Export Expansion vs. Factors of Development

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1. For the sake of argument, it is sometimes maintained that, if a certain ceteris paribus condition is imposed, exports and economic development tend to associate each other and thus impacts of export expansion on economic development can be relatively easily assessed. This technique is a partial derivative, all factors other than exports remaining constant. In other words, if it is assumed that other development factors are infinitely elastic, we can say that the increase in output is determined by the additional exports. Thus when the increase in exports contributes 10 percent points, it is expected that average percentage increase in output would have this much higher if, year by year, exports had changed while other output-determining factors remained unchanging. This is a very useful technique which is frequently employed in mathematical economics as well as in economic theory.

2. Critics loom large, however, against this simple method. In reality, it is insufficient to concentrate on an analysis of one factor only for understanding the development process.(1) There are many sources of economic development and exports are only one of a number of elements affecting it. Some of the other factors are probably given a greater weight than export expansion. Hence we need for broadening the analysis into a more general enquiry into the workings of various other factors. In other words,

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(1) T.H. Adler(ed.) and K.S. Krishnaswamy: *Economic Development for Latin America*

the relationship between new export expansion and additional output is a complex one and it depends not only on a composition of exports which may change over time but also on all non-export factors.

In an advanced economy, adequate non-export factors are likely to exist. Hence it is quite reasonable to make mutatis mutandis assumption that the supply of other necessary factors is forthcoming. In an underdeveloped economy, however, where non-export factors tend to be in short supply, it may not be adequate to assume an increase in exports as a sufficient condition for economic development. Since an expansion in output depends on many associated factors, increase in output may need changes in other factors, along with a rise in exports. Otherwise output may even change independently of export expansion. Even if the assumption that a certain correlation exists between exports and output is accepted, it may not follow that only exports are required to increase output. Therefore, it is essential to consider explicitly the effects of other variables on output, so that to ignore them and to attribute all of the output-increments simply to exports must be regarded as a too naive view. Thus, it will be badly needed to take a full derivative, all development factors other than exports being variables.

3. Then, what are the development factors other than exports? What is the division of growth among the sources? What sources are most important? Finally how to measure their impotance and how to compare relative contribution of exports and other strategic factors? Besides exports, there are so many sources which may cause an economy to grow. By long tradition, economic theory considers the level of output to be determined by capital, labour force and land. Earlier it has taken for granted that output would grow pari passu with capital, no more, no less, and that higher productive investment is the only way to promote development. But recently empirical evidence has accumulated which has cast doubt on

the validity of such simple theories.[2] It is said that the mere accumulation of capital is less instrumental to economic development and that only a part of the increased output per man could be ascribed to increased input of capital and labor. Nowadays, sufficient evidence has been indicated that there are important development factors hiding behind the residual which is a basket containing many different influences whose effects could not be easily isolated—technical progress, education, on-the-job training, entrepreneurship, modern organization, economies of scale, government economic policy, etc. etc. etc. Further, development is not purely an economic phenomenon. It embraces all aspects of social, cultural and political aspects.[3] Noneconomic change is more difficult to control than economic one. Development may be impossible without physical establishments but it is still more impossible if it does not take place in the minds of the man who build. In short, "mind over machine".

Sources of economic development are listed in summary form below, as Denison and others did.[4]

Capital
- dwellings
- non-residential structures and equipments
- inventories

Labour
- employment
- education

Land
- natural resources

(2) O. Aukurst: "Factors of economic growth; a review of recent research," *Productivity Measurement Review*, 1965.
G.M. Meier: *Leading issues in development economics.* Too many to be listed here.
(3) A.K.Cairncross: *Factors in economic development*
(4) E.F. Denison; *Why growth rates differ*

Output per unit of input

advances of knowledge and change in the lag in the application of knowledge

contribution of agricultural inputs and of non-agricultural self-employment

reduction of international trade barriers

economies of scale such as growth of national market, income elasticities and independent growth of local markets

