



Economic Growth and Human Development

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Summary. — The connections between economic growth (EG) and human development (HD) form two chains. Crosscountry regressions show a significant relationship in both directions, with public expenditures on health and education, notably female, especially important in the chain from EG to HD; and the investment rate and income distribution significant in the HD to EG chain. This gives rise to virtuous or vicious cycles, with good or bad performance on HD and EG reinforcing each other. Evidence over time has strong sequencing implications: countries initially favoring economic growth lapse into the vicious category, while those with good HD and poor EG sometimes move into the virtuous category. Where choice is necessary human development should be given sequencing priority. © 2000 Elsevier Science Ltd. All rights reserved.

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1. INTRODUCTION

Human development has recently been advanced as the ultimate objective of human activity in place of economic growth.¹ Its intellectual antecedents may be traced to the earlier basic needs approach of the ILO and the World Bank, as well as Sen's concept of capabilities.² Human development has been defined as enlarging people's choices in a way which enables them to lead longer, healthier and fuller lives.³ The definition of HD as "enlarging people's choices" is very broad. For the purpose of exploring the links between HD and EG theoretically, and especially empirically, we need to narrow it down. We shall consider the HD of a country as consisting of the health and education of its people, recognizing that this is very much a reductionist interpretation. Clearly, there exists a strong connection between economic growth (EG) and human development (HD). On the one hand, EG

provides the resources to permit sustained improvements in HD. On the other, improvements in the quality of the labor force are an important contributor to EG. Yet, while this two-way relationship between HD and EG may now be widely accepted, the specific factors linking them have not been systematically explored. Nor has the question of priorities in the phasing of policy. The purpose of this paper is to sharpen understanding of the two-way links between HD and EG at both theoretical and empirical levels. This in turn permits us to analyze priorities in the phasing of policy and to examine the usual assumption that EG must precede progress on HD.⁴

Section 2 identifies the major links between EG and HD. Section 3 presents some empirical

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crosscountry evidence on these links. Section 4 develops a typology of country cases, some representing the mutual enhancement of HD and EG and some demonstrating asymmetric performance. The final section investigates the movement of countries from one category to another and reflects on the implications for policy.

2. THE TWO CHAINS

We view HD as the central objective of human activity and economic growth as potentially a very important instrument for advancing it. At the same time, achievements in HD themselves can make a critical contribution to economic growth. There are thus two distinct causal chains to be examined: one runs from EG to HD, as the resources from national income are allocated to activities contributing to HD; the other runs from HD to EG, indicating how, in addition to being an end in itself, HD helps increase national income. The two chains are pictured in Figure 1.

(a) *Chain A: from EG to HD*

GNP contributes to HD mainly through household and government activity; civil society, e.g., through community organizations and other nongovernmental organizations (NGOs), also plays a role. The same level of GNP can lead to very different performance on HD according to the allocation of GNP among and within these institutions and variations in their behavior.

Households' propensity to spend their after-tax income on items which contribute most directly to the promotion of HD in poor countries, e.g., food, potable water, education and health, varies, depending on such factors as the level and distribution of income across households as well as on who controls the allocation of expenditure within households. In general, poor households spend a higher proportion of their incomes on HD items than those with higher incomes, and similar results flow from greater female control over household income.

