royal Statistical Society*, Series A, general, vol. 111, Part 4, 1948, pp. 309-330. It was republished in the University of Glasgow Reprint Series, no. 4, Department of Social and Economic Research, 1950.

Messrs. Singer and Leser had pointed out that the net output per person employed, in all industries covered, was 225 pounds sterling for England and Wales, as compared with 213 pounds for Scotland. Unemployment had been worse in Scotland. The speakers were uncertain whether the small difference in productivity between the two areas was significant.

In the ensuing discussion, Dr. George (page 321) said:

"Net product per head is obtained by deducting from gross output the cost of materials and fuel used, and the amount paid for work given out; and then dividing by the average number of persons employed (including administrative, technical, etc., staff, but excluding out-workers). At first sight, that seems fairly clear and free from difficulties; but net output is the fund from which have to be met depreciation, wages, salaries, rents, advertisement and selling expenses, etc. The net output per employee, which may be affected further by variations in labour composition, overtime, etc., must therefore be regarded with much reserve as a measure of the relative efficiency of industries. . . ."

Builders or employers in London "have to pay higher wages than elsewhere; and, as only people working in London can build houses in London, the fact that wages are higher there will necessarily be reflected in increased gross output and net output per head

"One wonders how much . . . such factors cause the difference between the net output per head of London firms, compared with firms in other areas."

England and Wales, he points out, if London be excluded, give a figure closely similar to that for Scotland.

B.S. Keirstead (*Theory of Economic Change*, Toronto, Macmillan of Canada, 1948, 386 pages) faced the same problem in studying productivity in different regions of Canada.

#### NATIONAL INCOME ACCOUNTING.

In 1946, America adopted the Employment Act and set up the President's Council of Economic Advisers. Since that year, that Council, and also the Bureau of the Budget, the Department of Labor, the Department of Commerce, the Federal Reserve Board, and other agencies public and private, have concerned themselves with national income accounting. John W. Kendrick of the Department of Commerce, has done interesting work in this connection; he is now carrying forward his studies with the National Bureau of Economic Research.

A national figure on income, if divided by a figure that represents in some way the total population -- such as the total number of heads of families -- yields a quotient helpful in studying the standard of living. But if the national income is divided by a labor figure, and the quotient is called "productivity", the procedure is questionable.

#### A MEASURE OF EFFICIENCY AT THE PLANT LEVEL.

When the "productivity ratio" is inverted, it becomes labor cost per unit of output. This inverting is increasingly practiced, possibly because resistance to the straight productivity calculation develops. The inverted ratio, labor cost per unit of output, may be used at plant level: (a) for planning, as in laying out a new factory; and (b) in comparison with an "ideal" value, also of labor cost per unit of output, to measure efficiency. Some of the English reports mentioned in the bibliography, tell of such measuring of actual performance against a "target" figure.

An excellent feature of the inverted ratio is that companion ratios are invited, such as:

$$\frac{\text{number of trucks}}{\text{total net product}},$$

$$\frac{\text{money spent on trucks}}{\text{total net product}} \quad \text{and} \quad \frac{\text{cubic feet of factory space}}{\text{total net product}}.$$

But the term "productivity" should not be applied.

PART II. IF A TRUE AVERAGE PRODUCT  
OF LABOR SHOULD BE WANTED.

*SUGGESTED IMPROVEMENT OF THE PRODUCTIVITY  
RATIO.*

Part I of this criticism contains a protest against the distorted "average" employed in the calculation of the so-called productivity. If, for any reason, the average product should be sought, then it should be a true average. In Part II, a search will be made for a true average; in that search, it will be necessary to reveal the besetting difficulties.

The two commonly used productivity ratios are:

(a)  $\frac{\text{net output}}{\text{number of workers}}$  and (b)  $\frac{\text{net output}}{\text{number of man hours}}$ .

These two purport to measure the productivity of the supply of labor, and the productivity of the amount of labor service used. Though they do not correspond to the two aspects of the dictionary definition -- to latent productivity, the mere power to contribute to the product, and to active productivity, the delivered power -- they may suggest those two aspects.

*NUMERATOR AND DENOMINATOR.*

The net figure which occupies the numerator, the total net output, is obtained from gross output by subtracting the following items: materials, supplies and containers, fuel, purchased electric energy, and contracted work. This list is taken from the United States Census of Manufactures, and resembles the similar list used in the British census.

But, in calculating the net product, in the numerator, we may not subtract rent, interest, wages, nor profit. The purpose of a productivity study is to determine the productivity of the factors of production: they must be placed in the denominator. Nor, in the numerator, may we subtract taxes.

Materials -- and the supplies, fuel, containers and purchased electric energy -- are submitted to the process of production, which adds value. The enterpriser engages the services of the other three factors of production, and the four of them -- enterprise, land, labor and capital -- perform the production. These four, only, may occupy the denominator of the productivity ratio. It is important to exclude materials from the denominator, despite the impulse of some students of productivity to imitate the input-output students, and to include in the denominator all inputs possible.

If the full net product is to stand in the numerator, effort should be made to get all four of the factors of production into the denominator, and each of them fully represented. This particular quotient may be called the global productivity of the enterprise. I seriously doubt that it will be of much use. Is there not a tendency for the rewards (the costs) of the factors of production to approach the full value added in manufacture? Then, would not the value of the ratio approach unity? Or can the calculation be carried forward in terms other than money?