Economic policy and organization

effective economic planning and policy including monetary and fiscal policy

effectiveness of the tax system

effectiveness of financial institution

character of agricultural organization

Socio-cultural factors(5)

dualism(socio-economic and technical)

spirit of enterprise

birth control

urbanization

basic social organization

literacy

mass communication

indigenous middle class

social mobility

modernization of outlook

Political factors

(5) I. Adelman, and C.T. Morris; "Performace criteria for evaluating economic development potential in an operational approach" *QJE* 1968

national integration

administrative efficiency

political stability

commitment of leadership to promoting economic development

Exports(including reduction of international trade barriers and economies of scale as described above) are one of the many development factors which may influence economic development significantly. But in relation to economic development, there may be two kinds of effects of exports; one is that which exports operate to influence growth by affecting one or more of the sources considered above. The other is what exports affect economic development directly. In the latter case, exports and other development factors are moving indepentently without affecting and other. In the former case, however, it can be reasonably assumed that they are cooperative in facilitating or retarding economic development, so that it is very difficult to attempt to isolate joint effects separately and to identify and quantify each contribution. Therefore, such estimates tend to be made by guesses based only on general influences or impressions. The causations and qualifications pertinent to each figure should be provided when they are derived.

4. The complex relationship between economic development and various strategic factors can be expressed in functional form below.(6) This model is a very crude general production function and may provide a conceptual framework for grouping the development factors.

$$O_t=F(K_t, L_t, N_t, E_t, S_t, U_t, P_t\cdots\cdots)$$

where O_t=output at time t

K_t=capital stock at time t

L_t=labour force employed at time t

(6) I. Adelman; "Factors in Economic Growth," *Towards a strategy for development cooperation*, ed. by J. Tinbergen

N_t=natural resources at time t

E_t=exports at time t (not considering indirect effect through other variables)

S_t=applied knowledge, technology and science at time t

U_t=socio-cultural and organizational factors at time t

P_t=politcal factors at time t

This model shows that the rate of output is a function not only of the employed level of capital, labour and natural resources, but also of exports, technology, skills used in production, and of the socio-cultural, political environment in which the economy operates. Taking derivatives to isolate and measure effects of each factor.

$$\frac{dO}{dt}=\frac{\partial O}{\partial K}\frac{dK}{dt}+\frac{\partial O}{\partial L}\frac{dL}{dt}+\frac{\partial O}{\partial N}\frac{dN}{dt}+\frac{\partial O}{\partial E}\frac{dE}{dt}+\frac{\partial O}{\partial S}\frac{dS}{dt}$$
$$+\frac{\partial O}{\partial U}\frac{dU}{dt}+\frac{\partial O}{\partial P}\frac{dP}{dt}=\frac{K}{K}\frac{\partial O}{\partial K}\frac{dK}{dt}+\frac{L}{L}\cdot\frac{\partial O}{\partial L}\frac{dL}{dt}$$
$$+\cdots+\frac{P}{P}\frac{\partial O}{\partial P}\frac{dP}{dt}+\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots(2)$$

Divided by O,

$$\frac{\frac{dO}{dt}}{O}=\frac{\frac{K}{K}\frac{\partial O}{\partial K}\frac{dK}{dt}}{O}+\frac{\frac{L}{L}\frac{\partial O}{\partial L}\frac{dL}{dt}}{O}+\cdots+\frac{\frac{P}{P}\frac{\partial O}{\partial P}\frac{ap}{pt}}{O}+\cdots\cdots$$
$$=\left(\frac{\partial O}{\partial K}\frac{K}{O}\right)\frac{\frac{dK}{dt}}{K}+\left(\frac{\partial O}{\partial L}\frac{L}{O}\right)\frac{\frac{dL}{dt}}{L}+\cdots+\left(\frac{\partial O}{\partial P}\frac{P}{O}\right)\frac{\frac{dP}{dt}}{P}+\cdots\cdots(3)$$

Hence,

$$g=\alpha\frac{\dot{K}}{K}+\beta\frac{\dot{L}}{L}+\gamma\frac{\dot{N}}{N}+\sigma\frac{\dot{E}}{E}+\cdots\cdots\cdots\cdots\cdots+\phi\frac{\dot{P}}{P}+\cdots\cdots(4)$$

where $\alpha,\beta,\gamma,\sigma,\phi$ are elasticities.