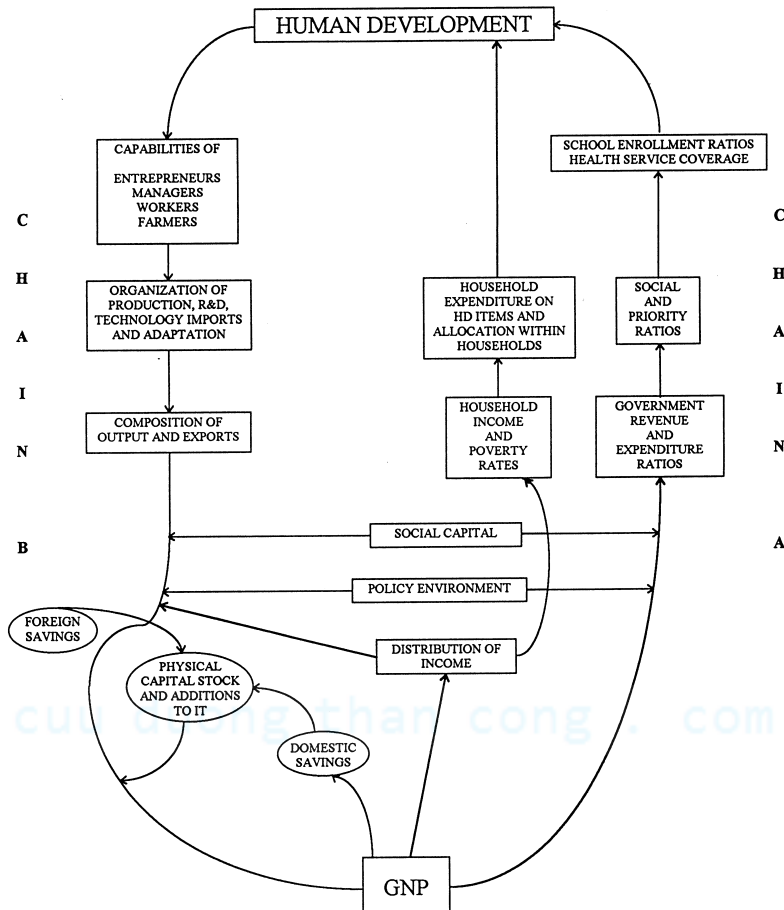
When levels of poverty in a country are high, either because per capita income is low or badly distributed, the expenditure of many households on HD is bound to be low. While evidence⁵ indicates that, in general, poverty is reduced with economic growth, the extent of the reduction varies greatly with the distribu-

tion of income and its change over time.⁶ The way in which growth translates into income distribution and poverty reduction depends on the nature of the growth process—in particular, the extent to which it is based on the generation of employment and on increasing rural incomes, e.g., if the output mix is labor intensive and rural incomes rise rapidly income distribution is more likely to improve and poverty reduction to occur than if growth is urban biased and capital intensive.⁷

Expenditure on HD-related items is strongly affected by the rate of poverty reduction. Not surprisingly, if poor households receive extra income, they increase their food expenditure and calorie consumption significantly.⁸ Empirical evidence—for example, for Bolivia, Brazil, Chile, Côte d'Ivoire, Ghana, India, Indonesia, Pakistan, Philippines, Malaysia, Nicaragua and Peru—also indicates the positive effects of family income change on child schooling.⁹ For example, a crosscountry study of the determinants of secondary education found that more egalitarian countries had higher secondary enrollment rates.¹⁰ One estimate suggests that if the distribution of income in Brazil were as equal as Malaysia's, school enrollments among poor children would be 40% higher.¹¹ While the evidence on the relations between income and health is less extensive, studies in Brazil, Chile, Côte d'Ivoire and Nicaragua suggest that household income also has a significant effect on the demand for health,¹² some showing a much higher relative response for low than for high-income households.¹³

Where women control cash income, it appears that expenditure patterns are geared relatively more toward HD inputs, such as food and education. For example, among Gambian households, the larger the proportion of food under women's control the larger household calorie consumption.¹⁴ Similarly, in the Philippines it has been shown that consumption of calories and proteins increases with the share of income accruing directly to women.¹⁵ In the Côte d'Ivoire, an increase in women's share of cash income was associated with significantly higher spending on food and reduced spending on alcohol and cigarettes.¹⁶

Turning to the government, the allocation of resources to improving HD is a function of total public sector expenditure, of how much of this flows to the HD sectors, and of the way in which it is allocated within these sectors. This can be expressed in the form of three ratios:¹⁷ the public expenditure ratio, defined as the

