The Pakistan Development Review
36 : 4 Part II (Winter 1997) pp. 765—790

Economic Growth of Rich and Poor Countries: A Social Accounting Matrix Approach

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Many recent empirical studies on comparative growth focus on the supply side determinants of growth. This paper highlights the insights to be gained from employing a demand-determined growth model. A modelling framework along the Social Accounting Matrix, empirically analysed for a group of sixteen countries at different stages of economic development, gives support to the convergence thesis.

1. INTRODUCTION

The well-known data set of real GDP for 130 countries over 35 years compiled by Summers and Heston (1988), together with population figures have been used by many economists in studying income convergence patterns between rich and poor countries: Baumol (1986), followed by Dowrick and Gemmell (1988); Barro (1991); Mankiw, Romer and Weil (1992); Sprout and Weaver (1992) and Theil and Seale (1994). Taking all rich vis à vis all poor countries together the statistical material shows that there is a slight catching up tendency but further disaggregration has highlighted a convergence of income levels within the richer countries but divergence within the poorer countries with some of the latter even falling behind the rest and becoming relatively poorer. These trends can be readily seen from Table 1.

Two economic models have been invoked to explain the above tendencies: Solow's growth model which predicts convergence, Solow (1956), and Krugman's divergence model Krugman (1981). The mechanism behind Solow's growth model is diminishing returns to reproducible capital. A poor country characterised by a low capital/labour ratio, has a higher marginal productivity of capital and thereby tends to grow at a higher rate than a rich country with a higher intensity and lower marginal productivity of capital. Furthermore, there is a tendency for capital to move from rich

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Author's Note: The author acknowledges the special contributions of M. de Zeeuw regarding computations.

Keywords: economic growth, convergence, SAM.

Table 1

Income, Population, and Income Per Capita: Values, and Growth Rates by World Regions

	Values 1987			Average Annual Growth Rates 1961–1987		
	Income (Billions of US $)	Population (Millions)	Income Per Capita (US $)	Income	Population	Income Per Capita
World	24388	4866	5012	4.4	1.8	2.5
Rich Countries	13583	1032	13162	3.7	0.8	2.9
OECD Countries	10657	707	15074	3.7	0.8	2.9
Communist Countries	2926	325	9003	3.8	0.9	2.9
Poor Countries	10805	3835	2817	5.4	2.2	3.2
S. America and Carib.	1782	404	4411	4.8	2.5	2.3
S. Asia	1164	1076	1082	3.9	2.3	1.5
E. Asia	5270	1441	3657	7.0	1.8	5.2
Arab Region (W. Asia + N. Afr.)	2112	436	4844	4.6	1.9	2.7
Other Africa	296	448	661	2.8	2.8	0.0

Source: Sprout and Weaver (1992), based on Summers and Heston (1988).

to poor and thereby accelerating the convergence process. The contrary model is that of Krugman which stresses increasing returns to capital, technological edges and learning in assuring higher levels of more competitive capital and industrial exports in the rich country. Endogenous growth is seen to work to the advantage of the rich country which grows at a higher rate than the poor country. Capital flow tends to reverse from poor to rich, aggravating income gap between rich and poor, furthermore. Krugman's model has been elaborated further by Lucas (1993); Barro (1991) and others along endogenous growth theory to show basically the same: an increasing income gap between, on the one hand, countries which invest in human resources and are able to capture the public goods character of those investments, and, on the other, countries which do not (are unable or unwilling) to invest sufficiently in human resources, learning and innovation.

A synthesis is found in Mankiw, Romer and Weil (1992) who develop a model which combines the mechanical growth theory as represented by Solow and endogenous growth theory as represented by Krugman, Lucas and others. They test their model to the data set of Summers and Heston and find that countries with similar technologies and rates of accumulation and population growth should converge in income per capita. Yet this convergence occurs more slowly than the Solow model suggests. More generally, the results indicate that the Solow model is consistent with the international evidence if one takes account of intervening (dis)advantages of individual countries with respect to human and physical capital endowments.

Another empirical paper which contributes to a synthesis is by Barro and Lee (1993). They explain the growth performance of 116 economies from 1965 to 1985 and find a conditional convergence effect whereby a country grows faster if it begins with lower real GDP per capita in relation to its initial level of human capital in the forms of educational attainment and health; next to other stimulating factors such as high ratio of investment to GDP, small government and political stability.

It is noted that all the models mentioned above emphasise supply factors in determination of economic growth. The debate has so far been unbalanced as it excluded models of economic growth which emphasise demand factors. This paper highlights the insights to be gained from employing a demand-determined growth model. We use here a circular flow model based on the Social Accounting Matrix, SAM. The results of this model, empirically verified for a group of sixteen countries at different stages of economic development, would give general support to the convergence hypothesis. This paper discusses in Section 2 the SAM-based model. In Section 3 the SAM multipliers are used to assess the convergence hypothesis. In Section 4 empirical results are analysed. In Section 5 a numerical demonstration is reviewed, and Section 6 concludes.

2. THE DEMAND MODEL

For the purpose in mind, the fittest framework within the wide range of demand-oriented models is the circular flow model based on the Social Accounting Matrix, SAM. The Social Accounting Matrix is a very general data base which is well suited for the flexible modelling of the economy, cf. Pyatt (1991) and Cohen (1993).

The SAM is nothing more or less than the transformation of the circular flow into a matrix of transactions between the various agents. In the rows of such a matrix there are the products, the factors, the current accounts of institutions consisting of households, firms and government as well as their capital accumulation account, the activities and the rest of the world. The columns are ordered similarly. Transactions between these actors take place at the filled cells and in correspondence with the circular flow. A particular row gives receipts of the account while columnwise we read the expenditure of the actor.

Assuming proportional relationships for the cells in terms of their column totals a SAM coefficient matrix is obtained which can be written as a model of the economy with the endogenous part on the left hand side and exogenous part on the right hand side. The endogenous variables include production, income, consumption, investment, among others. The exogenous variables in such a model are those of government and rest of world. We shall discuss the assumptions of the model in a moment.

A SAM-based model can take the form of Equations (1) to (6), whereby the following notations hold:

V_v = value of production of sector v,
W_w = factor incomes of factor type w which can be wages, profits, etc.,

Z_z = receipts of household group by region z,
F = receipts of firms,
K = capital formation,
Y = national income,
X = purchases of government and/or exports, both of which are assumed exogenous,
T = transfers from government and/or rest of the world, both assumed exogenous.

Equation (1) gives the sectoral balance by sector v, consisting of intermediate delivery $\sum_{v'} a_{vv'} V_{v'}$, consumption expenditure $\sum_{z} c_{vz} Z_{z}$., capital formation e_v K, and a variable for the sectoral receipts from both government expenditure and exports i_v X, where i_v gives the sectoral share in these receipts.