On the other hand, if a single factor of production is to be studied in the denominator, then the total net product of the firm should be divided into shares, as was suggested on page 6, and only that share placed in the numerator which corresponds to the particular factor of production being studied. To be sure, this splitting of the numerator is forbiddingly difficult. This will be discussed below.

*WHAT DO WE MEAN BY LAND?  
AND BY CAPITAL?*

Each factor of production requires careful definition. The concept of capital as a factor of production is bounded on one side by the materials, etc., upon which the productive process works. The supply per year, the flow of materials (etc.) taken into the plant, belongs in the numerator, as a subtraction from gross product. But the stand-by supply of materials, the necessary working inventory, is a standing feature of the manufacturing process, like the stand-by supplies of labor and land, and of financial credit at the bank. This stand-by supply of materials may be regarded as a factor of production, and may be placed in the denominator, along with machinery and buildings.

In another direction, the concept of capital is bounded by land, as will be mentioned below, in connection with agriculture and the extraction of minerals. Luckily, both capital and land are factors of production. At first glance, at least, both belong in the denominator; it may not be a matter of great concern in the productivity study to distinguish sharply between them.

As for the factor land, Ricardo long ago distinguished between the site and the natural goods. The site is indestructible; at the end of a lease, no matter how long, the tenant returns to the owner the site element in the land unimpaired. The site is a true factor of production; it commands a true rent; it belongs in the denominator of the productivity ratio. But the natural goods blend with materials, so far as productivity is concerned: the topsoil, the water supply, the petroleum, coal, metal ore, and other minerals. So-called quarry rental agreements, petroleum royalty contracts, etc., are really sales of the natural goods, the payment to be made in installments as the natural goods are extracted.

We may properly say that one parcel of land is richer in natural goods than another. The coal seam may be twelve feet rather than six feet thick; it may lie two hundred feet rather than four hundred feet below the surface; the overlay may be of suitable material rather than unsuitable; the sulphur content may be low rather than high; the availability of transport may be good rather than poor. But let us not call one area *more productive* than the other. For, in the productivity study, we are concerned with industrial processes in which man participates. In other types of study, it is eminently proper to speak of the productive activity of nature during the geological epochs, when coal and mineral beds were laid down, river courses established, topsoil formed, etc. But here let us give attention to the effective-

ness of industrial processes. To be sure, there are many forms of productive activity: two stages of productive effort are to be found in the extraction of natural goods from the earth, and the later stages of industry, in which the raw materials are fashioned into finished consumers' goods.

In some cases, man does not deplete the stores of natural goods, but replenishes them, or builds them up. In agriculture we may witness an actual building up of the fertility: the spreading of fertilizer, the better management of the water, the improvement of fences and roads, etc. Indeed, as the generations pass, farm land comes to resemble more and more closely capital equipment, a man-made instrument of production. Additions to the natural goods in the topsoil, and to facilities like the water supply, should be entered in the first part of the numerator, as part of the gross product for the year. Depletion, on the other hand, belongs in the second part of the numerator, a subtraction from gross product.

I have divided the categories capital and land. The productivity students themselves make such divisions in the field of labor. Sometimes the division is between direct labor which eventuates in a tangible good, and indirect labor in the salesroom or office. Sometimes the division is between present labor, and that which was performed at an earlier date on the materials and machines used in the present stage of the manufacturing process, the so-called "embodied labor".

*AN ALTERNATIVE TITLE FOR PRODUCTIVITY  
WOULD BE NO IMPROVEMENT*

It is advisable to reject, along with the use of the term "productivity", such alternative forms as output per man, output per acre, and output per man-hour. Professional economists must be careful of the use of terms in their own field. And we must be on guard against over-eagerness to be concise. Often it is better to use a term with a dozen words rather than condense it to such brevity that its meaning is not apparent. We must not, by improper use of terms, appear to attribute productivity in undue amount to one element -- to one factor of production.

Examples: The Bureau of Agricultural Economics of the United States Department of Agriculture has recently divided the produce of a farm by the number of workers, or by the number of man hours of work. Should it call the quotient the output per man, or the output per man-hour? No! The long and awkward terms, "the ratio of bushels of corn to the number of workers" -- or to the number of man hours of work -- would be preferable. Even under that milder title, the ratio has little meaning. Again, for centuries, it has been customary to divide the produce of a farm by the number of acres and to call the quotient "twenty bushels of corn to the acre". It would be better to call it "the ratio of bushels of corn to acres of land"; and even that quotient should be handled with care by an economist.

I suggest that any such ratio should be accompanied immediately by similar quotients for the other factors of production.

*WITH THE RATIO OF NET PRODUCTION TO LABOR,  
COMPANION RATIOS SHOULD BE PRESENTED.*

We have considered setting up correctly the fraction or ratio to calculate average productivity, and the problem of exercising professional care in

terminology. There is a further course of action that will help keep writer and reader alert. If the writer is emphasizing one factor of production, he should nevertheless, and in the same report, offer companion figures -- even though he has but estimates on which to base them -- for the contributions of the other factors. The joint nature of production must be kept before the mind.

*PRODUCTIVITY OF THE STAND-BY SUPPLIES OF THE FACTORS, AND OF THE AMOUNTS OF THE FACTOR SERVICES USED UP.*

Hiram S. Davis has suggested that several productivity ratios be calculated, some dealing with the stand-by supplies of the several factors, and some with the amounts of the factor services used up. Six possible ratios are listed below:

Ratios expressing the productivity\* of stand-by supplies of the factors. This quotient resembles latent productivity.