Figure 1. *The HD-GNP cycle.*

proportion of GNP spent by the various levels of government; the HD-allocation ratio, defined as the proportion of total government expenditure going to the HD-sectors; and, finally, the HD priority ratio, defined as the proportion of total HD-sector expenditure going to “priority areas.” Within the HD-sectors, some expenditures are clearly much more productive in terms of achieving advances in HD than others; for example, basic education, especially at an early stage of development, is generally recognized to have a larger impact on HD than tertiary education. But the precise definition of what constitutes a “priority area” will inevitably vary according to a country’s stage of development, rendering this third ratio more arbitrary and difficult to measure than the other two. There are very large variations

across countries in each of these ratios, which means that the same level of GNP may be associated with very different levels of government spending on HD priorities.¹⁸

The underlying determinants of these three ratios are complex, but include the following: (i) the tax capacity of the system; (ii) the strength of the demand for military expenditure and for other non-HD priorities of the government; (iii) the varying interplay between bureaucratic forces, vested interests and popular pressures. It should be noted that all three ratios are affected by the extent of decentralization of government: country evidence suggests that real decentralization, i.e. devolution, tends to increase the total revenue available; it often raises the HD-allocation ratio; and it almost always improves the HD-priority ratios.¹⁹

The significance of public expenditure choices for improving HD is illustrated by a comparison between Kenya and Malawi. In the 1980s, a similar proportion of national income went to public expenditure (27% in Kenya; 30% in Malawi) but Kenya had a significantly higher social allocation ratio (47% compared to 35%) and social priority ratio (34% compared to 14%) so that the proportion of GDP going directly to HD-improving priorities in Kenya was over three times that of Malawi (5.1% compared to 1.5%).²⁰

The importance of economic growth for raising resources to promote HD is illustrated by a comparison between Botswana and Sudan. In 1970 public expenditure on health and education per person was similar in the two countries (\$96 in 1987 prices in Sudan, and \$65 in Botswana). During 1970–92 per capita expenditure increased more than seven times in Botswana, while remaining practically unchanged in Sudan. Hence, by 1992, Sudanese expenditure was less than a quarter of that in Botswana (\$114 versus \$466). This was not due to differences in the public expenditure ratio, which was higher in Sudan during the 1970s and equal to Botswana's during the 1980s, but to the much faster income growth in Botswana. With a similar share of Botswana's GNP going to health and education, real expenditure rose much faster there.

Finally, NGO or other civil society activity, on which information is more scattered, is typically heavily oriented toward HD objectives (e.g., generating incomes for the poor and on schools, nutrition and health projects). Resources are derived from private donations and government, in each case including both foreign and domestic sources. There are considerable variations in the extent, vitality and effectiveness of NGO activities across countries, depending on their history, culture, tax laws and actual or perceived government deficiencies in providing services. In most contexts, NGOs play a supplemental or even marginal role, but in a few areas—e.g., BRAC and the Grameen Bank in Bangladesh, the Harambee Schools in Kenya and the “Comedores Populares” in Peru—they appear to represent a major source of HD-enhancement.²¹

Expenditures on HD inputs are clearly not objectives in themselves, but rather constitute instruments for achieving advances in various dimensions of basic well-being. A further important link in Chain A, therefore, is the

effectiveness of these expenditures in raising HD levels, i.e. what type of provision is most productive at what level of development, and how different combinations effect a change in HD. We shall call this link in the chain the “HD improvement function” (HDIF); it resembles a production function in that it relates the inputs into HD, such as public expenditure on health services or water, to the HD objective of achieving better health. An illustration of the type of relationship represented in the HDIF is whether and how far the provision of safe water is complementary to or substitutes for education in contributing to improvements in health. Another is what combination of family planning expenditure, improved nutrition and immunisation levels most effectively yield improvements in infant mortality. The relationships embodied in the HDIF are complex, depending on individual and community behavior and local knowledge about relevant technologies. Moreover, the relevant arguments of the HDIF are bound to differ at different stages of development.