Equation (2) defines national income, consisting of factor incomes.

Equation (3) determines factor incomes by factor w, as being originating from value added coefficients and production by sector $\sum_{v} a_{wv} V_{v}$.

Equation (4) determines household receipts by household group z, consisting of portions of factor income $\sum_{w} b_{zw} W_{w}$, inter household transfers $\sum_{z'} c_{zz'} Z_{z'}$, and transfers from government and rest of the world $i_z T$, where i_z gives the household group's share in the transfers.

Equation (5) determines firm receipts, consisting also from portions of factor income and transfers from government and rest of the world.

Equation (6) shows the different sources of capital formation to consist of deprivation summed over sectors, savings summed over households, reinvested savings of firms and capital transfer from government and the rest of the world.

The coefficients a,b,c are proportions of the total receipts (outlays) for the columns corresponding with V, W, Z respectively, and $\sum a = 1.0$, $\sum b = 1.0$, $\sum c = 1.0$.

$$V_v - \sum_{v'} a_{vv'} V_{v'} - \sum_{z} c_{vz} Z_z + eK_v = i_v X \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

$$Y - \sum_{w} W_w = 0 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

$$-\sum_{v} a_{wv} V_v + W_w = 0 \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

$$-\sum_{w} b_{zw} W_w - \sum_{z'} c_{zz'} Z_{z'} + Z_z = i_z T \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

$$-\sum_{w} b_{fw} W_w + F = i_f T \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

$$-\sum_{v} a_{kv} V_v - \sum_{z} c_{kz} Z_z - d_k F + K = i_k T \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

In the above equations, the endogenous variables appearing on the left hand side can be denoted by y, and they include national income among other variables. The exogenous variables appear on the right hand side and can be denoted by x. These include outlays of government and rest of the world. While the coefficient matrix which joins them can be denoted by S. The system can be described in matrix form by $y - Sy = x$, solving gives

$$y = (I - S\ )^{-1} x = Mx \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

where M stands for the matrix of system multipliers. We focus on the national income multiplier of rich and poor countries and examine their growth tendencies to shed light on the convergence hypotheses.

Before proceeding further, we discuss here main assumptions and limitations of the SAM multiplier approach as well as our counterpart arguments in defence of the approach for the purpose in mind.

(1) The evaluation of the multipliers of the SAM-model cannot be done in isolation from the closure rules applied. The size of the multipliers depends on the choice of the exogenous and endogenous variables, which in turn depends on the problem studied. In the context of the comparative analysis of economic systems there is an established rationale due to Koopmans and Montias (1971) for considering government policy and rest of the world conditions as exogenous and taking the rest of the economy as endogenous. This is also what is postulated in the SAM model.

(2) The SAM model describes an endogenous economy with fixed relative prices and complementarity-based production and consumption functions. Producers and consumers are assumed to face fixed prices, and in their pursuit of profit and utility maximisation, respectively, adjustment takes the form of changes in quantities supplied and demanded. As regards the assumption of producers and consumers facing given relative prices this is common practise in short-run models. Moreover, even in the longer run, having in mind the broad categories of sectors and products in the SAM we can draw on empirical evidence over long periods which supports indefinite shifts in relative prices between such broad categories, cf. Bleaney and Greenaway (1993).

(3) Cell entries of the SAM are amounts, i.e. products of prices times quantities. However, quantities and prices are not explicitly disentangled. In the SAM model, supplied amounts are supposed to adjust to demanded amounts. They

will, but if there is restricted capacity the result is inflation. This may require a revision downwards in the real sizes of multipliers. The role of investment in the model is confined to that of enhancing demand, and not of adding to the productive capacity. Whether the potential multiplier effects of impulses will be realised in increased quantities in full or disappear for a part in increased prices depends on the elasticity of supply. If the size of the impulse is relatively small, which is usually the case, these multipliers can still be seen to represent realisable quantity effects with little leakage into price effects. It is also feasible to check in a simple way within the SAM framework whether the capacity limits will be violated or not. The supply side can be simply modelled as a relationship between the investment rate and economic growth via an incremental capital output ratio x as in $K/Y = x\ (\bullet\ Y/Y)$. From the SAM we obtain multiplier effects for K and Y. If division of the multiplier effects of K by those of Y gives values equal to or above K/Y for the base period then this implies that the SAM solves for sufficient investment to meet the projected capacity increase. It is noted that multiplier results show that this condition is fulfilled for the countries studied. In principle, similar checks can be applied to trace whether the base period equilibria in the balance of payments and the government budget are reproduced by multiplier effects.

(4) The coefficient matrix in the SAM model, S, is a matrix of fixed average proportions. Compared to averages, observed marginal coefficients are better since they incorporate income and scale effects, but they can be disputable as their estimated values may carry other than income effects, which is inconsistent with the SAM framework. While the c set, in the equation system (1) to (6) (these are consumption propensities), can be calculated sensibly as marginal instead of average values, the problem is severe for the a set (these are input-output coefficients) as well as for the b set (these are sector—factor earnings coefficients), and other coefficients in the model, which do not usually depict stable marginal propensities. Taking a portion of the coefficients as marginal and the other as an average introduces an estimation bias. Moreover, the uniform fixed coefficient assumption in cross-country comparisons is an advantage in contrast with incomparable specifications for individual countries (which, of course, can be suitable for other purposes).

(5) The size of the multiplier depends to some degree on the level of aggregation. This argument is not relevant in the context of a uniform aggregation for the compared countries. Moreover, the differences in multipliers due to alternative aggregations tested do not go beyond 8 percent for the individual countries studied here.

(6) Although it is commonly perceived that a SAM-inverted model belongs more to the prototype of demand-oriented models, yet under general equilibrium

conditions it is a representation of the supply side as well, which is why the SAM is directly convertible to the CGE model. Finally, although we use a demand model, this does not mean that we are implying short-run growth rates. By analysing and fitting our hypothesis to the economic growth of countries ranging from developing countries such as India and Pakistan to advanced countries such as Germany and the Netherlands we are clearly emphasising the long range character of economic growth.

3. THE CONVERGENCE HYPOTHESIS

Recalling Equation (7) which gives the endogenous vector as function of the system multipliers and an exogenous vector $y = Mx$, our concern in this paper goes to one endogenous variable from the vector y i.e. national income, Y, and one exogenous variable from the vector x, namely government expenditure and exports combined, X, in Equations (2) and (1). The multiplier elements from the multiplier matrix, which interest us here are those giving the sum total effects of equal sectoral injections via X on Y, which we shall call m. We shall thus restrict our interest to the total multiplier effect of the unweighted exogenous injections in government expenditures and exports, X, on the national income, Y, as in Equation (8.1) where m consists of the summed relevant elements[1] from the multiplier matrix M.

$$Y = mX \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (8.1)$$

To simplify matters we shall ignore for the moment the less significant multiplier impact of the exogenous variable of transfer payments by the government and the rest of the world, T, but we comment on the impact of its incorporation in Section 4, which will be shown to reinforce our conclusions.

