Book Reviews

Basic Facts on Productivity Change. Solomon Fabricant. National Bureau of Economic Research, Inc., New York, 1959. viii + 49 pp. $1.

When you listen today to the discussion of any burning professional economic problem by economists or laymen it will not be long before you hear the word *productivity*. Wage rate increases in excess of productivity gains cause inflation. Productivity must be raised if the West is to win the battle of production with the nations of the Communist bloc. Productivity must rise if production in the underdeveloped countries is to match or exceed the population growth. If productivity increases as in the past, the American economy will grow by 40 percent over the next decade. Productivity, it seems, is the key to the solution of many economic problems.

The National Bureau of Economic Research has initiated a number of research projects which have a bearing on the measurement of changes in productivity. These studies will appear in voluminous tomes over the years; meanwhile the debate about productivity goes on without benefit of these research studies.

In this situation it is highly welcome that Solomon Fabricant, director of research of the National Bureau, presents in a small pamphlet the main findings of the several research studies which are under way. All students of the topic will find here in concise form a summary of the pioneering work done in this field, by John W. Kendrick, in particular.

However, the layman who is lured to this pamphlet by the author's promise to state the findings "in a minimum of technical language" (page 3) will be more exasperated than enlightened by some aspects of the study. If he is looking for advice on how to measure productivity, he finds not one measurement but 46 in the first summary table. Let me hasten to add that I do not criticize the author for presenting various ways in which productivity can and should be measured. Indeed, I believe that this concept has different meanings and requires different measurements depending on whether it is used, for example, in a discussion of the effects of next year's wage rate increases, or in an international comparison, or in projecting the growth of an economy. More guidance would have been helpful in determining which measurement is most suitable for which purpose.

The summary table presents annual long-term productivity gains of between 0.7 and 2.3 percent for the period from 1889 to 1953. The most refined measurements give an average between 1.4 and 1.7 percent. It seems that the author believes that only these figures should be used, rather than the 2.3 percent which results from the conventional measurements.

The conventional measurement of productivity simply divides the dollar value of total production by the number of man-hours worked in an industry or in the economy as a whole. In order to make comparisons over time meaningful, the dollar values are expressed in constant prices; in order to make international comparisons of productivity levels meaningful, the values have to be expressed in some comparable money unit. An increase in productivity thus measured does not necessarily mean that employees have worked that much harder or that much more skillfully. The increase in productivity may be due also to the increased use of capital equipment, to technological and managerial innovations, and to many other factors. Productivity gains may be held up, however, if real costs of production or distribution rise—for example, through the use of lower-grade raw materials, through more costly transportation, through increased sales effort (advertising), and so on. What we measure is the net gain in all these factors.

The National Bureau studies have brought a threefold refinement of this conventional measurement of productivity. First, it is proposed to use a "weighted" measurement of man-hours, which takes account of changes in the relationship between more or less skilled labor (using wage and salary rates for measuring differences in skills). The second, even more important, refinement consists in computing the increase in production not only per man-hour worked but also per unit of tangible capital. These two productivity measurements are then combined into one ratio which expresses the extent to which total production has increased over and above the weighted increase in man-hours worked and the increase in tangible capital. A third kind of refinement relates to a special treatment of defense production in the production total. This refinement is understandable only to students familiar with previous National Bureau publications. It is used but not explained in the present pamphlet.

The second refinement, the introduction of a productivity ratio of an increase in output related to an increase in tangible capital, is the most significant innovation introduced by the National Bureau studies In virtually all instances in which productivity ratios have been used heretofore—in connection with wage rate increases, inflation, international comparisons, and economic projections into the future—the conventional measurement has been used. Is the conventional measurement obsolete and should the refined measurement be used from now on for these various purposes? Although the author does not directly answer this question, the reader gets the impression that wrong answers are obtained if the conventional measurement of productivity is used. I will briefly attempt to give my own answer, because of the crucial importance of productivity measurements for so many timely issues of practical economics.

Let us first assume that we are comparing productivity gains of two countries—one of extreme capital scarcity, the other, of capital abundance. In the country of capital scarcity most work is done by labor; the installation of additional machinery is kept to a minimum. In the country of capital abundance more machinery is installed year after year. Gaged by the conventional measurement, productivity gains very little in the first country; it increases rapidly in the second. If the country of capital scarcity should be tempted by the comparison to install more machinery, it may be making a mistake, because its economic structure may be such that it should make the most efficient use of labor rather than replace labor by machines. The refined measurement would more accurately indicate the comparative advancement in efficiency of the two countries. (This simplified example should not be construed as a position on my part with respect to the question of whether adoption of modern technology is desirable for overpopulated and underdeveloped countries.) If we compare productivity development in countries or time periods of substantially different economic structure, the refined method of measurements presents an advancement over the conventional, cruder method.

As a matter of fact, Fabricant does use the combined index for a very illuminating long-range historical analysis

of the relationship between productivity gains and the rise in real earning in the economy as a whole and in selected industries. These findings give what is probably a more accurate picture than previous studies made with less refined statistical methods.

