Can Project Appraisal be Linked with Growth Rate in the Economy?

Ravindra H Dholakia

In underdeveloped mixed economies, the choice of big investment projects has a direct bearing on the productivity of capital. The economic rate of return on big projects determines the achievable growth rate in the economy given the flow of investment.

Ravindra Dholakia's argument is that project appraisal of such projects can and should be linked to the economy-wide growth target of the Planning Commission. Such a linkage would facilitate rigorous scrutiny of projects and demand more creative project design for achieving national goals.

Ravindra Dholakia is a faculty member in the Economics Area of the Indian Institute of Management, Ahmedabad.

It has been a painful experience for our country that we have not been able to achieve remarkably high growth rate in spite of raising our saving rate from about 5 per cent in the early 50s to about 25 per cent of national income in the mid-80s. The reason very often advanced for this performance is that our economy has experienced almost a continuous increase in the capital-output ratio. The latter, when measured in incremental terms, reflects the degree of efficiency of our new investment projects to produce additional output. In a developing mixed economy committed to achieving multiple goals such as growth, equity, self-reliance, etc., within a specified time horizon, major developmental projects involving huge investments are considered essential and inevitable. Such projects would typically include investments on major irrigation, power, transport, communication, big industrial complexes like plants for steel and fertilizers, etc. These projects would accelerate the economic growth in the system if they utilize available scarce resources with expected efficiency. On the other hand, if the resources invested in such projects are not efficiently utilized, they may end up retarding the growth rate of the economy. This is because the flow of income generated from such big projects in relation to the new investments in them determines, to a large extent, the overall incremental capital-output ratio in the economy. Increasing incremental capital-output ratio implies higher capital intensity and lower efficiency of the new capital resources in the economy. Our past performance, therefore, clearly suggests that resources invested in our big projects have not been efficiently utilized to achieve the desired growth rate.

Assessing Project Potential

Basically, we can identify two distinct lines of reasoning for this: a) the projects have the potential...
to deliver the goods ex-ante, but serious inefficiency in their implementation and related matters may cause poor performance in ex-post terms; and b) the projects themselves may not have the required potential for generating desired level of growth in the system irrespective of how they are implemented. Category (a) includes implementation delays resulting in severe cost escalations, structural imbalances due to lack of integration and coordination efforts, and shortage of timely critical inputs arising out of faulty planning and/or implementation in other segments of economy and consequent under-utilization of capacity, culminating in the shortfall of actual performance as compared to the ideally achievable performance. However, the projects per se are not inferior, and corrective measures can be undertaken by way of planning, implementing and coordinating the projects with other segments in the economy. Therefore, the issue of appropriateness of the very choice of the project with all its technical specifications does not arise in this case.

In category (b) however, some definite corrective actions can be taken right at the stage of project formulation and appraisal: either make the project more attractive or reject an inferior project, which does not have the potential to achieve the desired growth rate. Early detection of an inferior project may reduce unwarranted strains on the system and wastage of scarce resources. Our primary focus, however, is on examining the potential of the project rather than explaining its actual performance.

The thrust of the argument here is that an economically viable project does not necessarily ensure the desired rate of growth in the system; it can only generate some growth of output. The question of achieving the desired rate of growth through new investment projects, so crucial for underdeveloped mixed economies like India, is not incorporated explicitly in the project appraisal exercises by setting definite norms for minimum internal rate of return or benefit-cost ratio of the project. Unless such norms are fixed and strictly adhered to in practice while selecting new projects, the economy cannot be expected to automatically achieve the targeted growth rate. Since the type of big investment projects, referred to earlier, generally represent public sector investment in most of the developing countries, such norms for the minimum internal rate of return or benefit-cost ratio can become an effective management tool for achieving the desired growth.

**Political Interventions**

In an underdeveloped mixed economy with a democratic set up, numerous socio-political factors outweigh pure economic considerations in the choice of big investment projects undertaken by the government. As a result, the projects' expected economic rate of return either does not get calculated or, if calculated, gets ignored in the target setting exercises carried out in the Planning Commission. This is a matter of concern for us as it is only through these projects that the country can aspire to achieve the desired rate of growth.