Equation (8.1) can be rewritten as in Equation (8.2)

$$Y = m(X/Y)Y \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (8.2)$$

and reexpressed in growth rates as in Equation (8.3)

$$Y^{\bullet} = m^{\bullet} + (X/Y)^{\bullet} + Y^{\bullet} \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (8.3)$$

If we further denote a hypothesised growth rate by * and a realisable growth rate by o, Equation (8.3) can be rephrased as in (8.3.1).

Note here that we treat the three growth rates on the right hand side as hypothetical values in the sense that these growth rates are either assumed or forecasted

[1] m is a weighted sum of multipliers by sector, i.e. $y = \sum_v m_v X_v = \sum_v m_v s_v X = mX$, where s_v is sectoral share of the exogenous variable X.

and are consistently estimated in relation to each other. The combined effect of the three growth rates result in the realisable growth rate of the national income on the left hand side. We are in a position thus to answer the question how the economy will perform in the longer run based on components derived from the SAM model.

$$Y^{\bullet o} \gtreqless m^{\bullet *} + (X/Y)^{\bullet *} + Y^{\bullet *} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (8.3.1)$$

Equation (8.3.1) reads more specifically for poor countries, p, and rich countries, r, as follows:

$$Y_p^{\bullet o} \gtreqless m_p^{\bullet *} + (X/Y)_p^{\bullet *} + Y_p^{\bullet *}, \text{ and}$$

$$Y_r^{\bullet o} \gtreqless m_r^{\bullet *} + (X/Y)_r^{\bullet *} + Y_r^{\bullet *}$$

The hypothetical and realisable values of the growth rate of income, $Y^{\bullet *}$ and $Y^{\bullet o}$, respectively, are generally different due to the independent determinacy of $m^{\bullet *}$ and $(X/Y)^{\bullet *}$.

If it can be shown for the groups of the poor and rich countries for which we have SAMs that starting from the *same* hypothetical growth rates $Y_p^{\bullet *} = Y_r^{\bullet *}$ we can expect $m_p^{\bullet *} + (X/Y)_p^{\bullet *} > m_r^{\bullet *} + (X/Y)_r^{\bullet *}$ then it follows that realisable growth rates will show $Y_p^{\bullet o} > Y_r^{\bullet o}$, which is an indication of catching up. We may start first with growth of the exogenous share $(X/Y)^{\bullet *}$ and show that this can be expected to be higher for poor than rich countries and take up later the prospects for $m^{\bullet *}$

We start first with X/Y. An interesting feature of the accounting system is that the row element of government expenditure and exports X can be divided by the row of total national income Y to give the exogenous share, X/Y. We have defined X to consist of government expenditure and exports. The hypothesis, which we put forward is that the share of these items in the national income, X/Y, tends to grow rapidly during early stages of economic development but ebbs down and stops growing at higher stages of economic development. This hypothesis is put down in Figure 1 which shows the relationship between X/Y and income per capita, Y/N, this being the conventional expression for the stage of economic development.

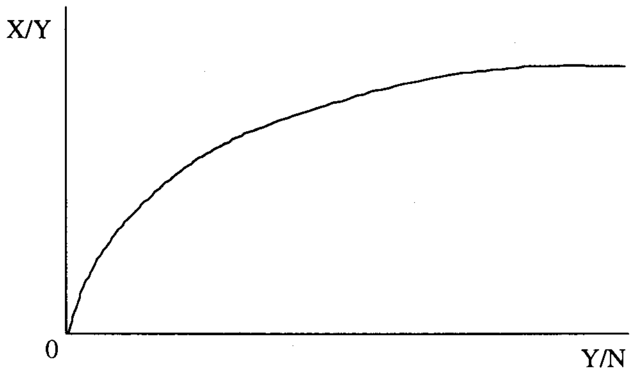

Fig.1.

The quasi-logistic curve in Figure 1 can be formulated as Equation (9). This is also the form in which the hypothesis will be empirically tested.

$$X/Y = \frac{\beta(Y/N)}{(Y/N)+\alpha} \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (9)$$

Wagner's law predicts that at higher levels of economic development, that is, as income per capita grows, the relative share of the public sector in national income will grow. Although the basis of the statement of Wagner was the empires of the nineteenth century, the theoretical foundations behind the phenomenon were developed later by Peacock and Wiseman, Musgrave, Baumol and others using various public choice arguments. More recent experiences in the balancing of budgetary deficits in rich countries directed attention to fiscal, monetary and incentive limits to the further growth of the government share in total expenditure. So the share of the public sector grows as income per capita grows, up to a certain limit. This share has a tendency to stabilise at the higher levels of income per capita.

A similar tendency applies to the share of exports in income, which share is very much dependent on economic development, location and population. As per capita income grows, there is a tendency for the economy to become more open and attain a higher share of exports up to a point where the share levels off as more open economy countries get their portions of world exports. It is also established that the larger the country is in terms of population and economy the lesser the share of exports in income. Among the four rich countries treated in this paper Germany, Italy and Spain will be seen to fall in this class. On the other hand, the small population countries which are also centrally located like the Netherlands tend to have higher shares of foreign transactions with the rest of the world.

The conclusion is that as far as the exogenous share is concerned, and this applies to both constituents of government expenditure and exports, the growth of this share for developing countries is higher than for rich countries: $(X/Y)_p^{\bullet *} > (X/Y)_r^{\bullet *}$

We go now to $m^{\bullet *}$ Recalling Equation (8.1) we have: $1/m = X/Y$. Seen as a definition a rise in *X/Y* should lead to a proportional fall in *m*.

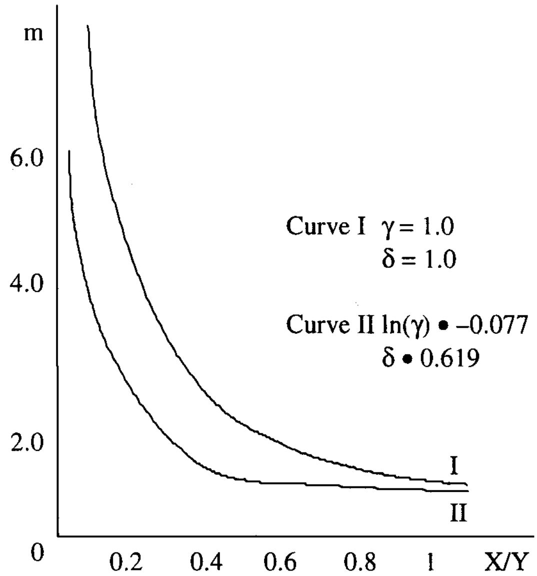

Fig. 2.