Let us now consider the subject of productivity gains in connection with agreements in wage rate increases. Let us assume that labor unions and management have agreed on increases in wage rates in proportion to the increase in productivity in the economy as a whole. What difference does it make whether the conventional or the refined method of measurement is used? If the conventional method is used for determining a wage rate increase, labor participates pro rata in the net gains in production attributable to the installation of new machinery, to technological and managerial improvements, and to all other factors making for an increase in production per unit of tangible capital invested and per man-hour worked. The corporation, on the other hand, *shares* in the contribution of a greater labor effort. Basically the percentage distribution of incomes between labor and capital remains the same.

If the refined measurement is used, labor would not participate in the production gains attributable to a larger investment in tangible capital per worker. Labor would gain pro rata through improvements in the efficiency of management and in the technological qualities of plant and equipment. Use of productivity ratios for an appraisal of wage rate increases is by its nature a short-run application. In the short run, very drastic changes in the relationship between labor and capital cannot be assumed. Therefore, the assumption of a constant distribution between capital and labor should not cause a very serious error in a short-range analysis. On the other hand, the use of a measurement of capital productivity resting on only crude tangible capital data does introduce a source of possibly serious error into the calculation.

The capital productivity ratio which is combined with the man-hour productivity ratio is based not on tangible capital actually used but on that available (footnote, page 14). Thus, the refined productivity measurement is a combined measure of production in relation to man-hours *actually worked* and of production in relation to tangible capital *available,* irrespective of the degree of its utilization. It would be justifiable to measure production in terms of available factors of production (manpower and machines) as an expression of the efficiency of the economic system. The combination of one factor actually utilized with another factor available introduces an error in the computation which may be less than the error committed if different countries or distant time points are compared with the use of the conventional period. The error of the refined method may, however, be larger than the error of the conventional method for short-range analyses.

Also, as a tool for long-range economic projections the use of the conventional method is justified as long as the economic analyst is fully aware that the rate of productivity growth thus measured includes the effect of changes in the tangible investment per worker in addition to all other factors which make for either increased or decreased net output. For a projection into the future it would be best if each of these factors could be appraised separately.

A mechanical extrapolation of the refined index of productivity is not much better than an extrapolation of the cruder index. The latter has the advantage that it can be taken as a point of departure for studying each of the factors which enter its determination, including changes in tangible capital per worker, the efficiency of capital, the efficiency of management, and all other factors. In any case, a projection must consider separately the trends in the ratios of capital stock to output and of man-hours to output. But no particular advantage would be gained by using the combined index for this purpose.

The refinements in productivity measurements proposed through the various studies of the National Bureau and summarized in this pamphlet have substantially contributed to our understanding of the problem and have provided us with tools for measurement that are of great value for certain problems. The conventional method of productivity measurement is, however, not yet obsolete and probably will continue to be most suitable for most practical purposes. Fabricant failed to discuss the purposes for which the various methods of measuring productivity are most suitable. This is my only criticism of an otherwise extremely useful publication.

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Medical Education. Annotated bibliography, 1946–1955. World Health Organization, Geneva, Switzerland, 1958 (order from Columbia University Press, New York). 391 pp. $6.75.

The basis for this select bibliography was a search of the world literature on medical education published between the years 1946 and 1955. Over 4000 references were collected. Virtually all of them were examined, and 2500 were selected for listing in this bibliography.

The references are classified alphabetically by author under the following headings: "History of medical education"; "Aims, trends, and general considerations"; "Special subjects" (for example, allergy, anesthesiology, bacteriology); "Pre-medical education"; "Students"; "Teachers"; "Curriculum"; "The patient in medical education"; "Academic teaching"; "Audio-visual aids"; "Research in medical education"; "The medical school in the community"; "Internship and licensure"; and "Countries and continents." An author index is included.

Brief annotations are given for all articles written in a language other than English, or, in the case of works published in English, for articles whose scope cannot be deduced from the title.

The Physics of Elementary Particles. J. D. Jackson. Princeton University Press, Princeton, N.J., 1958. ix + 135 pp. $4.50.

This concise survey of elementary particle physics had its origin in a series of lectures given at the summer seminar of the theoretical physics division of the Canadian Association of Physicists in 1957. The emphasis tends to be on recent developments; for example, the author gives considerable attention to the formulation of the theory of β-decay required by the experimental asymmetries that demonstrate nonconservation of parity.

The book is divided in three parts. The first outlines the interpretation of results on pion-nucleon scattering and on photoproduction of pions from nucleons. The second discusses K mesons and hyperons in terms of the Gell-Mann classification scheme and several models that have been proposed for the strong interactions of these "strange" particles. The third part is devoted to weak decay processes. Both the β-decay of nuclei and meson and hyperon decays are discussed, with emphasis on the nonconservation of parity. Among the topics that are omitted are nucleon-nucleon forces, antinucleons, and the production of pions in nucleon-nucleon collisions. In general, experimental methods are not described, but experimental results are quoted whenever necessary to justify or illuminate the development of theoretical ideas.

The result is a logical and consistent presentation of the areas in which understanding of elementary particles has been advanced most significantly during the last decade. As an introduction to the field of elementary particle physics the book will be of somewhat limited usefulness, since a good working knowledge of quantum mechanics, nuclear