Ratios expressing the productivity\* of factor services used up -- active productivity.

$$\frac{\text{net output}}{\text{number of men on the payroll}}$$

$$\frac{\text{net output}}{\text{number of man hours}}$$

$$\frac{\text{net output}}{\text{acres of land cultivated for this crop}}$$

$$\frac{\text{net output}}{\text{amount paid in rent}}$$

$$\frac{\text{net output}}{\text{full capitalization}}$$

$$\frac{\text{net output}}{\text{money paid in interest and dividends}}$$

and, if I knew how to do so, I should offer two more ratios, reporting the productivity of the enterprisers.

Note that the six do not include ratios for the productivity of materials, supplies and containers, fuel, purchased electric energy, nor contracted work. Those items do not report the productive activity of this enterprise. Some of them do not report productive activity at all. It would be easy to set up a fraction or a pair of fractions for the purchased electricity: one would indicate capacity, the ability of the community to supply electricity; the other would indicate kilowatt-hours consumed. Such ratios for the contribution of the purchased electricity might be meaningful in some other type of efficiency study, but not here. The attention in a productivity study should be confined to the productive contributions of the four factors of production.

*THE INPUT-OUTPUT STUDY MAY NOT BE TAKEN AS A MODEL.*

One reason that productivity students are tempted to place in the denominator of the ratio, inputs that are not suited to the productivity study, is

\* Permit me to remind the reader that the oversize numerator has led me to call such ratios "over-average productivity".

that Wassily Leontief has done so splendid a job with complete lists of inputs and outputs. Of course, he is not studying productivity. The objectives of the two types of study are quite different. When Leontief makes a study of a geographical region, he tries to assemble all inputs and all outputs. In his study it is quite proper to include among the inputs materials and forces originating in the region or imported to it, and among the outputs finished goods consumed in the region or exported from it. By contrast, in a productivity study, the attention must be confined to the productive contributions of the four factors of production.

*A WAY OUT SUGGESTED: BUILD UP THE DENOMINATOR.*

To meet the difficulty that the numerator is too large to be associated with a single factor of production, some productivity students would build up the denominator by adding inputs other than labor. They run into difficulties. How can they assemble *complete* figures on the contributions of land, capital and enterprise? If less than the full list of the four factors of production is included -- for example, if only labor and a few capital input items are included -- the initial shortcoming of the ratio remains: the numerator is still too large to be associated with the denominator.

And, as has been suggested, at best the meaning of the global productivity ratio is uncertain. If the components are measured in money, the value of the ratio tends to approach unity.

However, if proper safeguards are set up, any experiment in building up the denominator should be watched with appreciation.

The set of six productivity ratios above presented, following the suggestion of Mr. Davis, would be reduced to two by the "global productivity" advocates:

(a) The first of the two ratios reporting the productivity of stand-by supplies of the factors; it resembles latent productivity.

(b) The second ratio, reporting the productivity of the factor services used up.

net output

---

all stand-by factors: land, labor,  
capital and enterprise

net output

---

factor services used up: man hours,  
interest, dividends and rent

In handling either of these fractions, there would be faced the problem of reducing the several factors to a common measure. Money seems to be the most suitable common measure.

*AN UNSUCCESSFUL ATTEMPT TO SEPARATE THE CONTRIBUTIONS OF LABOR AND OF LAND.*

Some years ago, in *Production Economics* (Henry Holt, 1929), John D. Black attempted to calculate the share of the product of a farm to attribute to labor and the share to land. His method is not satisfactory (see his explanation, page 161), but at least he shows appreciation that production is accomplished jointly by the factors.

*A DIFFERENT EXPEDIENT TO IMPROVE THE PRODUCTIVITY RATIOS: SPLIT THE NUMERATOR.*

Another procedure may be considered, to bring numerator and denominator to comparable size: split the numerator into several parts, each of them as nearly as possible representing the productive contribution of one factor. To be sure, even approximate accuracy would be impossible of attainment; the proposal is made solely for the theoretical value -- to indicate the true relationships of the quantities involved.

As suggested in the numerical example on page 6, if the annual net product of a firm is one million dollars, then calculate or estimate that \$420,000 of the product may be attributed to labor, \$250,000 to capital, \$270,000 to land, and \$60,000 to enterprise. Divide the \$420,000 by one of the two figures for the quantity of labor, \$250,000 by a figure for capital, and \$270,000 by a figure for land.

If one should carry such a study over the years, he would need to change the proportions in which he attributed shares of the product to the different factors. For, if the productivity of the firm is studied over a half-century, the coal seam may grow thin or may dip deep into the earth. A new chemical process may be invented, so that the same amount of capital (in value) will turn out a larger product. There may be a migration of consumers, or of supplying firms. And remember the caution voiced by the technocrats, that, as the productivity of capital increases, that of labor may decrease.

The proposed splitting of the numerator may appear crude -- even impossible. But grant it a moment's thought. Even on the basis of an inaccurate guess, it is much nearer correct than is the present practice of relating total net product to the one factor of production.

Should we essay to split the numerator, we may set up six ratios. Indeed hundreds of ratios may be set up, if the investigator wishes to study separately the productive contributions of common labor, the salesmen, the machinists, the storage yard, the trucks, the conveyor system, the office machines, etc. But I shall list only six ratios, for the three great and inclusive groups of factors.