Political interventions in certain matters like location, technical specifications, and scale of operation of the project are sometimes justified by bringing in other objectives of planning in the country, e.g., equity, development of backward areas, self-reliance, transfer of technology, etc. Since the Planning Commission does not mention explicit trade-offs among various objectives, any such justification can both be accepted or objected to in principle. However, if we recognize that achievement of the targeted growth rate is one of the most important objectives of planning, then economic viability becomes a pre-condition for the choice of the project. The government has to be concerned about the expected economic rate of return of the project as it significantly influences the expected overall productivity of capital, which in turn, determines the growth rate of the economy. We need to take the exercise of economic appraisal of big projects more seriously and develop explicit norms in terms of certain economic parameters to select or reject them, because economic planning by definition, requires optimization of scarce resources within a given time frame (Rangarajan and Dholakia, 1979). If inferior projects go undetected, genuine growth opportunities as well as time is lost. Thus, the targeted level of national output, say, for the year 1990 cannot be achieved by the same year if we consciously or unconsciously choose projects whose expected economic rate of return and other such parameters fall below the desired norms.

While establishing the norms for such big projects, one or two most crucial parameters have to
be considered. Since economic viability of the project is inseparably linked with economic appraisal, certain standard measures like the benefit-cost ratio and the internal rate of return represent obvious choice for the parameters. Estimation of both these parameters for a given project requires the same amount of information except one variate, namely, the discount rate. The criterion of internal rate of return does not require information on the discount rate, except indirectly, if used for identifying economically viable projects. Since the economically viable projects are expected to generate some growth in the system, the choice of the discount rate plays an important role and needs more discussion.

Choice of the Discount Rate

Identification and measurement of the benefits and costs of such big projects to the society at large involve familiar problems of estimating the shadow prices of resources associated with these projects including labour and foreign exchange besides determining the discount rate. Assuming that the shadow prices of the resources are carefully estimated, the economic viability of the projects is determined by the choice of the discount rate.

In countries with well-developed, competitive capital markets, the market rate of interest can be taken as the rate of return on capital or the opportunity cost of capital and hence as the rate of discount. However, in the standard framework of the social benefit-cost analysis, a clear distinction between the social rate of time preference and the rate of return on capital is drawn. The social rate of time preference can be defined as the marginal rate at which additional future consumption is needed to compensate the loss of satisfaction due to sacrifice of one unit of the present consumption. Because of income tax and corporation tax, the pre-tax rate of return on capital always far exceeds the rate of time preference. Thus, even in countries with well-developed capital markets, the pre-tax rate of interest or the opportunity cost of capital exceeds the social rate of time preference. Since the big investment projects undertaken by the government have a very long economic life over which their returns keep flowing, Marglin (1963) argues that the stream of social benefits and costs of such projects should be discounted at the social rate of time preference and not at the market rate of interest. When the society invests resources in the projects, it foregoes current consumption for future consumption so that the effective time value of money is represented by the social rate of time preference and not by the opportunity cost of capital. However, he also recognizes that costs of the project have to be measured in terms of the social opportunity cost of capital since investing resources in a given project implies foregoing their alternative uses.

It was Baumol (1968) who formally demonstrated that Marglin's procedure of discounting the streams of benefits and costs at the social rate of time preference, after measuring the costs in terms of social opportunity cost of capital, yields the same result as the one obtained by applying the rate of return on capital. However, as Arrow (1969) argues, Baumol's result obtains from Marglin's approach only when there is an absolute saving constraint in the system. India being a developing country with a very high marginal rate of taxation on the one hand and a fairly high saving rate on the other, the assumption of overall capital rationing appears to be reasonable. After all, the resources required for such huge projects are generally and largely diverted from their respective alternative potential uses rather than raised afresh by cutting the present consumption further. We may, therefore, accept Baumol's solution of taking the rate of return on capital as the rate of discount for examining the economic viability of the projects.

Relevant Rate of Return for the Economy

Considering the magnitude of the projects under scrutiny, the rate of return on capital relevant for our purpose should actually be the rate for the economy as a whole. As we have noted earlier, such a rate is adequately represented by the market rate of interest if the capital market in the economy is well-developed and competitive. In India and other developing countries, the capital markets are neither well-developed nor competitive. Therefore, the concept of the market rate of interest becomes vague and can scarcely be considered adequate to represent the rate of return on capital.
the economy as a whole. We have to depend on other methods to derive an estimate for the required rate.