Some aspects of the HDIF have been greatly illuminated by detailed empirical work.²² An example of the potential usefulness of an improved understanding of this production function is the abundant evidence that education, especially female, tends to improve infant survival and nutrition.²³ Another study, for Brazil, showed that an increase in the nonlabor income of women increased the probability of child survival by 20 times that of a comparable increase in the nonlabor income of men.²⁴ Research in Ghana has shown that in rural areas the provision of basic health services, including adequate drugs, increases child health and survival significantly, while the evidence is less clear on urban services.²⁵

Conditions liable to bring about an improvement in the efficiency of the HDIF include better information about available technologies and the appropriate combinations of inputs; the generation of new and more effective technologies; and the enhancement of the motivation to make use of available options, e.g., to send children to schools and clinics. Such motivation appears to be influenced by education levels, the power structure within the family, incentives and the magnitude of the opportunity costs.

It should be clear from this discussion of the various links in the ED-HD chain that, in general, we would expect important causal connections to exist between the economy and

HD achievements, but these connections are *not automatic*: the strength of the links in Chain A varies according to a large range of factors, including the structure of the economy, the distribution of assets, and the policy choices made. The richness of the so-called social capital²⁶ of a society presumably also affects these choices and the strength of links at each stage; when people act together to promote their well-being, when public morality is high, when the community monitors malfeasance, and when it participates extensively in public life, *ceteris paribus*, we can expect all the links in Chain A to be stronger.

In summary, we would hypothesize from this review of the links in Chain A that the connection between GNP to HD is likely to be stronger:

A.i—the lower the proportion of the population below the poverty line; for a given level of GNP per capita, this means the more equally income is distributed;

A.ii—the more income households allocate to HD at a given income level; this may be related both to the level of female education and to female control over income within the household.

A.iii—the higher the proportion of GNP devoted to priority social expenditure by the government;

A.iv—the more effective the contribution of social capital, including community organizations and other NGOs;

A.v—the more efficient the HDIF.

We shall test some of these hypotheses; others we do not test, either because of conceptual problems or data constraints, notably A.iv. and A.v.

(b) Chain B: from HD to EG

Turning our attention to the second chain, from HD to EG, ample evidence suggests that as people become healthier, better nourished and educated they contribute more to economic growth, although some important dimensions of HD, such as making the lives of the terminally ill tolerable, do not directly lead to enhanced productivity.²⁷ Higher levels of HD, in addition to being an end in themselves, affect the economy through enhancing people's capabilities and consequently their creativity and productivity. Clearly, the health and education of a population are among the main determinants of the composition and growth of output and exports, and constitute an

important ingredient in a system's capacity to borrow foreign technology effectively.

Specifically, (i) health, primary and secondary education and nutrition raise the productivity of workers, rural and urban; (ii) secondary education, including vocational, facilitates the acquisition of skills and managerial capacity; (iii) tertiary education supports the development of basic science, the appropriate selection of technology imports and the domestic adaptation and development of technologies; (iv) secondary and tertiary education also represent critical elements in the development of key institutions, of government, the law, the financial system, among others, all essential for economic growth.

Empirical evidence at both micro and macro levels lends support to the importance of these relationships.

At a *micro*-level, numerous studies indicate that increases in earnings are associated with additional years of *education*, with the rate of return varying with the level of education.²⁸ While social rates of return (which deduct the publicly financed costs of education but make no other adjustments to the private returns) are below the private, they are still typically greater than returns to most physical investment.²⁹ These rate of return estimates are sometimes interpreted as indicating the magnitude of the impact of education on productivity; but this view has also been challenged by the argument that education performs a signalling function, distinguishing among people of different innate ability, rather than itself raising productivity. But, investigations in rural Pakistan, and in urban Kenya and Tanzania, differentiating between additional earnings due to cognitive achievement and those due simply to schooling, showed that cognitive achievement accounted for a high proportion of the extra earnings.³⁰