But the above model does not deal with the fundamental question as to whether the functional relationship is additive or multiplicative, that is, linear, loglinear or non-linear. Therefore, production function of the Cobb-Douglas type has been recently used, instead of the above, for stati-

stical purposes to explore some of determinants of growth and to measure the relative contribution of each variable to economic development. Notable among these studies are those made by Solow, Denison, Aukurst, Kendrick, Fabricant and Abramovitz. The production function used is of the following primitive type.(7)

$$O_t=A_tK_t^{\alpha}L_t^{\beta}N_t^{\gamma} \qquad (\alpha+\beta+\gamma=1) \cdots\cdots (5)$$

where 0=output

K, L, N=quantities of capital available, labour force employed and natural resources respectively

A=an index of total factor productivity

r,β,r=elasticities of output with respect to capital, labor and natural resources respectively

Taking logarithms, differentiating and assuming r,β and r to be constants,

$$\Delta O/O=\Delta A/A+\alpha(\Delta K/K)+\beta(\Delta L/L)+\gamma(\Delta N/N) \cdots\cdots (6)$$

In view of Section 3, ΔA/A must be explained and classified in detail. Thus, equation (5) will be modified as follows;

$$O_t=A_t^{(1)}K^{\alpha}{}_tL^{\beta}{}_tN^{\gamma}{}_tE^{\sigma}{}_tS^{\delta}{}_tU^{\phi}{}_tP^{\phi}{}_t \cdots\cdots (7)$$

$$(\alpha+\beta+\gamma+\sigma+\delta+\phi+\psi=1)$$

If we consider both kinds of effects of export expansion, then

$$O_t=A_t{}^{(2)}K^{(\alpha+e1)}L_t{}^{(\beta+e_2)}N^{\gamma}{}_tE^{\sigma}{}_tS^{\delta}{}_tU^{\phi}{}_tP^{\phi}{}_t \cdots\cdots (8)$$

$$(\alpha+e_1+\beta+e_2+r+\sigma+\delta+\phi+\psi>1)$$

where e_1,e_2= elasticities added to capital and labor respectively due to export expansion

Following Solow's technique to include embodied technical progress,

$$O_t=A_t{}^{(3)}J_t{}^{(\alpha+e1)}L_t^{(\beta+e2)}N^{\gamma}{}_tE^{\sigma}{}_tS^{\delta}{}_tU^{\phi}{}_tP^{\phi}{}_t \cdots\cdots (9)$$

when $J_t=\beta(1+\lambda_k)^tK_t[1+\lambda_k(\bar{a}_o-\bar{a}_t)]$

(7) R.R.Nelson; "Aggregate production functions and medium range growth projections" *AER* 1964
J.G.W. Williamson; "Dimensions of postwar philippine economic growth" *QJE* 69

where J_t=a quality-weighted number of machine,
reflecting the newer technology embodied in them
$A_t^{(3)}$=an index of ecnomic efficiency, different from $A_t^{(1)}$ and, $A_t^{(2)}$ excluding things that are incorporated in J_t
$\bar{a}_t, \bar{a}_0$= the average ages of capital at time t ando respectively
λ_k=improvement rate of quality of new machines by advancing technology