**Alternative Method**

A well-known theorem from elementary growth theory offers an alternative. According to the theorem, the rate of return on capital is equal to the long term rate of growth in the economy. Since we have experienced a growth rate of about 3.5 per cent per annum over the past 35 years, we should expect the rate of return on capital of about 3.5 per cent for the economy as a whole on the basis of this theorem. The validity of this theorem, however, rests on many restrictive assumptions which appear to be unrealistic in the light of Indian conditions: first, it assumes the classical saving function which is based on the notion that all profits are saved and that nothing is saved out of wages; second, the average propensity to save which is taken to be equal to the rate of investment is supposed to remain constant over time; and third, the incremental capital-output ratio is assumed to be equal to the average capital-output ratio implying constancy of the latter. It requires only a casual awareness of the Indian economic environment to reject each one of these three assumptions underlying the theorem.

However, if we drop the assumption of classical saving function and modify the other two assumptions by using the findings of Dholakia (1983) on the time-trend of aggregate average capital-output ratio and the time rate of increase in the investment rate estimated by the Seventh Plan (1985), it is possible to derive an estimate of the rate of return on capital for the Indian economy as a whole (Appendix 1). Our estimate of the rate is in the range of 6.4 per cent to 7 per cent per annum. This figure is relevant for the next decade and is most likely to be stable. It may also be pointed out here that the estimate of marginal productivity of capital for the mining and manufacturing sector is in the range of 6.8 per cent to 7.1 per cent if we repeat the exercise with the sectoral targets and related estimates from the Seventh Plan document. Thus, there is some evidence for us to believe that in the planning exercises, marginal productivity of capital is not assumed to vary significantly across sectors in the Indian economy.

**Incremental Output-Capital Ratio and Internal rate of return**

Having determined the envisaged marginal productivity of capital for the Indian economy based on the planning targets and other plausible estimates, the next question is to relate the internal rate of return of such huge projects with the envisaged long term rate of growth of the economy. As we have noted earlier, use of the rate of return on capital as the discount rate only ensures some growth—not the required rate of growth in the economy. This is because given the investment rate, the required rate of growth in the system is determined by the incremental output-capital ratio which invariably exceeds the rate of return on capital. In fact, the latter is only one of the three positive components of the former implying thereby that the latter would always be less than the former. The precise relationship between the two variates can be expressed by the following equation:

\[
\text{IOCR} = \text{MP}_k + \frac{\text{LC}}{I} + \frac{\text{TFPG}}{I} \ldots \ldots \ldots (I)
\]

where IOCR is incremental output-capital ratio, \(\text{MP}_k\) is the marginal productivity of capital, \(\text{LC}/I\) is the labour cost per rupee of investment and \(\text{TFPG}/I\) is the total factor productivity growth (or technical progress) per rupee of investment. The details of the derivation and estimation of various components are given in Appendix 2.

When the Planning Commission fixes a growth target, it invariably assumes a certain value for the incremental capital-output ratio which is an inverse of IOCR used in equation (1). Since \(\text{MP}_k < \text{IOCR}\) in equation (1), economic viability of projects established by taking the rate of return on capital as the discount rate need not ensure the required incremental productivity of capital resources in the country to achieve the desired rate of growth. Take, for example, a case of a major irrigation project (or any other project for that matter) which is undertaken because it is found economically viable when the rate of return on capital in the economy is used as the discount rate, but fails to achieve the required incremental output per unit of capital invested. Such a project would end up retarding the rate of economic growth in the system although it is found economically viable. The Planning Commission has,
therefore, to fix a clear norm for project appraisal in terms of minimum internal rate of return which is consistent with its growth target. This is because the internal rate of return of a project is calculated by excluding the labour cost which makes it easily identified with the first and the third terms taken together on the right hand side of the equation (I).

Since the Planning Commission always has an implicitly assumed value for the incremental output-capital ratio over the planning period, estimation of consistent internal rate of return required from the investment projects to achieve the growth target is not difficult. As per the details given in Appendix 2, our estimate of the range for the required internal rate of return to maintain the growth rate at 5 per cent level over the next 15 years is 10.9 per cent to 11.3 per cent per annum in real terms. If we want these estimates in nominal terms, i.e., by considering expected changes in the prices, we have to add the expected rate of inflation to these numbers. Thus, taking the expected rate of inflation to be 8 per cent per annum, 11.3 per cent is replaced by 19.3 per cent and 10.9 per cent by 18.9 per cent.