Productivity of the stand-by  
supplies of the factors

$\frac{\$420,000}{\text{number of men on the payroll}}$

$\frac{\$250,000}{\text{full capitalization}}$

$\frac{\$270,000}{\text{acres of land cultivated for this crop -- or number of square feet occupied by this factory}}$

Productivity of the factor  
services used up

$\frac{\$420,000}{\text{number of man hours}}$

$\frac{\$250,000}{\text{money paid in interest and dividends}}$

$\frac{\$270,000}{\text{amount paid in rent -- or chargeable to rent}}$

and two similar ratios, if they can be devised, for enterprise.

*IN WHAT UNIT SHOULD THE CONTRIBUTIONS  
OF THE FACTORS BE MEASURED?*

Mr. Davis discusses the common unit in which the contributions of the factors of production may be measured. The two possible units seem to be money and labor. I am glad to see that Mr. Davis favors money.

But some investigators speak of the "embodied labor" in the capital equipment -- and unfortunately they also speak of the embodied labor in the materials worked on. When one undertakes to measure or to explain the productivity of capital items and of materials, in terms of embodied labor, he finds himself descending into the Marxist half-world, where economic principle is lost in dogma. To be sure, some conservative economists, for example F. W. Taussig, have adopted the embodied labor thesis to explain the value of capital equipment. But the idea fits best into, and has been adopted into *Marxism*.

Karl Marx had indicated his adherence to the labor theory of value. All value and all product are due to labor, and must be attributed to labor. Yet he was compelled to face the patent fact that capital equipment is productive. He would not yield his dogma. So he "explained" the productivity of capital equipment by adopting another dogma, that in each machine and in each unit of semi-finished product, there is "embodied labor", which was incorporated during the earlier stages of production, when the machine or the material was being produced.

## CONCLUSION

The ratio of the net output of a firm to one of the two figures representing the quantity of labor, does not give the productivity of labor, nor does it report properly on the productivity of the firm. The changes over time, of the ratio, do not reflect the pattern of changes that may be taking place in the effectiveness of the enterprise as a whole.

Possibly some economist who considers valuable the productivity studies that are currently being conducted by agencies of the American Government, may explain their value to the public, so convincingly as to persuade adverse critics. But, until such support is offered, in clearer fashion than anything that has come forth so far, the worth of the studies remains in the dark shadow of doubt.

## SELECTED BIBLIOGRAPHY

*America's Transportation* (magazine), vol. 2, p. 1, Sept. 1937, "The Productivity of Railroad Labor; A Refutation of Propaganda".

Anglo-American Council on Productivity (since 1952 it has been the British Productivity Council), London, *Productivity Measurement in British Industry*, a symposium, 1950 -- and many other works, including reports of productivity missions to the United States.

Herbert Ashton, "Some Considerations in the Measurement of Productivity of Railroad Workers", *Journal of Political Economy*, vol. 46, no. 5, Oct. 1938, pp. 714-720.

Jules Backman, several items of testimony before labor boards, in which he marshals time series and charts on productivity. Write the National Industrial Conference Board, New York City, for the references.

T. Barna, "Note on the Productivity of Labour; Its Concept and Measurement", *Bulletin of the Oxford University Institute of Statistics*, vol. 8, no. 7, July 1946, pp. 205-216.

Spurgeon Bell, *Productivity, Wages and National Income*, Washington D.C., Brookings Institution, 1940, pp. 344.

John D. Black (see page 19)

Witt Bowden, "The Productivity of Labor; A Note on Terminology and Method", *Journal of Political Economy*, vol. 46, no. 6, Dec. 1938, pp. 857-863.

British Productivity Council (see Anglo-American Council)

J. T. Brownlie and H. A. Grimshaw, *The Trade Unions and Output*, Birmingham England, the Birmingham Printers, for the Council of Ruskin College, 1920.

Eveline M. Burns, "Productivity and the Theory of Wages", an essay (pp. 183-209) in the symposium edited by T. E. Gregory and Hugh Dalton, *London Essays in Economics in Honour of Edwin Cannan*, London, Routledge, 1927, pp. 376.

Chamber of Commerce of the United States, *Our Miracle of Productivity*, mimeographed, 7 pages, April 1954 (Economic Research Department).

Colin Clark, *Conditions of Economic Progress* London, Macmillan, 1940, pp. 584. (Mr. Clark has other publications in the field; see my page 12)

Congress of Industrial Organizations (the C. I. O.), Wage Research Committee, *An Evaluation of Bureau of Labor Statistics Data on Productivity*, mimeographed, pp. 25, Pittsburgh, Jan. 1946.

John Davidson, *The Bargain Theory of Wages*, New York and London, G.P. Putnam's Sons, 1898, pp. 319 (see my page 8).

Hiram S. Davis, *The Industrial Study of Economic Progress*, Philadelphia, University of Pennsylvania Press, 1947, pp. 187. (Mr. Davis has other publications in the field; see my pages 18 and 19)

Gaston M. Deurinck, "Mesure de la Productivité", *Organisation Scientifique* (magazine), Brussels, Dec. 1948, pp. 362 ff. M. Deurinck has on file at the University of California at Los Angeles his master's thesis, on productivity.