In agriculture, evidence suggests positive effects of education on productivity among farmers using modern technologies, but less impact, as might be expected, among those using traditional methods.³¹ In Thailand, farmers with four or more years of schooling were three times more likely to adopt fertilizer and other modern inputs than less educated farmers.³² Similarly, in Nepal, the completion of at least seven years of schooling increased productivity in wheat by over a quarter, and in rice by 13%.³³

Education is also an important contributor to technological capability and technical change in industry. Statistical analysis of the

clothing and engineering industries in Sri Lanka, to cite just one example, showed that the skill and education levels of workers and entrepreneurs were positively related to the rate of technical change of the firm.³⁴ Education alone, of course, cannot transform an economy. The quantity and quality of investment, domestic and foreign, together with the overall policy environment, form other important determinants of economic performance. Yet the level of human development has a bearing on these factors too. The quality of policy-making and of investment decisions is likely to be influenced by the education of both policy-makers and managers; moreover, the volume of both domestic and foreign investment will probably be larger when a system's human capital supply is more plentiful.

Improved *health and nutrition* have been shown to have direct effects on labor productivity, especially among poorer individuals.³⁵ A range of labor productivity gains has been observed associated with calorie increases in poor countries,³⁶ including studies of farmers in Sierra Leone, sugar cane workers in Guatemala, and road construction workers in Kenya.³⁷ In these cases productivity enhancement appears to follow fairly immediately as current intakes of calories or micro-nutrients are increased. In other cases the effects are medium-run (as reflected in weight) or long-run (as reflected in height), based on evidence from Bangladesh, Brazil, India, Sri Lanka, and the Philippines.³⁸ A longitudinal study of a sample of children in Chile concluded that providing nutritional supplements to children to prevent malnutrition would generate benefits six to eight times the cost of the intervention in terms of additional productivity.³⁹ A similar study of Cali, Colombia found that a health and nutrition program increased the lifetime earnings of individuals to from 2.5 to 8.9 times those of an illiterate worker.⁴⁰

It is difficult to capture the effects of ill-health (other than malnutrition) as there are few accurate estimates of the incidence of illness. But studies in both Ghana and Côte d'Ivoire show the negative impact of morbidity, with men who reported that their activities had been curtailed by illness having lower hourly wage rates, reduced hours of work and a smaller probability of being in the labor force.⁴¹ In some contexts the evidence even indicates larger productivity effects arising from health and nutrition than from formal schooling, although the impact of education has been

much more emphasized in the development literature.

From a *macro*-perspective, the "new growth theories" aim to endogenize technical progress by incorporating some of these same effects, emphasizing education as well as learning and research and development (R&D). According to Lucas (1988), for example, the higher the level of education of the workforce the higher the overall productivity of capital because the more educated are more likely to innovate, and thus affect everyone's productivity. In other models a similar externality is generated as the increased education of individuals raises not only their own productivity but also that of others with whom they interact, so that total productivity increases as the average level of education rises.⁴² A complementary view is that technical progress depends on the level of R&D in an economy. By investing labor and capital in R&D a firm is able to improve not only its own profitability but also the productivity of the firms which consume its output. Again, education plays a key role, both in contributing to R&D and via interactive learning.⁴³ A number of empirical studies have shown the positive effect of education on economic growth at a macro level, with its size varying according to the measure of education and the particular macro growth model adopted.⁴⁴

The impact of education on the nature and growth of exports, which, in turn, affect the aggregate growth rate, is another way in which human development influences macro performance. The education and skills of a developing country's labor force influence the nature of its factor endowment and consequently the composition of its trade. It has been argued that even "unskilled" workers in a modern factory normally need the literacy, numeracy and discipline which are acquired in primary and lower secondary school.⁴⁵ Theoretical models incorporating skills and learning as important determinants of comparative advantage have led to modifications of the simple two factor Heckscher-Ohlin model, helping to explain the Leontief Paradox and the dramatic success in the manufactured export growth of some developing countries, notably those of East Asia.⁴⁶ Investigations have shown a significant positive correlation between the growth of manufactured exports and the growth of GDP, although serious identification problems remain.⁴⁷