It should be noted here that the above criterion in terms of the internal rate of return from the project should be coupled with that of labour cost per rupee of investment in the project at the rate implied by the plan targets, i.e., 0.086 to 0.09 in real terms. Moreover, both these criteria are additive in the sense that if a project has a distinctly higher internal rate of return but falls short of the employment generation aspect or vice versa, it can still help achieve the growth target.

Internal Rate of Return and Technical Progress

As discussed above, we can view the internal rate of return as consisting of two components. In symbolic terms we can represent it as:

\[ \text{IRR} = \text{MPt} + (\text{TFPC}/I) \quad \ldots \quad (2) \]

where IRR is the internal rate of return and the other two terms have the same meaning as in equation (1). We have seen earlier that there is empirical evidence to support our hypothesis that marginal productivity of capital can be taken to remain the same across different sectors in the Indian economy. If we, therefore, extend it further and assume that the opportunity cost of capital remains the same for different investment projects, we can draw an interesting implication from equation (2). Thus, with the opportunity cost of capital remaining the same for any two projects, if their internal rates of return differ, it necessarily implies that their impact on the growth of total factor productivity or what is popularly termed as the rate of technical progress in the economy must be different. For a single project, if the internal rate of return exceeds 11.3 per cent in real terms, it implies that the project accelerates the growth of total factor productivity in the economy because the project has a higher value for the technology component in equation (2) than the corresponding economy-wide average. After all, the rate of technical progress per unit of investment in the economy as a whole is nothing but a weighted average of the corresponding aggregates for different projects undertaken in the economy. The internal rate of return of any large investment project can, therefore, be directly linked with the growth rate of the total factor productivity or the rate of technical progress in the system.

Norms for Achieving Growth Targets

From the above discussion, it becomes clear that internal rate of return of a project can certainly help us decide whether the project will accelerate or decelerate the target rate of technical progress in the economy, but we require additional information in terms of the labour cost per rupee of investment in the project if we want to examine the likely impact of the project on the overall growth target in the economy. In real terms, the effect of any project on the growth rate of the economy can be summarized as in Table 1 based on the two criteria recommended.

It is important to note here that our estimates are in real terms. If we want to convert them into nominal terms, we have to add the expected rate of inflation of about 0.07 to 0.09 per annum to the respective figures.
In the present paper, we have shown how the economic appraisal of large investment projects can be linked to the plan target of economic growth. The discounted cash flow technique of calculating the internal rate of return of a project provides the basic link. As argued above, we can derive meaningful cut-off points for the internal rate of return and the labour cost per unit of investment in such projects to achieve the growth target. Although we have mainly focused our attention on big projects, the analysis and conclusions can be easily generalized for smaller projects also.

The main argument here is that current practices of economic appraisal of projects, at best, guarantee non-negative growth rather than the desired rate of growth envisaged over the next decade. This is a very serious limitation which needs to be immediately overcome if our intention is to arrest the rising trend of the capital-output ratio in the system. Project appraisal techniques in a mixed economy with planned development goals have to be appropriately modified to consider this aspect. The choice of the discount rate for big investment projects has to be made on the basis of the internal rate of return consistent with the incremental capital-output ratio assumed in the plan to achieve the growth target. We need to take the calculation of the internal rate of return of a project more seriously because it can indicate what contribution the project is likely to make towards achieving, the technology and the growth targets.

When we recommend a norm in terms of a combined cut-off for internal rate of return and the labour cost per unit of investment in the project, we should be very clear about the modus operandi of calculating/estimating these numbers for any given project. The details of such procedures are readily available from the existing literature on the subject (IDBI, 1980). Since the future is uncertain with a high degree of volatility expected for crucial parameters like output, prices of inputs and outputs, foreign exchange rates, etc., the project appraisal exercise can yield different results for internal rate of return and labour per unit of investment depending on the specific set of assumptions made for the behaviour of all these parameters over the project life. This is a familiar problem which can be tackled effectively through sensitivity analysis.

Thus, if the project appraisal exercise is carried out using sensitivity analysis technique, we can be reasonably sure about the range of estimates for internal rate of return and labour cost per unit of investment for the given project that would obtain with 95 per cent or 99 per cent probability. Such an internal estimate could then be compared against the norm established in the present paper for internal rate of return and labour cost per unit of investment which would help achieve the growth target set in the national plan. If a project fails to meet these norms, the project sanctioning authorities should return the proposal for reworking by pruning the investments required in the project. A detailed exercise can also help identify the weak links in the project that need strengthening and improvement. In other words, a tough project appraisal along the lines outlined above has the potential to encourage creative project design which is the key element in developmental planning exercises in developing countries like India.

