Capital Output Ratios in Indian Industry

The author, who is from the Massachusetts Institute of Technology, is currently examining certain aspects of the development of industries in India.

In the discussion of both the First and Second Five Year Plans, the capital: output ratio has inevitably been of major interest to economists concerned with the Plans, since the estimate of this ratio is a determinant of the overall investment requirements of the Plans. For the first Five-Year Plan a ratio of about 3.0 was assumed. That is, for an increase in national income of one rupee, an investment of 3 rupees would be required. This ratio was largely and inevitably based on the experience of other countries which had industrialized. In fact the actual ratio during the first Five-Year Plan proved to be much lower about 2.3. This reflected the great increase in agricultural output during the period and the relatively low capital: output ratio that existed in agriculture.

This same ratio of 2.3 is assumed to continue during the second Five-Year Plan, although there has been a shift in investment plans and projected output increases from agriculture to manufacturing industry. In both the public and private sectors of factory industry it is planned to invest approximately Rs 1,300 crores to achieve an increase of 540 crores in the income derived from factory establishments or a ratio of 2.4. There has been a good deal of discussion among economists whether these assumed ratios are too low that is whether the Plan is too optimistic with respect to its investment programme.

During the past six months I have been studying growth in Indian industry for the specific purposes of computing fixed capital output ratios for certain industries, and to estimate trends in the use of capital (machinery) and labour in those industries. The three industries studied up to now are the cement, paper and iron and steel industries; and it is planned to make similar studies for the cotton textile, sugar, and engineering industries. The three industries examined up to now are considered to be relatively capital intensive—i.e. to require a large investment to expand output.

Two methods were used to compute the estimates of the capital: output ratio. The first was to relate changes, over time, in the gross block item on the balance sheets of the companies in the industry, to changes in their output estimated at capacity, after corrections were made for changes in the prices of machinery and output. The second was to use engineering data of actual estimates of the costs of constructing a new plant or expanding an existing one. From these data various ratios were computed. The relevant ratio to use for the Five-Year Plan is the one that relates changes in investment to changes in income derived from the greater output i.e. net value added. This is called the marginal capital: net value added ratio and estimates the additional fixed capital required to increase the income derived from a given industry by one rupee.

It should be stressed that the results are quite tentative at this stage of the research, with the existing data, and with the complicated series of computations and adjustments that are gone through before a ratio is computed. Nevertheless, they are offered since they give what appear to be reasonable orders of magnitude, and because they may be of value in the present period of planning. For the cement industry the marginal fixed capital: value added ratio is about 3.0-3.5; for the pulp and paper industry it is about 3.5-4.0; and for the basic iron and steel industry (steel works and rolling mills) it is also about 3.5-4.0. This means that for the cement industry an investment in plant and machinery of about 3.3 rupees is required to increase the net income from greater output by 1 rupee; and in the paper and in iron and steel industries the investment required is about 3.8 rupees to do the same. Working capital requirements for this greater output were not considered. If they were added to the fixed capital the ratios would obviously be larger.

Of the total planned investment of Rs 1,300 crores in factory industry in the second Plan, these three industries will absorb almost 50 per cent (the investment in fixed plant alone in the iron and steel industry will approach 500 crores). With the ratios indicated for these industries, and with the expansion planned for the engineering and chemical industries, which are also supposedly capital intensive, it is unlikely that the ratio for all manufacturing will in fact be as low as the 2.4 ratio that the Plan assumes.

Various other tentative conclusions with respect to the use of capital and labour in these three industries also emerge from my studies, and these may be of value in the present discussion of the Five-Year Plan.

First, unlike the United States, there is no positive relationship between the size of the average fixed capital: output ratio in those industries and the size of the firm. In the United States this positive relationship was explained partly by the fact that the larger firms are able to purchase more labour-saving machinery. In fact, in India, if any relationship was found it would support the opposite conclusion—that the larger firms have lower capital: output ratios than the smaller firms. In these three industries the possibilities of variations in the actual product-making machinery are not great. However, in the raw material handling, transporting, loading and unloading, and in packing, it is possible to substitute machinery for labour readily. The lower capital: output ratio for the

This passes no judgment on the overall ratio in the Plan, which may be more correct. It is significant that in an as yet unpublished study of capital: output ratios in the USSR during the 1928-37 Plan period both and overall ratio and a ratio for manufacturing within a range of 2.2 to 3.0 were computed. See Eckstein and Gutmann "Capital and Output in the Soviet Union, 1928-37" (mimeographed.)

larger firms support the notion that both the large and small firms in India use similar plant and equipment. The larger one has certain advantages of size which permit it to achieve greater output with a smaller investment (for example a larger machine may cost less per unit of output than a small one). However, the subsidiary operations mentioned have been done in a similar manner—primarily by using labour—by both large and small firms. The larger firm had not in the past invested more money for the mechanization of those operations. This reflected the past cheapness of labour and dearth of capital in India to both large and small firms. Therefore it had not paid to substitute machinery for labour where it had been possible to use labour.

My studies however indicate a current trend to the greater mechanization of operations in India. While this is of lesser importance in older plants, the plants that are being expanded and the new plants being constructed are increasingly mechanizing those operations—raw material handling, moving, loading and unloading, and packing materials—in which machinery can be substituted for labour. This trend, and it is only a trend, reflects in part the overemployment of labour that occurred during the war. While this was of minor importance when wages were very low and workers could be easily dismissed, the rise in money wages since the war and the increasing difficulty of reducing the labour force have made for greater mechanization with expanded output. Furthermore the necessity for provision of housing, etc., and the increasing legal and union rigidities in the conditions of employment, make for greater mechanization both to reduce costs and to reduce potential future difficulties. Meanwhile the cost of capital in the form of Interest rates has remained low in India for large, well established firms and it is possible, with the government's accelerated depreciation policy, to write-off the value of additional plant and equipment within a relatively short period of time. At the same time, where the government is constructing plants, it is building the most modern, capital-intensive plants. It has invested as much as it believes desirable in those plants without limiting itself with respect to capital supplied for that purpose. The result is that private firms, to compete, are forced to mechanize their operations. The combined effect of these tendencies is to raise the capital:output ratio and the capital requirements in manufacturing. With the overall shortage of capital resources indicated in the Draft Outline of the Second Plan, together with the major problem of unemployment of labour, it may be that government policy has gone too far in raising the cost of labour, and in keeping the cost of capital low both to the large private plant owner and for its own plants. Some change of this policy might lead to greater employment of labour in factory industry (especially in the peripheral operations) and to greater conservation of the apparently limited capital resources, during the next Plan period. As the rate of capital accumulation grows and unemployment is decreased it may prove increasingly economical to adopt policies resulting in a greater use of more capital intensive techniques.