Taking logarithms and differentiating,

$$\Delta O/O=[A^{(3)}/A^{(3)}+(\alpha+e_1)\lambda_k-(\alpha+e_1)\lambda_k\Delta\bar{a}]+(\beta+e_2)\Delta L/L+(\alpha+e_1)\Delta K/K+r\Delta N/N+\sigma\Delta E/E+\delta\Delta S/S+\phi\Delta U/U+\phi\Delta P/P+ \cdots\cdots(10)$$

where $\Delta\bar{a}$=the change in the average age of capital

Further, following the Denison's method which developed Solow's with introduction of an average labor quality variable into the new-style Solow model, ren,

$$O_t=A_t^{(4)}J_t^{(\alpha+e1)}H_t^{(\beta+e2)}N^{\gamma}{}_tE^{\sigma}{}_tS^{\delta}{}_tU^{\phi}{}_t\ P^{\phi}{}_t \cdots\cdots(11)$$

where H_t= reflecting improvements in the quality of the labour force
$A_t^{(4)}$=narrower than $A_t^{(3)}$

Taking logarithms and differentiating,

$$\Delta O/O=[\Delta A^{(4)}/A^{(4)}+(\beta+e_2)\lambda_L+(\alpha+e_1)\lambda_k-(\alpha+e_1)\lambda_k\Delta\bar{a}]+(\beta+e_2)\Delta L/L+(\alpha+e_1)\Delta K/K+\gamma\Delta N/N+\sigma\Delta E/E+\delta\Delta S/S+\phi\Delta U/U+\phi\Delta P/P+\cdots(12)$$

where $[\Delta A^{(4)}/A^{(4)}+(\beta+e_2)\lambda_L+(\alpha+e_1)\lambda_k-(\alpha+e_1)\lambda_k\Delta\bar{a}]$=
the rate of growth of total factor productivity
λ_L=the rate of improvementsin the average quality of the work force
$\Delta A^{(4)}/A^{(4)}$=improvements not directly embodied in capital, labour, exports, advanced knowledge, socio-

cultural and political factors

5. But, this kind of the factor share method of estimating elasticity coefficient can be criticized, since there are a number of rigid assumptions which have to be made, specially when applied to our underdeveloped economy. Also, it is very difficult to measure the rate of growth of technology, natural resources, social and political factors, as well as elasticities of such elements. Qualitative factors are nearly impossible to be measured by the mathematical and statistical method so far developed. In addition, there may be a number of interaction(multicollinearity) between the variables, in the sense that changes in one determines the effect of changes in another. Therefore, both in theory and practice, it is very hard to deal explicitly with the very strong complementarity among the variables and to examine the relative contribution to economic development separately. Moreover, there exist some kind of causal relationships(or feedback effects) which should be distinguished from mere correlation. Causal relations are of central importance in economic analysis, but compared with the natural sciences, causal relationship is disappointingly hard to be discovered. We still search for the fundemental causes of economic change.(8)

6. To conclude, the development process is one of the most complex phenomena. The causation is intricate and depends upon the milieu under consideration. A factor which may be the main cause in somewhere may be not a cause in another. Also the relative importance of each variable may vary greatly from period to period. It should be therefore noted that the studies mentioned are by no means decisive. They all suffer from some shortcomings and fallacies, and their conclusion is questionable both on theoretical and empirical grounds, and their results should be taken with

(8) G. Garb; "The problem of causality in economics," *Kyklos*, 1964.

some reservation. The development process is, we think, the outcome of the interaction of a number of forces including capital, labour, skills, education, economies of scale, techical progress and a host of other social, cultural and political factors, all of them interacting in a complex way the outcome of which is economic progress. Economist, mania to quantify everything may lead to the wrong conclusion when it is carried to the extreme.

But, this critics cannot deny the fact that the extended Cobb-Douglas production function(or CES function) is a part of the useful quantitative framework for analysing economic development. If we are prepared to share the weaknesses of the Denison-Solow approach, some interesting and useful results can be obtained from it, even when applied to underdeveloped countries. Our strong desire is, however, that these studies as well as ours be elaborated further and thus be in a more complete model of economic development.

This means that at the moment we should be confined to the discussion and not dare to attempt to measure and compare the relative contribution of various development factors and export expansion too hastedly. To make bold methodological innovation is beyond the scope of this paper.