Vikalpa
Estimating the Rate of Return on Capital for the Indian Economy

Dholakia (1983) shows that the aggregate average capital-output ratio in India over the past 30 years displays a clearly rising time-trend. This finding by itself is sufficient to reject the assumption of the strict equality of the incremental and average capital-output ratios. The exact relationship between the two types of ratios can be derived in the following way:

Let \( k/y = a + bt \)

therefore, \( \frac{d}{dt}(k/y) = b = \frac{ydk/dt - kdy/dt}{y^2} \)

therefore, \( b = \frac{dy/dt}{y} \left( \frac{dk}{dy} - \frac{k}{y} \right) \)

i.e., \( b = G \left( dk/dy - k/y \right) \)

i.e., \( dk/dy = k/y + b/G \) .... (1)

Now, \( G \) is also defined as

\[
G = \frac{s}{d/dt}
\]

therefore, \( G = \frac{k}{k/y + b/G} \) \hspace{1cm} \text{using (1) above}

therefore, \( s = (k/y)G + b \)

therefore, \( (s - b)k = (qk/y)G \) \hspace{1cm} \text{Multiplying by} \ q

therefore, \( q = R_k G/\left(s - b\right) \) .... (2)

where \( R_k \) represents the relative share of capital in the national income.

From equation (2), we can readily estimate the rate of return on capital, \( q \), for any economy if we get reasonably satisfactory estimates of the parameters on the right hand side. This equation, moreover, can also be viewed as a variant of the basic aggregate planning model based on the Harrod-Domar approach. With the latter interpretation given to equation (2), the parameters on the right hand side can be selected on the basis of the targets fixed over the planning horizon. The estimate of \( q^* \) so obtained would be fully consistent with the plan targets. When we look at the parameters on the right hand side of equation (2) more closely, we find that our Planning Commission fixes targets only with respect to the growth rate \( (G) \) and the investment rate \( (s) \). It generally remains silent for the other two parameters, viz., \( R_k \) and \( b \) that appear in the equation. For these two parameters, moreover, no official estimates are available so far in India. It is, however, possible to derive implicitly assumed estimates of \( b \) from the target setting exercise of the Planning Commission.

It is interesting to note that the growth rate \( G \) is assumed constant over years during the plan period though the investment rate \( s \) is assumed to increase over the same period. By implication, the capital-output ratio is also assumed to increase over the period. Since our parameter \( b \) is the time rate of increase in the average capital-output ratio, it can be implied by the targets fixed by the Planning Commission for \( G \) and \( s \). The specific relationship can be derived as under:

We assume that \( k/y = u + vt \)

and \( s = c + et \)

As per equation (1)

therefore, \( dk/dy = k/y + b/G \)

Now, \( G = s/(dk/dy) \)

therefore, \( G = c + et \)

therefore, \( (k/y)G + b = c + et \)

therefore, \( G = \frac{c + et - b}{k/y} \)

therefore, \( G = c + et - \frac{b}{a + bt} \) .... (3)

Thus, \( G \) becomes a function of \( t \). If, however, \( G \) is assumed to remain constant over years during the planning horizon.

\[
\frac{dG}{dt} = \frac{(a + bte - b + c + et - b)}{(a + bt)^2} = 0
\]

therefore, \( c + et - b = \frac{a + bt}{a + bt} \)

therefore, \( b = c/G \) .... (4)

As we have already mentioned, the Planning Commission fixes targets for \( s \) and \( G \) such that we can easily obtain the estimates for \( c \) and \( G \) to get, in turn, the implicitly assumed estimate for \( b \). Taking the targets fixed in the Seventh Five Year Plan in India, \( G = 5 \) per cent, \( c = 0.0028 \) and hence \( b = 0.056 \). This implicitly assumed value of \( b \) in the Seventh Plan compares very well with the regression estimate of \( b \) (0.053) made by Dholakia (1983) on the basis of his estimates of the average capital-output ratio for the period 1948-49 to 1980-81. If anything, the average capital-output ratio is assumed to rise faster during the Seventh Plan than in the past.