Gertrude Deutsch, "Trends in Productivity", *Conference Board Business Rec-*

ord Feb. 1945, pp. 51-55.

-----, "British vs American Productivity", *Conference Board Business Record*, vol. 4, no. 11, Nov. 1947, pp. 317-321.

J. Frederic Dewhurst, *America's Needs and Resources*, New York, The Twentieth Century Fund, 1947, 812 pages.

Paul H. Douglas, *Theory of Wages*, New York, Macmillan, 1934, pp. 639. (Senator Douglas' other publications in the fields of labor and wages are also of interest here)

Eddy-Rucker-Nickels Co., *Progress in Productivity and Pay, All United States Manufacturing Combined*, , Cambridge, Mass., Dec. 1952, pp. 72.

W. Duane Evans and Irving H. Siegel, "The Meaning of Productivity Indexes", *Journal of the American Statistical Association*, vol. 37, no. 217, March 1942, pp. 103-111. (each author has other publications in the field)

Mordecai Ezekiel, "Productivity, Wage Rates and Employment", *American Economic Review*, vol. 30, no. 3, pp. 507-522, Sept. 1940.

Solomon Fabricant, *Output of Manufacturing Industries, 1899-1937*, 1940, pp. 682. -- *The Relation between Factory Employment and Output since 1899*, Dec. 1941, pp. 39. -- *Productivity of Labor in Peace and War*, Sept. 1942, pp. 28. -- *Employment in Manufacturing, 1899-1939; An Analysis of its Relation to the Volume of Production*, 1942, pp. 358. -- *Labor Savings in American Industry, 1899-1939*, 1945, pp. 52 (see my page 10)

All these published by the National Bureau of Economic Research, New York City.

-----, *Summary of Proceedings of the Conference on Productivity, October 28-29, 1946*, U.S. Department of Labor, Bureau of Labor Statistics, Washington, D.C.

Mr. Fabricant participated in two symposiums -- listed below. He has published a number of magazine articles.

Herbert Feis, *Principles of Wage Settlement*, a collection of decisions, New York, H.W. Wilson Co., 1924, pp. 452.

Allan Flanders, "Wages Policy and Full Employment in Britain", *Bulletin of the Oxford University Institute of Statistics*, vol. 12, nos. 7 and 8, July and August 1950, pp. 225-242.

A. W. Flux, "Industrial Productivity in Great Britain and the United States", *Quarterly Journal of Economics*, vol. 48, no. 1, Nov. 1933, pp. 1-38.

*Fortune Magazine*, "The Treaty of Detroit", vol. 42, no. 1, July 1950, 53-55. (the wage contract, General Motors and the United Automobile Workers)

Jean Fourastie, *Le Grand Espoir du XXIème Siècle*, Paris, Presses Universitaires, 1949.

-----, *Civilisation of 1960*.

-----, *Machinisme et Bienêtre*, Paris, 1951, pp. 255.

-----, *La Productivité*, Paris, Presses Universitaires, 1952, pp. 119.

-----, "Productivity and Economics", *Political Science Quarterly*, June 1951, vol. 66, no. 2, pp. 216-225.

French Government, *Actions et Problèmes de Productivité*, premier rapport du Comité National de la Productivité, édité pour le compte de Société Auxiliaire de Diffusion des Editions de Productivité, Décembre 1953, pp. 568. (and other publications, including reports of the productivity missions to the United States. Many of the publications may be secured from the Ambassador of France in Washington; some, from the Office of Technical Services, U.S. Department of Commerce, Washington.)

Martin R. Gainsbrugh and Gertrude Deutsch, *Productivity and Progress*, National Industrial Conference Board, May 1946, pp. 36, New York.

Oswald George (see page 13)

J. Gouin (see page 7)

H. E. Hansen, "Productivity on the Increase", *Survey of Business Practices*, National Industrial Conference Board, New York, June 1948.

Frederick H. Harbison, "The General Motors -- United Automobile Workers Agreement of 1950", *Journal of Political Economy*, October 1950, pp. 397-411.

Henry Hazlitt, "Delusions of Productivity", *Newsweek*, vol. 39, no. 6, Feb. 11, 1952, p. 74.

Graham Hutton, *We too can Prosper, the Promotion of Productivity*, London, 1953, published by Geo. Allen & Unwin, for the British Productivity Council.

Industrial Relations Libraries. This group of libraries, at Princeton University, the University of Minnesota, etc., have published a series of occasional mimeographed "exchange bibliographies", some of them dealing with productivity.

The International Labour Organisation (Geneva). *The Economic Background of Social Policy*. 1947, pp. 221; *Methods of Labour Productivity Statistics*, 1949, pp. 136; *Factors Affecting Productivity in the Construction Industry*, 1953, mimeographed, pp. 74; *Report on Productivity in Coal Mines*, 1953, pp. 137 (see my page 3)

Charles Mason James, *Measuring Productivity in Coal Mining*, Philadelphia, Wharton School of Finance and Commerce, University of Pennsylvania, March 1952.

Harry Jerome, "The Measurement of Productivity Changes and the Displacement of Labor", *American Economic Review*, vol. 22, no.1, Supplement, March 1932, pp. 32-40.

John Jewkes, "The Efficiency of American Manufacturing Industry", *Economic Journal*, Dec. 1930, vol. 40, no. 160, pp. 581-598.  
-----, "Is Britain's Industry Inefficient?" *Manchester School* (magazine), vol. 14, no. 1, Jan. 1946.