There is also a positive feedback from improved education to greater income equality which, in turn, is likely to favor higher rates of growth. As education becomes more broadly based, low-income people are better able to seek out economic opportunities. For example, a study of the relation between schooling, income inequality and poverty in 18 countries of Latin America in the 1980s found that one-quarter of the variation in workers' incomes was accounted for by variations in schooling attainment; it concludes that "clearly education is the variable with the strongest impact on income equality."⁴⁸ Another study suggested that a 1% increase in the labor force with at least secondary education would increase the share of income of the bottom 40 and 60% by between 6 and 15% respectively.⁴⁹ An investigation of the determinants of income distribution in 36 countries found secondary enrollment rates to be significant.⁵⁰

Finally, education may affect per capita income growth via its impact on the denominator, i.e. population growth. For example, a study of 14 African countries for the mid-1980s showed a negative correlation between female schooling and fertility in almost all countries, with primary education having a negative impact in about half the countries and no significant effects in the other half, while secondary education invariably reduced fertility.⁵¹ The three success countries in terms of reduced fertility, Kenya, Botswana and Zimbabwe, had the highest levels of female schooling as well as the lowest child mortality rates.⁵²

As in Chain A, the strength of the various links in Chain B varies considerably and there is no *automatic* connection between an improved level of HD and increases in per capita GNP. It is not enough to create a larger pool of educated people; there must also be opportunities for them to be productively employed or it might simply increase the number of educated unemployed. Relevant to the demand-side are the savings and investment rates, technology choice and the overall policy setting.

Although high rates of saving and investment by themselves, as shown by past East European experience, do not guarantee high levels of sustained growth, normally a positive relationship between investment and growth prevails, with its strength depending on such factors as the policy environment, the quantity and quality of human resources, the availability of technology choices and the flexibility of the

institutional framework. As pointed out earlier, both domestic investment and direct foreign investment are influenced by a country's HD level—particularly the education and skill levels of the workforce.⁵³ But differences in economic growth across societies are again not only due to the level of inputs but also by how effectively they are used and for what purpose. One important influence is the incentives set by economic policy. Another derives from people's motives and behavior patterns.

Income distribution again appears to be important in Chain B, as it was in Chain A. Recent empirical evidence suggests that the distribution of assets and income has an effect on economic growth, with a more equal distribution favoring higher rates of growth.⁵⁴ Among the explanations put forward for this, one is derived from the relationships in Chain A, i.e., that a more equal distribution of income implies better nutrition and a stronger demand for education and hence raises labor productivity. Others derive from political economy considerations and relate to Chain B, e.g., that an unequal distribution of income may be associated with greater political and economic instability, more likely to interrupt economic progress.⁵⁵

In summary, the connection between HD and GNP, represented by Chain B, is likely to be stronger:

- B.i—the higher the investment rate;
- B.ii—the more equal the distribution of income;
- B.iii—the more appropriate the economic policy setting.

Because of difficulties in defining and measuring hypothesis B.iii we shall confine our tests to B.i and B.ii.

3. EMPIRICAL FINDINGS

The discussion above led us to a set of hypotheses about the links between HD and EG for both causal chains—from EG to HD (Chain A) and from HD to EG (Chain B), some of which we test with crosscountry regressions for 1960–92. Our sample consists of 35 to 76 developing countries, according to the availability of data for particular variables. We generally use lags of the original variables as instruments to reduce the simultaneity bias that would have resulted from applying ordinary least squares (OLS). Lagged values are reasonable candidates as instruments since the

correlation between the residuals in the two periods analyzed is not substantial.