In order to estimate the marginal productivity of capital \( (q) \) from equation (2), we require only an estimate of the relative share of capital. This is an area of darkness considering the state of statistical estimation in the country although some plausible bounds on such an estimate can be easily defined on the basis of some individual studies in the past. We can take it to be ranging between 25 per cent and 25.5 per cent at the beginning of the plan period (i.e., 1985). It may increase by about 2 percentage points considering the heavy investments envisaged during the Seventh Plan. Thus, the average value of relative share of capital over the period 1965-90 may be taken to be between 25 per cent and 27.5 per cent. The average value of rate of investment over the period works out to 25.2 per cent. Correspondingly, therefore, we have the value of the marginal productivity of capital \( (q) \) which is between 6.4 per cent and 7 per cent.
Appendix 2
Estimation of Various Components of Incremental Output-Capital Ratio

Let us assume an aggregate production function for an economy:

\[ y = f(k, l, n, t) \]

where \( y, k, l, n, \) and \( t \) represent respectively aggregate output, capital, labour, land, and time.

Differentiating this equation with respect to time,

\[ dy/dt = f_k dk/dt + f_l dl/dt + f_n dn/dt + f_t \]

Taking \( dn/dt = 0 \) as is customarily done in growth accounting exercises,

\[ dy/dt = f_k dk/dt + f_l dl/dt + f_t \]

therefore,

\[ dy/dk = f_k + f_l dl/dk + f_t/(dk/dt) \] \hspace{1cm} (5)

i.e., \( IOCR = MP_k + (LC/l) + (TFPG/1) \).

(This is-equation (2) in the text).

As it can be seen, equation (5) expresses \( dy/dk \), the reciprocal of the incremental capital-output ratio, in terms of meaningful components. The first component in equation (5) is the marginal product of capital \( (q) \), the estimate of which we have derived for the Indian economy in Appendix 1. The next term namely \( dl/dk \) represents the product of the marginal productivity of labour \( (f_l) \) and the additional employment to be generated per rupee of investment \( (dl/dk) \), i.e., the wage income generated or labour cost per rupee of investment \( (LC/l) \) during the plan. The third term in equation (5) can be called the 'technology term' which represents the gain in the output due to 'technical progress' or 'residual factors' or total factor productivity growth per rupee of investment during the plan. Since the Planning Commission usually provides the targets for \( dl/dk \), we need to estimate only the marginal productivity of labour or the wage rate in the economy to obtain the estimate of the second term in the equation (5).

The relative share of labour is an important link to obtain the required estimate. This is because the marginal productivity of labour or the wage rate depends on what concept of labour force we are using for estimating the employment. The Planning Commission uses the 'standardized person years' as the relevant concept to measure the employment in the economy. The wage rate \( (f_l) \) has, therefore, to correspond to this concept of employment only. Although the wage rate is sensitive to the concept of labour force or the units of measurement, the relative share of labour is not. This is because the relative share of labour is a ratio of marginal productivity to average productivity. Like the relative share of capital, however, firm official estimates of the relative share of labour are also not available for the Indian economy. The plausible range of estimates for the relative share of labour in the Indian economy is 65 per cent to 68 per cent. Moreover, it is likely to remain stable over the period on account of increase in both the marginal as well as the average productivity of labour. The average productivity of labour as implied by the estimates/targets of the Planning Commission turns out to be Rs. 10,360 in the year 1985 and Rs. 10,873 in the year 1990. The average value can be taken as Rs. 10,613 over the period. The wage rate corresponding to this average productivity of labour with alternative estimates of the relative share of labour at 65 per cent and 68 per cent works out at Rs. 6,898 and Rs. 7,217 per annum respectively. The Seventh Plan, moreover, envisages the employment generation of 1 person-year per Rs. 79,873 of investment. Thus, the estimate of labour cost per rupee of investment as implied by the targets fixed for the Seventh Plan can be placed between 0.086 and 0.090.

Since the estimate of overall incremental capital-output ratio \( (dk/dy) \) can be obtained from the plan targets of growth rate and investment rate, its inverse (i.e., \( dy/dk \)) works out to 0.199. Feeding all these inputs in equation (5), we can obtain the estimate of the 'technology term' as the residual. Taking all possible combinations of plausible values of relative shares of capital and labour, the range of the estimate of the 'technology term' works out to 0.039 to 0.049 with the most likely range being confined to 0.043 to 0.045.

References