G.T. Jones (edited by Colin Clark), *Increasing Return*, Cambridge University Press, 1933, pp. 50 (see my page 12)

B.S. Keirstead, *The Theory of Economic Change*, Toronto, Macmillan of Canada, 1948, pp. 386 (see my page 14)

John W. Kendrick, *National Productivity and its Long-Term Projection*, Washington D. C., May 1951, mimeographed, pp. 36 plus charts, U.S. Department of Commerce, Office of Business Economics (see my page 14)

Labor Research Association, *The Labor Fact Book*, New York, International Publishers (a biennial).

Emil Lederer, "Technical Progress and Unemployment", *International Labour Review*, July 1933.

Wassily Leontief (see page 19)

C.E.V. Leser (see page 13)

Richard A. Lester, "Effectiveness of Factory Labor, South-North Com-

parisons", *Journal of Political Economy*, vol. 54, no. 1, Feb. 1946, pp. 60-75.

T. Levitt, "The Future of Collective Bargaining in an Age of Inflation", *Labor Law Journal*, Jan. 1954, pp. 7-27.

Charles Lindblom (see page 8)

S. Morris Livingston, "The Measurement of the Post-War Labor Supply and its Capacity to Produce", *Journal of the American Statistical Association*, vol. 40, no. 229, March 1945, pp. 20-28.

Knud Lönberg-Holm and C. Theodore Larson, *Planning for Productivity*, New York, International Relations Institute, 1940.

Daniel P. Loomis, Statement on the Award by Paul N. Guthrie, in the Productivity Wage Increase Case, Chicago, 1953. Summarized in *Traffic World*, vol. 91, no. 14, p. 74, April 4, 1953; also in *Railway Age*, vol. 134, no. 14, April 6, 1953.

A. Maddison, "Productivity in an Expanding Economy", *Economic Journal*, vol. 62, no. 247, September 1952, pp. 584-594.

-----, "Productivity in Canada, the United Kingdom and the United States", *Oxford Economic Papers*, New Series, vol. 4, no.3, October 1952. pp. 235-242.

-----, "Productivity in Canadian Manufacturing, 1935-1948", *Canadian Journal of Economic and Political Science*, vol.19, no.2, May 1953, pp. 222-226.

Harry Magdoff, "The Purpose and Method of Measuring Productivity", *Journal of the American Statistical Association*, vol. 34, June 1939, pp. 309-318.

Brotherhood of Maintenance of Way Employees *Journal*, vol. 56, no. 4, April 1947, pp. 11-12, "Productivity Increase Outstrips Gains in Wages"

American Management Association, *Economic Factors in Labor Relations*, Chicago, February 1947, pp. 35. (papers by Jules Backman and others)

Society for the Advancement of Management: the proceedings of the annual meetings touch on productivity. 84 William St., New York City.

University of Manchester, *Labour and Industry* (a symposium), Longmans Green, 1920, pp. 284. (includes a paper by Percy J. Pybus, "Labour, its Output and Reward", pp. 267-284)

National Association of Manufacturers (George G. Hagedorn), *Productivity, Gauge of Economic Performance* New York, 1952, pp. 48.

-----, *Instructors Manual* for the above, pp. 16. ("Educational Aids for Colleges", catalog no. 124a)

B. L. Markus (of the Russian Planning Commission), "The Stakhanov Movement and the Increased Productivity of Labour in the U.S.S.R.", *International Labour Review*, vol. 34, no. 1, July 1936, pp. 5-33.

Karl Marx (see pages 4, 11, 21)

Jean Trepp McKelvey, *American Federation of Labor Attitudes Toward Production, 1900-1932*, Ithaca, Cornell University Press, 1952, pp. 148.

Frederick C. Mills, *Productivity and Economic Progress*, New York, National Bureau of Economic Research, 1952 (see my page 6)

Ludwig von Mises (see page 11)

Raymond Moley, "Productivity as Pay Scale", a syndicated newspaper column, July 1951.

Henry L. Moore, *Laws of Wages*, New York, Macmillan, 1911, pp. 196.

National Industrial Conference Board, *The Miracle of Productivity* (Studies in Business Economics, no. 9), 1947, 10 pages, New York.

-----, *Productivity and Progress*, 1946, 36 pages.

----- *Measuring Labor's Productivity* (Studies in Business Policy, no. 15), 1946, 20 pages. A symposium; contributors: Fabricant, Rucker, Evans, Court.

William H. Nicholls, *Labor Productivity Functions in Meat Packing*, University of Chicago Press, 1948, pp. 256.

J. Shield Nicholson, *The Effects of Machinery on Wages*, London, 1878; second edition, London, Swann Sonnenschein, 1892, pp. 143.

John W. Nickerson, "How Should Labor Participate in Gains Through Technological Improvement?" *Advanced Management*, June 1952, pp. 2-7.

Edwin G. Nourse and others, *America's Capacity to Produce*, Washington D.C., Brookings Institution, 1934, pp. 608.

Organisation for European Economic Cooperation (OEEC, see page 7)

Melchior Palvi, "Escalators and the Productivity Racket", *Commercial and Financial Chronicle*, vol. 177, no. 5206, New York, New York, March 26, 1953, page 1 and following.

