

Techniques for Maximum Growth and Employment

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A LESS developed economy with a large and growing population but without a high saving ratio faces the delicate problem of programming its industrialization without aggravating the difficulty of underemployment. India is no exception, judging from the current controversy over the optimal choice of techniques. In this note I shall comment on two specific aspects of the problem, namely, (a) the question of capital-intensive vis-a-vis labour-intensive lines of development programming, and (b) the question of whether disguised unemployment is or is not a reliable source of capital formation.

An economy's rate of growth is generally understood to be a function of the saving ratio and the capital-output ratio. Since a growth rate is assumed to vary directly with the saving ratio and inversely with the capital-output ratio, it is often proposed that an underdeveloped economy with a low saving ratio should concentrate on "the lowering of the capital-output ratio". This proposal is popularly taken to imply that an underdeveloped economy had better gear its investment programming to agricultural projects, cottage industries, and light manufacturing that presumably "offer relatively lower capital-output ratios." Such a policy recommendation is usually qualified by the second thought that the lowering of the capital-output ratio may conflict with "the creation of a capital base for the economy" involving "capital-intensive" investment. As a consequence the policy makers are left suspended in mid-air, wondering whether to encourage light or heavy industrialization in the overall scheme of economic development.

Given a low saving ratio, the above proposal for lowering the capital-output ratio is theoretically sound, but the popular inference that therefore available capital must be invested in agriculture and light industries involves a great deal of misunderstanding. This misunderstanding is due largely to a tautological tendency to identify a high capital-output ratio with "capital-intensive" projects and a low capital-output ratio with "labour-intensive" projects. This tendency ignores the

fact that two different concepts are involved here, namely, a capital-output ratio expressing the technical requirement for real capital to produce a given output and a capital-labour ratio expressing the structure of capital or the degree of roundaboutness. The former measures the productivity of capital (or of investment when cast in marginal terms), while the latter measures the intensity of capital, that is, the proportion of capital combined with given labour in the production function. Thus distinguished, the lowering of the capital-output ratio must imply the raising of the productivity of capital, where the adoption of "capital-intensive" techniques must imply the greater substitution of capital for labour. The crucial question now is whether "capital-intensive" or "labour-intensive" techniques would contribute most toward the lowering of the capital-output ratio or, what is the same thing, towards the raising of

or less capital-intensive innovations are introduced. Quite the contrary, a rise in the amount of capital relative to given labour (a higher K/N) is, via an implied rise in roundaboutness, likely to entail a more than proportional rise in output relative to given labour (a still higher Y/N), with the possible result that the capital-output ratio is lowered. Conversely, a fall in the amount of capital relative to given labour is likely to occasion a more than proportional fall in output relative to given labour, with the net consequence that the capital-output ratio is raised.

Abstracting from the Index problem and relative factor prices, the implications of the above inter-relation between the coefficient of capital-intensity and the productivity of labour for the capital-output ratio and growth rate of an economy with a constant saving ratio may be illustrated as follows:

	1	2	3	4	5
Type of Technique Adopted	Degree of Roundaboutness (K/N)	Productivity of Labour (Y/N)	Capital-Output Ratio (K/Y)	Saving Ratio (S/Y)	Growth Rate ($\Delta Y/Y$)
Initial Capital	50/100	10/100	5	0.05	0.01
Capital-intensive	100/100	25/100	4	0.05	0.0125
Labour-intensive	25/100	4/100	6.25	0.05	0.008
	(3) = (1) + (2); (5) = (4) + (3).				

the productivity of capital. The answer depends on the probable effect of a change in the degree of roundaboutness on the productivity of labour.

This may be clarified by specifying the capital-output ratio as a function of the coefficient of capital-intensity and the productivity of labour, that is, putting K for capital, N for labour and Y for output, $K/Y = (K/N)(Y/N)$. This relation reveals that the capital-output ratio (K/Y) varies directly with the coefficient of capital intensity (K/N) and inversely with the productivity of labour (Y/N). It also indicates that K/Y can fall as a result of a fall in K/N , if and when Y/N remains constant. However, there is no good reason to suppose that the productivity of labour would remain unaffected when more

It is clear from the above illustration that a high capital-output ratio can be identified with "capital-intensive" innovations or projects and a low capital-output ratio with "labour-intensive" ones only on the assumption of the constancy of the productivity of labour. But the observable fact is that when more or less capital is used in combination with given labour (a higher or lower degree of roundaboutness expressed in K/N) can cause the productivity of labour to increase or decrease, with the result that the capital-output ratio may fall not in spite of but because of "capital-intensive" innovations or projects. Thus it is important for both analysis and policy to recognize the capital-labour ratio (K/N) and the productivity of labour (Y/N) not only as independent variables in rela-

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tion to the dependent variable K/Y but also as inter-dependent variables in relation to each other.