The relationship between *m* and *X/Y* can be put down more generally as Equation (10), which will be empirically tested in the next section.

$$m = \gamma(X/Y)^{-\delta} \qquad \ldots \quad \ldots\ldots \quad \ldots \quad \ldots \quad \ldots \qquad (10)$$

In Figure 2, curve I is obtained for values $\gamma = \delta = 1$, while curve II corresponds with our empirical estimation, which results in γ having a slightly lower value than 1, and $\delta < 1$ indicating that the fall in m is somewhat moderated.

The underlying relationship behind empirical curve II is that m falls with higher *X/Y* but increasingly at a lower rate than proportionally. The argument is that the income-expenditure-production linkages in the economy, which have been accumulated throughout the past and which have assured higher circular flow mechanisms and higher *m*, have been enriched in the development process and are not lost proportionally just like that by an increased exogeneity. The circular flow effects fall with a rise in the exogenous share but this fall happens at a lower rate than the rise in the exogenous share.

More generally, an open ended economy, with no specification of closure as yet, can be written down as a system of equations in one whole matrix with proportionate coefficients. The assignment of part of this matrix as an exogenous part is a specification of closure and gives determinacy to the system. The remainder of the matrix is the inverted part which gives the system multipliers. If the size of the exogenous part is relatively small, then the size of the inverted part will be relatively large, resulting in high multipliers, and hence low external leakage.

The internal leakage, as the term suggests is different, and is determined by the typical pattern of the inverted part. When the transactions of one agent (A) with a high multiplier effect flow to agents (B) with lower multiplier effects, thus $m(A) > m(B)$, internal leakage tends to be high. The more developed the economy the greater the linkages, the more correspondence between $m(A)$ and $m(B)$, and the smaller is the internal leakage. Once the endogenous linkages are built, their multiplier effects will not be proportionally written off with an increased exogeneity. There is an economic growth advantage here for the rich vis a vis the poor country. Other institutional structures matter also: there should be lesser variation of output multipliers in the free market economy which reacts quickly and competitively in setting up new transactions between agents when the need arises, this in contrast to the case of the centrally planned economy which is characterised by higher internal leakage.

All this means that the relative decline in multiplier m with increased exogenity can be expected to be higher for the poor than for the rich country, $m_p^{\bullet *} < m_r^{\bullet *}$. This contributes to a widening of the gap between rich and poor, but as will be empirically shown later this is not strong enough to countervail the catching up tendency due to $(X/Y)_p^{\bullet *} > (X/Y)_r^{\bullet *}$, so that in the longer run we can expect convergence, nevertheless.

4. EMPIRICAL RESULTS

This section will report on selected results from cross-country comparisons of SAM models applied to ten developing countries (India, Pakistan, Sri Lanka, Indonesia, Iran, Kenya, Colombia, Egypt, South Korea, and Suriname), two centrally planned economies (Poland and Hungary) and four developed market economies (The Netherlands, Italy, Germany, and Spain), for different years.

The classification of activities in these SAMs had to be limited to three large groups of sectors: agriculture, industry and services; whereby industry includes mining, manufacturing and energy utilities, and services includes construction and transport among other private and public services. Distinguishing more sectors would reduce the uniformity and comparability of the sixteen SAMs reported here. The disaggregation of households in the SAMs of the developing countries emphasises dualities in the location of population in urban and rural areas, and the differentiation within urban and rural groups by level of income earned. This differentiation is done by a categorical split-up among urban households leading to the distinction between the three groups of employers, employees and self-employed; and a split-up among rural households by size of land ownership leading to three groups of large landowners, medium landowners and small/landless households. As a result, there are six groups of households. For a couple of countries a seventh residual group was incorporated so as to accommodate for classifications which did not fit the standardised six categories. The SAMs of the European countries distinguish household groups by income classes obtainable from personal income distributions.

The testing of Equations (9) and (10) require data by country on the exogenous share of government and exports in national income, X/Y, and the income multiplier m, which are obtainable from the SAMs and the matrix inversions, respectively. Data on a third variable is needed, this is the GNP per capita, Y/N, expressed in US $ for the sixteen countries and their related years. These are obtainable from published tables of the World Bank Atlas, which are specially suitable in our context as they are based on conversions that smoothen the impact of annual fluctuations in exchange rates. Table 2 brings these data together. Note that the value of X/Y varies from a lower value of 0.12 for India (poor country) to a highest value of 0.89 for the Netherlands (rich country). The income multipliers start from 7.06 for a poor country and fall to 0.85 for a rich country.

The regression results of Equations (9) and (10) are found in Table 3. Equation (9) describes a quasi-logistic function which makes the level of the exogenous share dependent on the income per capita. To account for a particularly lower share in case of a large size rich country, e.g. Germany, Italy and Spain, and too high a share of exports for a few particularly foreign trade oriented small countries e.g. the Netherlands, Suriname and Kenya, a dummy variable is included which takes the value of 1.0 for the first group and –1.0 for the second group. The equation is estimated by non-linear least squares. The regression performs very well, in terms of the signs of the coefficients, their t-values and goodness of fit as indicated by R^2 (above 0.8). The predicted highest value of the exogenous share in the observed sample, disregarding the dummy, can be calculated at 61 percent for the richest country. The predicted and observed lowest value of the exogenous share are the same, at 12 percent for the poorest country.

Because Y is determined by the whole system including Equation 9, the question is raised on possible correlation between the explanatory variable, per capita income Y/N, and the disturbance term, yielding a biased non-linear least square estimator. Note that the explanatory variable is expressed as Y/N and not in terms of Y only. Furthermore, the residuals in Equation 9 were found not to correlate with the explaining

Table 2

SAM Features and GNP Per Capita of Sixteen Countries

Country	Year	GNP per Cap. (1000$)	Exogenous Share = X/Y	Average Multipliers in SAM: Multiplier Effect = m	Rank (a)	Highest/ Lowest (b)
Poor Countries						
Unweighted Average		0.55	0.34	2.89	ASI	1.54
India	1968-69	0.09	0.12	7.06	ASI	1.20
Pakistan	1979	0.17	0.24	6.11	ASI	1.24
Sri Lanka	1970	0.17	0.23	2.32	ASI	1.24
Indonesia	1975	0.21	0.37	2.90	ASI	2.15
Iran	1970	0.22	0.13	2.82	ASI	1.40
Kenya	1976	0.24	0.45	1.28	ASI	2.03
Colombia	1970	0.34	0.22	2.47	SAI	1.18
Egypt	1976	0.35	0.43	1.15	ASI	1.86
South Korea	1979	1.51	0.43	1.79	ASI	1.66
Suriname	1979	2.21	0.76	0.95	SAI	1.48
Rich Countries						
Eastern Europe						
Unweighted Average		2.26	0.45	0.85	SAI	1.52
Poland	1987	1.93	0.40	0.92	SAI	1.57
Hungary	1990	2.59	0.49	0.77	SAI	1.46
Rich Countries						
Western Europe						
Unweighted Average		8.70	0.54	1.30	SAI	1.32
Spain	1980	5.40	0.29	1.53	ASI	1.26
Italy	1984	6.42	0.43	1.50	SAI	1.42
Germany	1984	11.13	0.57	1.32	SAI	1.47
The Netherlands	1987	11.86	0.89	0.85	SAI	1.13

(a) ASI = Agriculture-Services-Industry; SAI = Services-Agriculture-Industry.