Raymond Pearl, *Medical Biometry and Statistics*, Philadelphia, W.B. Saunders Co., 3rd edition 1941. (see especially Chapter 7, on Rates and Ratios; and see my page 6)

H. C. Pentland, "Physical Productivity in Canada, 1935-1952", *Economic Journal*, vol. 64, no. 254, June 1954, pp. 399-404.

H. W. Quaintance, "The Influence of Farm Machinery on Production and Labor", *Publications of the American Economic Association*, 3rd Series, vol. 5, no. 4

Melvin W. Reder, "The Significance of the 1948 General Motors Agreement", *Review of Economics and Statistics*, vol. 31, no. 1, February 1949, pp. 7-14.

*Review of Economics and Statistics*, symposium on productivity, in vol. 31, no. 4, November 1949, pp. 292-311. Seymour Harris, Thomas K. Hitch, Clark Kerr, John C. Davis, Solomon Fabricant (see my page 10)

David Ricardo (see pages 4, 16)

John D. Robertson and F. G. Gurley, "Labor and Management Differ on Accounting as to Productivity of Employees and Wages", *Railway Age*, vol. III, pp. 239-241, August 9, 1941.

Charles Robinson (see page 8)

S. McKee Rosen and Laura Rosen, *Technology and Society; the Influence of Machines in the United States*, New York, Macmillan, 1941, pp. 474.

Arthur M. Ross, "The General Motors Wage Agreement of 1948", *Review of Economics and Statistics*, vol. 31, no. 1, February 1949, pp. 1-7.

Laszlo Rostas, *A Report on International Comparisons of Productivity in British and American Manufacturing Industry* pp. 125, 1947.

-----, *Productivity, Prices and Distribution in Selected British Industries*, 1948, pp. 199.

-----, *Comparative Productivity in British and American Industry*, 1948, p. 263. These three books sponsored by the National Institute of Econ-

omic and Social Research, London, and published by the Cambridge University Press.

Fred Rudge, *Bargaining on Productivity, a Management Guide*, Washington D. C., Bureau of National Affairs, 1953, pp. 146.

George E. Sadler, *The Productivity Program of the Bureau of Labor Statistics*, mimeographed by the Bureau of Labor Statistics, Department of Labor, 1950, 18 pages plus charts.

W. H. Schmidt (see page 8)

Benjamin M. and Sylvia K. Selekman, "Productivity and Collective Bargaining"; two articles in *Harvard Business Review*, vol. 27, pp. 373-392, May 1949; and vol. 28, pp. 127-144, March 1950.

Irving H. Siegel, "The Concept of Productive Activity", *Journal of the American Statistical Association*, vol. 39, no. 226, pp. 218-228, 1944.  
-----, *A Half-Century of American Productivity Measurement*, Washington D. C., 9 pages, December 1950, mimeographed by the Bureau of Labor Statistics, U.S. Department of Labor.  
-----, *Concepts and Measurement of Production and Productivity*, Washington D. C., 108 pages, 1952, mimeographed by the Bureau of Labor Statistics.

Hans Wolfgang Singer (see page 13)

Adam Smith (see pages 1, 4)

George Soule, "The Relation between Wages and National Productivity", *Annals of the American Academy of Political and Social Science*, vol. 100, March 1922, pp. 85-90.

Peter O. Steiner, "The Productivity Ratio: Some Analytical Limitations on its Use", *Review of Economics and Statistics*, vol. 32, no. 4, November 1950, pp. 321-328.

----- and William Goldner, *Productivity*, Berkeley, University of California Institute of Industrial Relations, 1952, pp. 60.

G.D. Sutton, "Productivity in Canada", *Canadian Journal of Economic and Political Science*, vol. 19, no. 2, May 1953, pp. 185-201.

F. W. Taussig, "Labor Costs in the United States Compared with Costs Elsewhere", *Quarterly Journal of Economics*, vol. 39, no. 1, Nov. 1924, pp. 96-114 (see my page 21)

Council for Technological Advancement (affiliated with the Machinery and Allied Products Institute), *The Measurement of Productivity*, Bulletin no. 14, August 1953, 16 pages, Chicago.

Lazar Teper, "Limitations of the Existing Productivity Measures and the Need for New Studies", presented to the Conference on Productivity, Washington D. C., 1946.

-----, "This Thing Called Productivity", *American Federationist*, vol. 55, no. 11, November 1948, pp. 16-18.

J. Tinbergen, "The Influence of Productivity on Economic Welfare", *Economic Journal*, vol. 62, no. 245, March 1952, pp. 68-86.

L.H.C. Tippett, "The Study of Industrial Efficiency, with Special Reference to the Cotton Industry", *Journal of the Royal Statistical Society*, vol. 110, part 2, 1947, pp. 108-122.

-----, *Indices of Productivity* (miscellaneous pamphlet no. 4, Conference Series no. 9), London, 1949, pp. 36, British Institute of Management.

Twentieth Century Fund, with Encyclopedia Britannica Films, a motion

picture film: *Productivity, Key to Plenty*, 1949. (based on Dewhurst)

United Kingdom, *Census of Production* (see my pages 13, 15)

-----, Minister of Production, *Report of the Cotton Textile Mission to the United States of America*, London, 1944, pp. 77.

-----, Economic Information Unit, London, *Productivity Pays*, a pamphlet, 1949.

United Nations, Economic Commission for Latin America, *Labour Productivity of the Cotton Textile Industry in Five Latin-American Countries*, New York, 1951, pp. 293.