We are led to the conclusion that, as far as the growth of productive capacity (expressed in Y/Y is concerned, an underdeveloped economy with a low saving ratio should gear its development programming to capital-intensive projects or innovations. In practical terms this means that the best way to lower the capital-output ratio relatively to the given saving ratio is not to invest in light industries but to invest in heavy industries, for the productivity of capital (which is the reciprocal of the capital-output ratio) cannot be expected to increase significantly so long as an underdeveloped economy confines its investment activity to the labour-intensive lines of production. There remains the other question of disguised unemployment to be discussed.

If an economy's population is growing at the rate g_p , the supply of employable labour may be considered as growing at the same rate. On the other hand, if its fully utilized capital is growing at the rate g_k the demand for labour (required for full utilization of capital) may be assumed to grow at the same rate. Then the rate of growth of structural underemployment is given by $g_u = g_p - k$. A positive g_y expresses itself largely in disguised unemployment and partly in undisguised unemployment. If the productivity of labour is growing in consequence of labour-saving technological progress, the situation becomes complicated by progressive technological unemployment. Suppose that the productivity of labour rises so as to reduce the amount of labour required per unit of output at the positive constant rate g_a . In this event the amount of labour demanded for full utilisation would grow only at the rate $(1+g_k)/(1+g_a)$, implying that output and capital must grow at the rate $(1+g)(1+g_a)$ or approximately at $(g_p - g_a)$. If there is to be continuous full employment, the well-known fear of technological unemployment is quite understandable, especially in an economy characterized by $g > g_k$. However, it would be amiss to propose labour-intensifying techniques, for that would only lead to a self-defeating fall in the rate of growth of capacity (and capital)

There is no basic alternative but to accumulate capital at the equilibrium rate $g_k - g$ when technological advance is "neutral" and at the equilibrium rate $g_k - g_p + g_2$ when technological advance is of a preponderantly labour-saving nature.

It is in this connection that the current notion of disguised unemployment as a "saving potential" makes its popular appeal to overpopulated underdeveloped economies. This notion is associated most prominently with the name of Ragnar Nurkse, distinguished author of "Problems of Capital Formation in Underdeveloped Countries". According to Nurkse, full mobilization of the disguised unemployed would increase net investment without reducing consumption. This he offers as a compromise between the classical notion of investment and consumption as inevitable alternatives (on the assumption of full employment) and the Keynesian idea of investment and consumption as possible complements (on the assumption of underemployment). For an underdeveloped economy with a large reserve of redundant labour but without redundant capital presumably stands between "a classical world of fully employed resources having to allocate more of those resources to capital-goods production at the expense of less to consumer-goods production and a Keynesian world of idle resources offering to increase output of both capital goods and consumer goods. This "neutral" position is a comforting thought, but it may prove illusory upon further reflection. Instead of repeating more or less familiar practical objections, we may suggest some theoretical difficulties involved in the various arguments advanced in support of Nurkse's compromise between the classical and Keynesian views of the relation of investment and consumption.

The gist of these arguments seems to be as follows: Assume that all the disguised unemployed are "employed" in the consumer-goods sector (usually specified as subsistence agriculture). Since the disguised unemployed are by definition marginal or unproductive labour, their withdrawal from the consumer-goods sector would leave output of consumer goods unaffected. Now let the disguised unemployed be shifted to the capital-goods sector, abstracting from the practical difficulties involved in such a shift. Since the mar-

ginal productivity of labour in the capital-goods sector is positive ex hypothesis, output of capital goods would increase as a result of adding the disguised unemployed to that sector's working force. Thus disguised unemployment is believed to be a "saving potential" that materializes in net investment. If and when the disguised unemployed are effectively and fully mobilized by the capital-goods sector. Thus, too, the impression is created that disguised unemployment is, after all, a blessing in disguise, instead of being a drag on industrialization. However, the following considerations may dispell this misleading impression.

When due account is taken of the specificity of the labour released from the consumer-goods sector, output of fixed capital, which is of crucial importance to industrialization, may not increase significantly. Granting that the disguised unemployed can be transferred to "investment" projects requiring no special skill or equipment, such "investment" projects of a labour-intensive nature can hardly be expected to turn out what is needed most fixed capital. For it takes "machines to make machines" on a scale large enough to speed up industrialization. And the disguised unemployed are an ineffective substitute for such "machines to make machines."

The assumption of constant consumption is thrown into question, not because marginal productivity of redundant labour in the consumer-goods sector may be above zero, but because its propensity to consume is likely to rise at all levels of income after its shift to the

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Volume VIII-Nos: 14, 15, 20, 27, 28, 29, 30, 31, 32, 33 dated April 7, 14, May 19, July 7, 14, 21, 28, August 4, 11, 18, 1956 respectively.

capital-goods sector. This likelihood is plausible for two reasons. First, prior to their shift to the capital-goods sector the disguised unemployed are forced to such a low standard of consumption that they will almost certainly develop new stronger consuming habits after the shift. Second, the urban areas, where capital-goods industries are heavily concentrated, are observably far more conducive to a strong propensity to consume than the rural areas from which the disguised unemployed are supposed to come. Thus when due account is taken of the "habit effect" and the "taste effect" let alone the "income effect" the propensity to consume for the whole economy may well rise in consequence of urbanizing the previously unproductive but presently productive consumers—the disguised unemployed. In this event the pressure will increase for allocating to the consumer-goods sector those resources which might otherwise be used to increase output of capital goods.