(b) For example, in the case of India dividing the average income multiplier of agriculture by that of industry gives 1.20.

Table 3

Regression Results of Equations (9) and (10)

Item	Explained, Explanatory Variables and Coefficient Estimates				R^2
Equation (9)	X/Y =	β(Y/N) /	[α + (Y/N)]	+ $E_9 D_9$	
Coefficient		0.632	0.369	–0.201	0.813
t-value		(12.95)	(3.25)	(–4.84)	
Equation (10)	ln m =	ln γ +	δ ln (X/Y)	+ $E_{10} D_{10}$	
Coefficient		–0.077	–0.619	–0.799	0.890
t-value		(–0.58)	(5.41)	(–6.39)	

variable of national income per capita ($r = 0.34$), giving no ground for applying more sophisticated regression methods than the followed non-linear least squares method.

Equation (10) describes a convex function between the income multiplier and the exogenous share. For estimation purposes the equation is formulated as $ln\ m = ln\ \gamma + \delta\ ln\ (X/Y)$ and tested by ordinary least squares. One dummy needs to be introduced to account for a high income multiplier bias in the SAMs of both India and Pakistan: the available SAMs of India and Pakistan do not register complementary imports to the full extent or at all, and hence underestimate the leakage and overestimate the multipliers.

Another dummy is required to account for the differential impacts of economic systems, e.g. Poland and Hungary. Although one should expect higher multipliers for the less rich Eastern Europe (Poland and Hungary) as compared to the more rich Western Europe; instead, they have about the same levels, as Table 2 shows. This under-performance of Poland and Hungary is due to the presence of institutions which do not make full use of the potential internal leakage effects within the system. The variation of income multipliers among the West European countries as represented by the ratio of the highest/lowest sectoral multiplier can be calculated as 1.44. For Eastern European countries the variation is higher. It is noted too that Poland has a wider variation (1.57) than Hungary (1.46), which reflects a more balanced and well-knitted economy in this respect.

Equation (10) was tested with two separate dummies as well as with one dummy carrying the value of −1.0 for India and Pakistan and 1.0 for Poland and Hungary. The results are very similar so that we can work as well with the simpler case of one dummy, which is reported in Table 3. The regression performs very well in terms of all prerequisites.

The focus of the paper is not the relationship $Y = mX$ for a specific country but searching for a valid relationship between the three variables over a range of poor and rich countries. This has led us to use two equations: one for explaining m in terms of X/Y (Equation 10) and one for explaining X/Y in terms of national income per capita (Equation 9).

If the mean of m over the 16 countries in Equation 10 was anything meaningful, we would have obtained values of 1 for γ and for δ in Equation 10 (curve I in Figure 2), but we do obtain curve II in Figure 2 with values $ln(\gamma) = -0.077$ and $\delta = 0.619$. These results are not due to whether the m's are calculated as weighted or unweighted sectoral impact multipliers, but they are due to the shapes and significance of linkages changing with economic development which were stated under Figure 2.

The paper calculates m as an unweighted sectoral average (see Footnote 2). It can be readily seen from Table 2 that if m was calculated as a weighted sectoral average the curve of Equation 10 would fall more steeply and flatten earlier with values of $ln(\gamma)$ and δ even further away from $\gamma = \delta = 1$. Note that in Table 2 agricultural multipliers score highest and have the highest share in poor countries. Weighting sectoral multipliers by sectoral shares would result in higher aggregate m's for the poor countries as compared to rich countries causing the curve to shift further away from curve I.

5. DEMONSTRATION

With the estimates of α, β, γ, and δ we are now in a position to predict for a poor and a rich country respectively, such growth rates as $(X/Y)^{\bullet *}$ and $m^{\bullet *}$ for assumed values of $Y^{\bullet *}$, insert them in Equation (8.3) for the poor and rich country separately, and solve for realised growth rates of income of the poor and rich countries $Y_p^{\bullet o}$ and $Y_r^{\bullet o}$. Recall Equation (8.3.1) for the poor and rich country:

$$Y_p^{\bullet o} \gtreqless m_p^{\bullet *} + (X/Y)_p^{\bullet *} + Y_p^{\bullet *}, \text{ and}$$

$$Y_r^{\bullet o} \gtreqless m_r^{\bullet *} + (X/Y)_r^{\bullet *} + Y_r^{\bullet *}$$

In Table 4 we start from initial income, population and income per capita for a poor and a rich country (poor and rich as was indicated by the averages in Table 2). We assume for both types of countries the same annual rates of growth of 2 percent per income, 1 percent for population and 1 percent for income per capita. Using the estimates of α, β, γ, and δ we obtain the predicted values of growth rates of X/Y, of X, and of m in columns 8, 10, and 12 respectively. These are used in solving for the realised growth rates of income of the poor and rich country in the last column. The calculations show that the realised growth rate of income of the poor country will exceed that of the rich country. The poor country would achieve an annual growth rate of 2.17 percent while the rich country would grow annually at 2.02 percent. Another scenario is run with assumed growth rates of income per capita for the poor and rich at 3 percent, this scenario results also with a higher rate of realised growth for the poor than the rich, 3.19 percent compared to 3.05 percent. In a more general way, Table 4 simulates the annual growth rate of income for rising levels of income per capita. The table shows higher growth rates of income at lower levels of income per capita, the growth rates diminishing slowly and practically stabilising at a high level of income per capita of around US $ 20,000.

The convergence tendency, $Y_p^{\bullet o} > Y_r^{\bullet o}$, is decomposable into a part due to $X^{\bullet}$ and a part due to $m^{\bullet}$, Equation (8.1). The positive but diminishing contribution of $X^{\bullet}$ standing for a growth potential at a lower level of economic development and an exhaustion of possibilities for exogenous growth at higher levels of economic development dominates the negative effect of $m^{\bullet}$, standing for the diminishing multiplier effects but at a reduced rate.