United States Government, Department of Agriculture, Bureau of Agricultural Economics, Washington D.C. (see my page 17)

Martin R. Cooper, Glen T. Barton and Albert Brodell, *Progress of Farm Mechanization*, October 1947, pp. 101.

Reuben W. Hecht and Glen T. Barton, *Gains in Productivity of Farm Labor*, Dec. 1950, pp. 121.

*Farm Production, Practices, Costs and Returns*, Oct. 1949, pp. 115.

United States Census (see my page 15)

United States Government, Department of Labor, Bureau of Labor Statistics, Washington D.C. This is the principal source of productivity information. The longer reports are often summarized in the *Monthly Labor Review*. My paper would be made very bulky if I attempted to list all the BLS publications in the field. The list would begin as early as the 1890s, when Commissioner Carroll D. Wright presented his famous reports.

Luckily, the BLS is equipped to furnish to inquirers adequate lists of publications; their library is excellent, and is open to all. (see pages 2, 3, 7, 14)

United States Government. The National Research Project was administered under the Works Progress Administration. About thirty monographs were published, Philadelphia, 1936 to 1942, many touching on productivity.

United States Government, National Resources Committee, *Technological Trends and National Policy*, Washington D.C., June 1937, pp. 338. This contains the article, David Weintraub, "Unemployment and Increasing Productivity", pp. 67-87.

United States Government, President's Council of Economic Advisers, semi-annual reports (see my page 14)

United States Senate, Special Committee Investigating the Defense Program, *Featherbedding and Make-Work Rules*, Nov. 1942. (summarized in *Railway Age*, vol. 113, Nov. 1942, p. 798)

United States Congress, Joint Committee on the Economic Report, *Report on Current Gaps in our Statistical Knowledge*, 1948, pp. 11.

United States Steel Corporation (see pages 2, 7)

Charles R. Walker, "American Productivity", *Fortune Magazine*, vol. 33, nos. 1 and 2, January and February 1946, pages 150 ff. and 131 ff.

David Weintraub, "The Displacement of Workers through Increases in Efficiency; and their absorption by Industry", *Journal of the American Statistical Association*, vol. 27, December 1932, pp. 383-400.

R. B. Whieldon, "Labor Productivity", *Editorial Research Reports*, vol. 2, no. 13, Sept. 25, 1946, pp. 647-662.

C. H. Wickens, "Australian Productive Efficiency", *Economic Record*, vol. 3, no. 5, pp. 175-188, Nov. 1927.

Charles Erwin Wilson, "Five Years of Industrial Peace; An American Pattern for Labor-Management Relations", *Vital Speeches of the Day*, vol. 16, no. 19, July 15, 1950, pp. 605-608.

-----, *Productivity, the Key to Progress*, Detroit, General Motors Corporation, Nov. 1950, 11 pages (see my page 9)

University of Wisconsin, Industrial Relations Center, *Report on the Conference on Productivity held in Milwaukee June 1949*, 42 pages, a symposium. Participants: Messrs. Fleming, Lescohier, Gainsbrugh, Scanlon, Clague, Baldwin, Friedrick, Karkrider, Cappel, Feinsinger, Gratz, Evans, Witte.

Leo Wolman, "Machinery and Unemployment, Difficult Problems of Measurement", *The Nation*, vol. 136, Feb. 22, 1933, pp. 202-204.

A. Wubnig, "The Measurement of the Technological Factors in Labor Productivity", *Journal of the American Statistical Association*, vol. 34, June 1939.

Allyn A. Young (see pages 12,13)

Sigmund P. Zobel, "On the Measurement of the Productivity of Labor", *Journal of the American Statistical Association*, vol. 45, June 1950, pp. 218-224.

Ferdinand Zweig, *Productivity and the Trade Unions*, Oxford, England, Basil Blackwell, 1951, pp. 240.

#### Periodicals that give attention to productivity:

##### Advanced Management

(two magazines of the American Federation of Labor) The American Federationist and Labor's Monthly Survey

Bureau of National Affairs (usually called by its initials, the BNA) What's New in Collective Bargaining; Negotiations and Contracts  
Business Week

Les Cahiers de la Productivité (recent issues announce that this magazine is a supplement to Productivité Française)

Capital Goods Review

Chamber of Commerce of the United States, Economic Intelligence

Cleveland Trust Co., Business Bulletin

Congress of Industrial Organizations (the CIO), Economic Outlook

Economic Journal

Economic Record

Economist

Guaranty Trust Co., The Guaranty Survey

Handbook of Labor Statistics (an annual, published by the Bureau of Labor Statistics)

Industrial and Labor Relations Review

Information Service, Inc., Labor-Personnel Index

International Labour Review

Journal of the American Statistical Association

Journal of Political Economy

Journal of the Royal Statistical Society

Journal of the Society for the Advancement of Management

Labor Fact Book (a biennial)

Labor Law Journal

Management and Engineering

Manchester School

Mill and Factory (published a "handbook" in 1947)

Modern Management

Monthly Labor Review

National City Bank, Monthly Letter on Economic Conditions

National Industrial Conference Board, Business Record

Oxford University, Bulletin of the Institute of Statistics  
Productivité Française  
Quarterly Journal of Economics  
Railway Age  
Review of Economics and Statistics  
Survey of Current Business  
Target (published by the Central Office of Information, London)