If, moreover, the capital-goods sector adopts labour-saving techniques of production, as it is likely to do in the course of industrialization, the implied reduction in the amount of labour required per unit of output sets a limit to that sector's ability to mobilize the disguised unemployed fully and continuously. As already mentioned, in a case of this sort capital would have to grow much faster to equip a labour force with a rising productivity than to equip a labour force with a constant productivity. Thus the tacit assumption of technological neutrality involved in the usual argument about disguised unemployment as a "saving potential" becomes untenable and unhelpful. Even if we abstract out the above complication arising from technological progress, we are still left with the fundamental problem of population growth tending to out-run capital accumulation. A growing, not just a large, population aggravates the difficulty of increasing net investment without reducing consumption, since it implies more mouths to feed as well as more hands to employ. In an underdeveloped economy with a growing population, such an increase in net national product in excess of consumption as full utilization of the disguised unemployed may make possible would probably be "eaten up" largely, if not wholly, by the genuinely unproductive addition to the population (e.g., a growing number

of those normally considered below the "productive age" of, say 15 years). Furthermore, the tendency of population growth to outstrip capital accumulation implies that the volume of disguised unemployment grows faster than can be absorbed productively by the very stock of capital that the disguised unemployed are supposed to help expand.

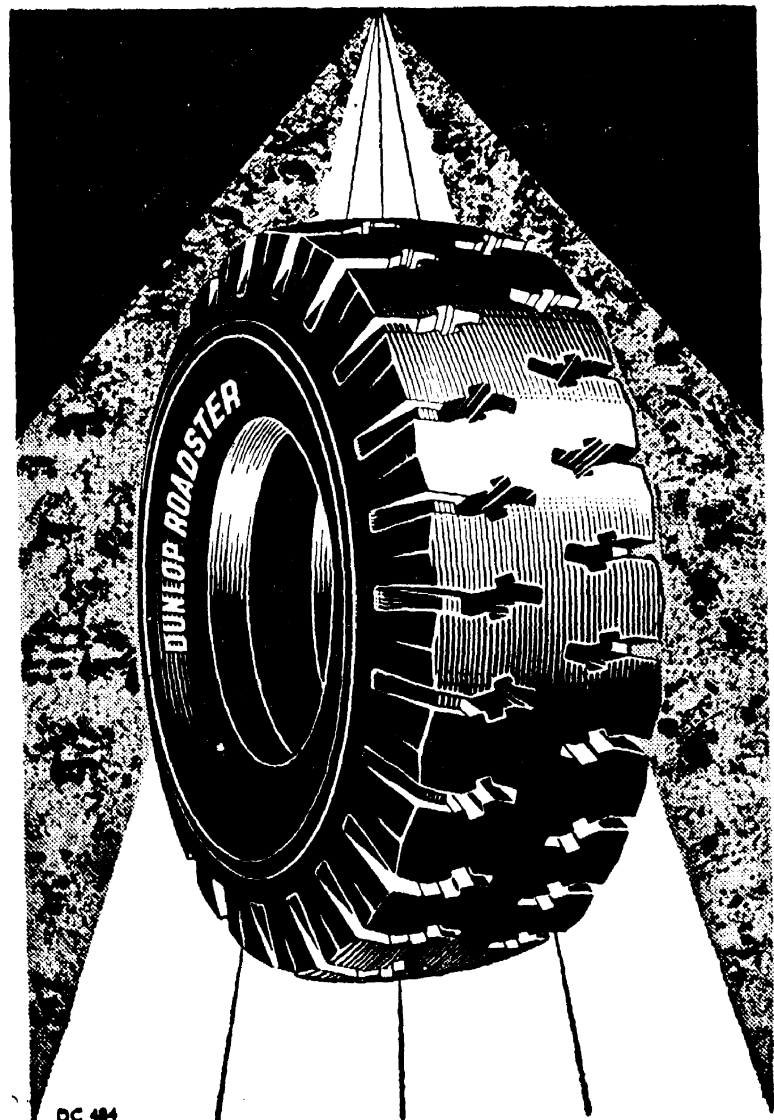
These considerations cast some

doubt on the usefulness of the hypothesis of disguised unemployment as a source of capital accumulation. These considerations also suggest that disguised unemployment, far from helping capital accumulation and economic development, is more likely to hinder them by giving "aid and comfort" to dubious projects of an employment-generating rather than a capacity-increasing nature.

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