Table 4

Selected Simulations

		Assumed						Predicted						Solution
		Income per Capita Y/P		Population P		Income Y		Exogenous Share X/Y		Exogenous Value X		Multiplier m		Income
Year		($)	Growth Rate	(Mln.)	Growth Rate	(Mln. $)	Growth Rate	(%)	Growth Rate	(mln. $)	Growth Rate	Value	Growth Rate	Growth Rate
Simulation for Rich and Poor														
Rich	0	8703.0		220.0		1914660		0.606		11609		1.2612		
	1	8790.0	0.01	222.2	0.01	1953145	0.02010	0.607	0.00040	11847	0.02051	1.2609	−0.00025	0.02026
	1	8877.1	0.02	222.2	0.01	1972483	0.03020	0.607	0.00080	11969	0.03102	1.2606	−0.00049	0.03053
Poor	0	551.0		880.0		484880		0.379		1835		1.6879		
	1	556.5	0.01	888.8	0.01	494626	0.02010	0.380	0.00399	1880	0.02417	1.6838	−0.00246	0.02171
	1	556.5	0.01	897.6	0.02	499523	0.03020	0.380	0.00399	1898	0.03431	1.6838	−0.00246	0.03185
	1	562.0	0.02	897.6	0.02	504469	0.04040	0.382	0.00793	1925	0.04865	1.6797	−0.00487	0.04377
	1	567.5	0.03	897.6	0.02	509415	0.05060	0.383	0.01182	1951	0.06302	1.6757	−0.00724	0.05578
	1	573.0	0.04	897.6	0.02	514361	0.06080	0.384	0.01567	1978	0.07742	1.6718	−0.00957	0.06785
Simulations for Different Income Levels														
	0	100.0		220.0		22000		0.135		30		3.1977		
	1	101.0	0.01	222.2	0.01	22442	0.02010	0.136	0.00785	30	0.02811	3.1822	−0.00483	0.02328

Continued—

Table 4—(*Continued*)

0	551.0		220.0		121220		0.379		459		1.6879		
1	556.5	0.01	222.2	0.01	123657	0.02010	0.380	0.00399	470	0.02417	1.6838	−0.00246	0.02171
0	1000.0		220.0		220000		0.462		1016		1.4928		
1	1010.0	0.01	222.2	0.01	224422	0.02010	0.463	0.00268	1039	0.02283	1.4903	−0.00165	0.02118
0	2000.0		220.0		440000		0.534		2348		1.3649		
1	2020.0	0.01	222.2	0.01	448844	0.02010	0.534	0.00154	2399	0.02168	1.3636	−0.00095	0.02072
0	4000.0		220.0		880000		0.579		5092		1.2982		
1	4040.0	0.01	222.2	0.01	897688	0.02010	0.579	0.00084	5199	0.02095	1.2975	−0.00052	0.02044
0	6000.0		220.0		1320000		0.595		7860		1.2754		
1	6060.0	0.01	222.2	0.01	1346532	0.02010	0.596	0.00057	8022	0.02069	1.2750	−0.00035	0.02033
0	8000.0		220.0		1760000		0.604		10633		1.2640		
1	8080.0	0.01	222.2	0.01	1795376	0.02010	0.604	0.00044	10852	0.02055	1.2636	−0.00027	0.02028
0	8703.0		220.0		1914660		0.606		11609		1.2612		
1	8790.0	0.01	222.2	0.01	1953145	0.02010	0.607	0.00040	11847	0.02051	1.2609	−0.00025	0.02026
0	10000.0		220.0		2200000		0.610		13410		1.2571		
1	10100.0	0.01	222.2	0.01	2244220	0.02010	0.610	0.00035	13684	0.02046	1.2568	−0.00022	0.02024
0	12000.0		220.0		2640000		0.613		16188		1.2524		
1	12120.0	0.01	222.2	0.01	2693064	0.02010	0.613	0.00030	16518	0.02040	1.2522	−0.00018	0.02022
0	20000.0		220.0		4400000		0.621		27306		1.2432		
1	20200.0	0.01	222.2	0.01	4488440	0.02010	0.621	0.00018	27860	0.02028	1.2430	−0.00011	0.02017

The analysis concentrated so far on the effects of exogenous changes in sectoral allocations originating from government and the rest of the world, X. How significant are the effects of exogenous changes in transfers originating from government and rest of world, T, and in which direction do they act?

In principle, the above analysis as in Tables 2, 3 and 4 can be repeated but with focus on T. It is also possible to demonstrate the effects via short-cuts. Recalling Equation 7 which gives the vector of endogenous variables y as function of multiplier matrix M and vector of exogenous variables x,

$$y = Mx$$

this can be specified for variables of interest: endogenous income Y, exogenous allocations X and exogenous transfers T.

$$Y = mX + m'T$$

and dividing throughout by Y gives

$$1 = m\,X/Y + m'\,T/Y$$

This equation can be specified for poor and rich countries as

$$1 = (m)_p\ (X/Y)_p + (m')_p\ (T/Y)_p \qquad \ldots \qquad \ldots \qquad \ldots \qquad (11.1)$$

$$1 = (m)_r\,(X/Y)_r + (m')_r\ (T/Y)_r \qquad \ldots \qquad \ldots \qquad \ldots \qquad (11.2)$$

Inserting the average values of the above parameters for the two groups of countries—see appendix Table 2—gives the following results:[2]

$$1 \approx (2.545)(0.356) + (2.423)(0.078) \approx 0.83 + 0.17 \qquad \ldots \qquad \ldots \ (11.1)$$

$$1 \approx (1.3)(0.543) + (1.648)(0.242) \approx 0.63 + 0.27 \qquad \ldots \qquad \ldots \ (11.2)$$

These results show the effect of X to be about 2.5 to 5.0 times that of T in determining economic growth. At higher levels of economic development the relative strength of X and T effects shifts from X to T. This happens via an increase in the share of T/Y (and a lower share of X/Y) as well as less reductions in m' (as compared to m). At still higher levels of economic development the increases T/Y are restricted by the same constraints which apply to X/Y. First, the T/Y share for individual rich countries has reached its ceiling in the late eighties/early nineties and is falling in others [Cohen and Bayens (1994)]. Second, the growth effect of transfers in rich countries, m'_r, forms 68 percent of that for poor countries, m'_p. Therefore the conclusions reached on converging tendencies due to the X effects apply to the T effects as well.

[2]The sum of Equation 11.1 does not tally to one because of unweighted values over sectors and countries. Similarly for Equation 11.2.

6. CONCLUSIONS

Investigation of whether the gap in the income per capita between rich and poor countries is widening or diminishing has relied mainly on supply side models of economic growth appropriately adapted to include elements of endogenous growth.

In this paper a demand side model, based on the Social Accounting Matrix (SAM) is estimated for sixteen countries. The SAM models predict higher economic growth at lower levels of income per capita, and indicate, therefore, the presence of a convergent tendency. The main cause behind this convergent tendency is the ability of a poor country to increase significantly exogenous injections of exports and government, this in contrast to the exhaustion of possibilities for exogenous growth—of both exports and government—at higher levels of income per capita; while the positive effects from linkage economies at higher levels of income per capita are too low to compensate for the loss in the exogenous growth potential.

