Capital Intensity and Productivity in Indian Industry by Asit Banerjee. Delhi, Macmillan, 1975, 196 p. Price Rs. 45.

The analysis of productivity in selected industries and sectors of the economy is an extremely worthwhile econometric exercise and offers valuable insights for a proper understanding of their functioning. In India, unfortunately, this was a comparatively neglected area till recent times. Dr. Banerjee has done a useful service by converting his doctoral thesis into a comprehensive book on the subject. The author has worked with time series and cross-sectional data, the terminal years being 1946 and 1964. The industries covered are Manufacturing, Textile, Bicycle, Paper and Sugar. The Census of Indian Manufactures and the Annual Survey of Industries are the major sources of data.

Central to the analysis of productivity, defined as a ratio of output over input, is the problem of measuring these quantities. Output is almost universally measured in terms of "Value — added by the manufacturing process", which is measured by the value of finished products less the cost of throughput items e.g. raw-material, fuel, capital servicing charges etc. The author has included in finished products not only the goods sold but all that has been produced in a particular year, and has possibly added to annual sales the closing inventory of finished goods. He has not clarified as to how he overcome the conceptual difficulty that while sales are valued at selling price, inventory is valued at cost. He has also excluded capital servicing charges. This This value — added figure is thus gross of depreciation.

The measurements of inputs offers a challenge which is possibly more fascinating. Inputs should actually denote the quantum of services following from the productive agents, typically capital and labour. Thus, wages represent the 'flow' of labour into the productive stream. In reality, however, the reciprocity between 'wages' and 'labour-inputs' is much less tautological, because market based wages do not reveal "the strong externalities associated with educational investment", (pp. 41). The author has however brushed aside this problem after invoking the limitations of human-asset-accounting. With capital, however, we are faced with the problem of selecting the variable that correctly specifies the 'flow' or 'use' of the productive capacity. Accounting depreciation having its well-known limitations, the analyst is forced to use a 'stock-concept' as a proxy of capital-inputs. The assumption is implicit that the 'flow' is proportional to the 'stock'. Several difficulties are now encountered.

First, net book values of assets may not be a useful indication because accounting depreciation neither leads to a correct measure of the productive capacity, nor does it give any clue to technological obsolescence. (This aspect and the problems of defining capital have been adequately focussed in the book.) Secondly, in defining capital, should the analyst take gross fixed assets alone ? Dr. Banerjee has adopted this method, and it may indeed be true that gross fixed assets provide the closest approximation to the productive capacity. But in this scheme 'output' and 'input' may lose some of their comparability when the fixed assets are rendered idle through a problem posed by current assets, say, stockout of raw-materials or spares. The

output measured in terms of value-added will automatically take care of such a contingency, while unutilised 'stock' of gross fixed assets will be included in the measure of capital-inputs. We may put the question in a slightly more stylised fashion : Is the proportionality between 'flow' and 'stock' acceptable in the event of under-utilisation of capacity caused by raw material shortage or, more plausibly, by lack of effective demand ? The author has not touched on this aspect. The present reviewer has however come across one study (Comitini and Huang, *Journal of Political Economy*, 1967) where the use of a capacity-corrective index has been briefly described.

Price-index corrections have been made for output as well as inputs. The gross-value-added has been deflated by using relevant whole-sale price index. For capital, net additional investment has been calculated for each year and has been corrected by applying the index for "machinery and construction cost."

The calculation of partial productivity indices is the relatively simpler task of finding the output per unit of particular input. The book gives for each industry the partial productivity indices of capital and labour, as well as capital-labour ratio, rate of return on capital, share of labour in value-added, and unit materials and fuel cost per unit of value-added and gross output.

The partial productivity indices are however of, limited use. Far more meaningful is the estimation of total factor-productivity which correctly signifies the result of combination among the various factor-inputs. The essential feature at this stage of analysis is the use of a production-function, which may be written as : $V = f (K, L)$, where V is output, K is capital and L is labour. If there is an increase in output over and above what can be accounted for by an increase in capital and labour, then such an increase in output is said to be a result of increased productivity. In the above equation it is implied that technological innovation will manifest itself in the use of newer and more productive machines, and that technology is thus 'embodied' in capital (K). In the disembodied form $V = f (K, L, T)$, where T is technology. The logic of 'disembodiment' may lie in the fact that technological progress may also be revealed through more productive methods, not encapsulated in the value of fixed assets. The disembodied form may indeed provide a more penetrating insight by using R & D expenditures as a surrogate for technology, Jora R. Minasian (*American Economic Review*, May 1969) has shown that gross return on investment in R & D is 54% as compared to 9% for capital. Dr. Banerjee has discussed the split in economic wisdom regarding the treatment of technology and has estimated the total productivity — index on the basis of three models. The first is Solow's disembodied model of 1957, the second is Kendrichs' model and the third is the 'Constant Elasticity of Substitution' — model.

The C.E.S. — model is supposed to be one of the most sophisticated in the field of productivity-analysis. It assumes that the elasticity of substitution (σ) between capital and labour can take any value between zero and infinity. However, for a particular industry, this value is not supposed to change over the years. (This restriction is removed in the slightly more sophisti-

cated model called "variable Elasticity of Substitution"). A knowledge of σ is thus essential for specifying the production — function exactly and the estimation of σ becomes one of the most important tasks in the analysis. The author has used five different models to estimate σ. The models include "variants of the standard SMAC relation to allow for partial adjustment (for distributed lag), serial correlation and nonconstant returns to scale", (pp. 58). He has used the least square method of estimation and argues these would be "unbiased and consistent (pp. 62)". The value of σ, in all the industries and by all the models, has not been found to be significantly different from one. This seems to be the more common experience with other analysts also, who accept the Cobb-Douglas function on the basis of $\sigma = 1$, although there are many restrictive assumptions in the Cobb-Douglas model. It is a moot point as to whether a different method of estimation would have yielded different results. The Covariance Matrix method of estimation (which is theoretically much superior to least-square) was employed by G. S. Sahota (*The Review of Economics and Statistics*, May, 1966), but σ was again not significantly different from 1.

An examination of the partial and total productivity indices of all the industries shows a general trend which is not very encouraging. Capital intensity has increased as revealed by K/L ratio), labour producitivity has increased (thus implying in some cases a fall in real cost of labour, where share of labour in value-added has remained somewhat constant), capital productivity has decreased, and total productivity has either declined or has improved only marginally. These findings are not at variance with the results obtained by other analysts in India.

When there is a rise in productivity, it is attributed to "technical progress" and it would follow that productivity—analysis would properly culminate in the construction of a hypothesis to account for technical progress. An excellent summary of such hypotheses is given by Sahota (mentioned above). Dr. Banerjee is however faced with a situation which possibly epitomises "technical regress". The author maintains that the fruits of technical progress have been more than offset by low capital productivity. Although he has given a general historical description of the changing industrial milieu, he has not offered any statistically tested (or testable) hypothesis for "technical progress". His contention that capital (and total) productivity declines as a result of capital-deepening is more an observation than a hypothesis. The chronic prevalence of capacity underutilisation is hardly illumined by his analysis.

The book contains a good list of references, but one misses any author or topic-index. The mathematical exposition of production-functions is adequate. The publishers could have been a little more careful with spelling. On the whole, a useful book for a researcher and for the more frequently visited shelves of a library.

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