Can one, with the SAM based demand side approach, speak of conditional convergence as has become common place in supply side explanatory approaches? In principle, this can be said to apply here too. The SAM analysis was supplemented by dummy variables to account for particularly low/high exogenous shares, these tend to associate with large/small sizes of the economy in relation to the rest of the world and the openness of an economy. Furthermore, the type of the economic system as to whether it is predominantly centrally planned or market oriented was found to influence the size of the multiplier effects. The inherent long-run tendencies towards convergence can be interpreted as conditional to the extent that the above mentioned particular features of individual countries—expressed as intervening dummies—enjoy a permanent presence. *Ceteris paribus*, the SAM analysis supports the convergence hypothesis.

The tables below give basic variables from the SAM's which are used in the analysis.

Appendix Table 1

Selected SAM Features and GNP Per Capita

Country	Year	Currency Unit	(1) Final Demand Consumption	(2) Investm.	(3) Govern-ment	(4) Export	(5) Interm. Deliv.s	(6) Output	(7) Import	(8) GDP	(9) X/O	(10) O/Y	(11) X/Y	(12) Average Income Multiplier from Injections in X	GNP Cap (1000$)
			In Bln. of Own Currency Units												
India	1968-69	Rupee	27.471	5.103	0.000	1.450	18.744	52.768	1.868	32.156	0.027	1.641	0.045	7.06	0.09
Pakistan	1979	Rupee	0.199	0.042	0.022	0.034	0.168	0.465	0.059	0.238	0.121	1.953	0.237	6.11	0.17
Sri Lanka	1970	Rupee	7.601	1.962	0.302	2.113	4.358	16.336	1.389	10.589	0.148	1.543	0.228	2.32	0.17
Indonesia	1975	Rupiah	8.201	2.227	1.062	3.253	5.797	21.223	3.009	11.734	0.203	1.809	0.368	2.90	0.21
Iran	1970	Rial	0.450	0.146	0.050	0.021	0.327	0.993	0.111	0.556	0.071	1.786	0.128	2.82	0.22
Kenya	1976	Shilling	0.951	0.199	0.120	0.472	0.932	2.673	0.431	1.310	0.221	2.041	0.452	1.28	0.24
Colombia	1970	Peso	93.863	28.660	9.962	18.516	108.065	259.066	20.639	130.362	0.110	1.987	0.218	2.47	0.34
Egypt	1976	Pound	3.927	1.198	1.893	0.800	3.482	11.300	1.604	6.214	0.238	1.818	0.433	1.15	0.35
South Korea	1979	Won	6.729	2.078	0.990	2.748	8.383	20.928	3.878	8.667	0.179	2.415	0.431	1.79	1.51
Suriname	1979	Guilder	1.026	0.181	0.000	0.917	0.507	2.631	0.921	1.203	0.349	2.187	0.762	0.95	2.21
Poland	1987	Zloty	8.371	4.425	2.937	3.516	19.373	38.622	3.218	16.031	0.167	2.409	0.403	0.92	1.93
Hungary	1990	Forint	1.094	0.409	0.166	0.685	1.953	4.360	0.605	1.749	0.195	2.493	0.487	0.77	2.59
Spain	1980	Peseta	9.791	3.548	1.929	2.400	14.071	31.739	2.664	15.004	0.136	2.115	0.289	1.53	5.40
Italy	1984	Lira	414.754	121.710	136.677	149.717	588.080	1410.938	162.013	660.845	0.203	2.135	0.433	1.50	6.42
Germany	1984	Mark	823.300	310.642	350.230	476.852	1508.506	3469.530	499.370	1461.654	0.238	2.374	0.566	1.32	11.13
The Netherlands	1987	Guilder	196.071	52.902	70.590	203.354	222.793	745.710	213.312	309.605	0.367	2.409	0.885	0.85	11.86

X = Government (Col. 3) + Exports (Col. 4) O = Output (Col. 6) Y = GDP (Col. 8).

Appendix Table 2

Selected SAM Features and GNP Per Capita

Country	Year	Currency Unit	(9) T/O	(10) O/Y	(11) T/Y	(12) Average Income Multiplier from Transfers in T	GNP Cap (1000$)
India	1968-69	Rupee	0.058	1.641	0.095	4.34	0.09
Pakistan	1979	Rupee	0.036	1.953	0.070	4.28	0.17
Sri Lanka	1970	Rupee	0.105	1.543	0.163	2.28	0.17
Indonesia	1975	Rupiah	0.009	1.809	0.017	2.64	0.21
Iran	1970	Rial	0.080	1.786	0.142	2.78	0.22
Kenya	1976	Shilling	0.063	2.041	0.129	1.98	0.24
Colombia	1970	Peso	0.016	1.987	0.032	2.17	0.34
Egypt	1976	Pound	0.027	1.818	0.050	1.87	0.35
South Korea	1979	Won	0.013	2.415	0.032	2.13	1.51
Suriname	1979	Guilder	0.008	2.187	0.018	1.67	2.21
Poland	1987	Zloty	0.019	2.409	0.047	1.54	1.93
Hungary	1990	Forint	0.055	2.493	0.138	1.40	2.59
Average of Poor Countries					0.078	2.42	0.84
Spain	1980	Peseta	0.079	2.115	0.167	1.87	5.40
Italy	1984	Lira	0.107	2.135	0.228	1.73	6.42
Germany	1984	Mark	0.083	2.374	0.196	1.57	11.13
The Netherlands	1987	Guilder	0.157	2.409	0.377	1.42	11.86
Average of Rich Countries					0.242	1.65	8.70

The sources of SAMs from several developing countries are as follows:

Egypt: Eckhaus R. S., F. D. McCarthy and A Mohie-Eldin (1981) A Social Accounting Matrix for Egypt (1976) *Journal of Development Economics* Oct. 1981.

India: Cole S. and G. A. Meagher (1984) Growth and Income Distribution in India, a General Equilibrium Analysis. In Cohen S. I., P.A. Cornelisse, R. Teckers, and E. Thorbecke (eds) *The Modelling of Socio-Economic Planning Processes.* Aldershot: Gower Publishing.

Indonesia: Biro Pusat Statistik Indonesia (1982) *Social Accounting Matrix Indonesia 1975*. Jakarta: BPS.

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Kenya: Vander Hoeven R. E. (1987) *Planning for Basic Needs: A Basic Needs Simulation Model Applied to Kenya.* Amsterdam: Free University Press.

Sri Lanka: Pyatt G. and A. Roe (1977) *Social Accounting for Development Planning.* Cambridge: Cambridge University Press.

The SAMs for Columbia, Suriname, Korea, and Pakistan have been constructed by the author and several associates and are reported upon in detail in Cohen S. I. (1989) Multiplier Analysis in Social Accounting and Input-Output Frameworks: Evidence for Several Countries. In R. E. Miller, K. R. Polenske, and A. Z. Roze, *Frontiers in Input-Output Analysis.* Oxford: Oxford University Press.

The SAMs for six countries from Europe are constructed from the following sources.

Italy: Civardi M. C. B. and R. T. Lenti (1990). A SAM for Italy. Paper presented at the conference 'A SAM for Europe'. Universidad Internacional Mendez Pelayo, Valencia, September 1990.

Spain: Kehoe T. *et al.* (1985) A Social Accounting Matrix for Spain 1980. Working paper 6386, Universidad Autonoma de Barcelona.

The SAMs for The Netherlands, Germany, Hungary, and Poland have been constructed by several associates under supervision of the author. The SAMs for Hungary were done in collaboration with T. Revesz and E. Zalai of Budapest University of Economic Sciences, and the SAMs for Poland were done in collaboration with A. Czyzewski, L. Zienkowki, and Z. Zolkiewski, of the Research Centre for Economic and Social Studies, Central Statistical Office, Warsaw. More details on the SAMs for Italy, Germany, The Netherlands, Spain, Hungary, and Poland are found in Cohen (1993)

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Theil, H., and J. L. Seale (1994) The Geographic Distribution of World Income, 1950–1990. *De Economist* 142: 4 387–419.

Comments

This is an innovative and interesting paper. It employs the Social Accounting Matrix (SAM) framework to demonstrate that low-income countries tend to grow faster than high-income countries. Therefore, there is a tendency for the income per capita of low-income countries to converge to that of high-income countries over time. While the convergence hypothesis appears to make sense and therefore commands widespread support among economists, this acceptance is neither universal nor unconditional. The author provides a good survey of the literature of empirical growth economics based on the neoclassical growth model stimulated by the Summers and Heston data set of 130 countries for over 35 years.

All the studies I have seen on cross-country growth, and believe me there have been many such studies originating with Barro's work (1991), have generally used the neoclassical growth framework. A typical study computes averages of ten years or longer for as many countries as possible on GDP growth rates and attempts to explain them statistically by performing cross-section regressions. Usually the explanatory variables are averages of labour or population growth, inflation, investment to GDP ratios, and fiscal, monetary, social, and demographic variables. Usually among the explanatory variables is an initial income variable which is included to determine whether the initial income level has bearing on long-term growth. Generally most studies have reported a negative coefficient on the income term implying that, *ceteris paribus*, the lower the initial income level of the country, the higher the growth. This is seen as evidence of low-income countries' tendency to grow faster than high-income countries. I have been guilty of this exercise too [Khilji and Zampelli (1993)]. Levine and Renelt (1992) provide a good critical survey of such studies. The use of the neoclassical framework for studies on long term growth makes sense since the objective is to look at the capacity of the economy to grow which clearly depends on its resources such as physical and human capital, and the types of policies it pursues. In other words it is the supply of output that has been the focus of these growth studies, and rightly so.

This paper is the first one I have seen that looks at growth from the demand side via the SAM framework. Using highly aggregated SAMs of various vintages for 16 countries (one SAM for each country) it works out the familiar system of equations [Equation (7) in the paper] that links value added by industry and other endogenous variables to exogenous variables through a system of multipliers. Focussing on the income Equation in this system and expressing it in growth rates produces the equation (8.3.1) in the paper. This equation is written for poor and rich countries separately. I reproduce these equations below:

$$Y_p^{*o} \gtreqless m_p^{**} + (X/Y)_p^{**} + Y_p^{**}$$

$$Y_r^{*o} \gtreqless m_r^{**} + (X/Y)_r^{**} + Y_r^{**}$$

The subscripts p and r refer to poor and rich countries respectively, the superscripts $*o$, and $**$ refer to hypothesised and realisable growth respectively in the variables, Y stands for income, X/Y is the ratio of exogenous variables to income, and m is the SAM multiplier. The author conveniently forgets the double inequalities in these equations and assumes the equalities to hold for the rest of his paper. The basic point of the paper is that if it can be shown that starting from the same growth rates, i.e., $Y_p^{**} = Y_r^{**}$, the right hand side of the poor countries' equation is greater than the right hand side of the rich countries' equation then the observed growth rate in the poor countries will be greater than the rich countries.

The author focuses first on the growth in the share of the exogenous variables (exports and government expenditures) in income $[(X/Y)^{**}]$ and reasons that this share grows rapidly in the early stages of development and then this growth tapers of at higher stages. He models this phenomenon as a quasi-logistic curve. For the growth in the multiplier (m^{**}), the reasoning is just the opposite. Low-income countries are supposed to have high multiplier effects which taper off at higher levels of development. This phenomenon is modelled as a rectangular hyperbola. These two models are then estimated based on 16 observations (one for each country). Based on the parameter estimates, simulations are performed for the two group of countries starting with the same per capita growth rates in income. Over time it is seen that the realised growth rate in income is higher for the poor countries than in rich countries. This is seen to prove the convergence hypothesis using a demand model.

Overall I found the paper to be interesting and ingenious. However I have several problems with the paper. First there are no price effects and it is assumed that long run supply will grow in conjunction with increased demand. Although the author reasons that relative prices will not change, I find that reasoning unconvincing for the long run. It is hard to conceive that the terms of trade between agriculture and industry will remain the same in developing countries. The author argues that the increase in (nominal) investment demand will be realised in a higher real capital stock which will bring forth the requisite supply. Again, in the absence of price effects in the model, this is all conjectural.

The argument that at high stages of development the exogenous sector is larger is not true for many high-income countries like the U.S. which is conspicuous by its absence. It is interesting to observe the choice of rich countries which are well known for their large social programmes and export sectors like Italy, The Netherlands and Germany. Among the rich countries Poland and Hungary are also included which by no means are the typical or desirable models of development. Nominal multiplier effects for poor countries may be larger but with supply constraints in these economies, this translates mainly into inflation as we all know.

The SAMs that are used are based on years that vary widely. We find that India's SAM is for 1968-69 while Pakistan's is for 1979. For the rich countries the SAMs are for a more recent years. Besides the different vintages, it is not clear how reliable these SAMs are, especially for the developing countries. We do not know how typical were the years for the countries involved. Basing long term growth tendencies on average coefficients for one year arouses a great deal of skepticism. The author points out that CGEs are also based on SAMs. However the CGEs are purported to be applicable for only the medium term (5 years or so). Their forecasting performance has not been very promising anyway. Since the inter-industry linkages and flows in the SAM are not utilised for the exercise in this paper, perhaps a Keynesian demand model (Hicksian IS/LM framework), based on the National Income and Product Accounts, would have been more useful. It would have accomplished the same purpose and the parameter estimates for the calculation of the multipliers would have been based on longer time series.

This study complements the cross-country growth studies based on the neoclassical framework. However, it is no substitute.

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