(a) *Chain A*

For Chain A the variable chosen as a proxy for achievement in human development was life expectancy shortfall reduction, 1970–92, from a maximum of 85 years.⁵⁶

The explanatory variables selected were:

- lagged GDP per capita growth rate (for 1960–70) as a measure of overall EG;
- social expenditure (defined as public expenditure on education and health) as a percentage of GDP for the whole period (1970–92), as well as lagged (1970–80). The hypothesis advanced earlier was that HD improvement would depend in part on the proportion of GDP devoted to social expenditure; priority social expenditure data were viewed as somewhat too arbitrary for deployment here;
- several measures of income distribution, i.e. income share of the bottom 20% or 40%, 1960–92, and the ratio of income share of the top to the bottom quintile, 1960–92;
- female primary school gross enrollment rate in 1965; this is a proxy for the change in the stock of educated females. The latter is likely to be associated with greater female control over household expenditure, thus tending to improve the HDIF;
- regional dummies, with East Asia allocated a zero value.

Table 1 summarizes the results for Chain A. GDP per capita growth proved significant and quite strong in all of the equations, with higher growth of per capita income leading to better HD performance. According to equation (1), a one percentage point increase in the average growth rate of GDP per capita is estimated to reduce life expectancy shortfall by more than three percentage points over the period. The social expenditure ratio also proved significantly positive in all but one case. For every percentage point increase in the average share of GDP invested in health and education, when lagged, the life expectancy shortfall decreases by about 1.75 percentage points (equations (1) and (3)).

An interesting finding is the mechanism through which the social expenditure ratio seems to affect human development. As regressions (4), (5) and (6) indicate, the female primary enrollment rate for 1965 has a significant but small impact on the rate of improve-

ment of life expectancy. We attribute this to the impact on household behavior of female income, knowledge and control within the household. Moreover, it should be noted that when this variable is added, social expenditure becomes less significant, which suggests that much of the impact of social expenditure appears to occur through its effect on female education. According to equations (4), (5) and (6), a 1% increase in the female primary gross enrollment rate is estimated to reduce the life expectancy shortfall by 0.1%.

The income distribution variables run counter to our expectations, i.e. a more equal distribution does not seem to advance human development.

Both the African and Latin American dummies are negative and significant throughout, as we might have expected, given that the comparator is highly successful East Asia. In each case the coefficient is quite small. The regional dummies include a number of region-specific features, including the level of per capita income.

(b) *Chain B*

For Chain B, the dependent variable chosen was GDP per capita growth, 1970–92.

The explanatory variables selected were:

- log GDP per capita in 1960, to test for convergence of income levels as countries approach high income levels;
- initial levels of HD, using three different measures, log life expectancy in 1962, adult literacy 1970–72, and a combined index of life expectancy and literacy for 1970 (HDI*);⁵⁷
- changes in HD over time for two of the measures of HD, the change in the log of life expectancy, 1962–82; and HDI* shortfall reduction 1960–80;⁵⁸
- gross domestic investment as a % of GDP for the period as a whole (1960–92);
- income distribution, lagged, (1960–70), using three alternative measures, the ratio of the income share of the top to bottom quintiles, the income share of the bottom 40% of the population, and the income share of the bottom 20%;
- regional dummies, as in Chain A.

The results are summarized in Table 2. Our measures of the initial level of human development invariably proved significant, although with low coefficients; i.e. the initial level of life expectancy in equations (10)–(12), as well as

Table 1. Chain A—ordinary least squares regressions dependent variable: life expectancy shortfall reduction 1970–92

Variable	1	2	3	4	5	6	7	8	9
GDP/n Growth rate 1960–70	3.25* (4.09) ^a	1.66* (3.61)	3.19* (4.06)	1.27** (2.56)	2.65* (3.17)	2.70* (3.17)	2.10* (2.82)	2.14** (2.52)	2.31* (2.95)
Social Expenditures as a % of GDP 1970–92	—	1.03* (2.84)	—	—	—	—	—	—	—
Social Expenditures as a % of GDP 1970–80	1.73** (2.37)	—	1.75** (2.56)	—	1.36 (1.64)	1.51*** (1.74)	1.28*** (1.91)	1.54** (1.76)	1.36*** (1.91)
Income share of bottom 40% 1960–92	–0.004 (–0.93)	—	—	–0.004 (–1.29)	—	–0.002 (–0.45)	—	—	—
Income share of bottom 20% 1960–92	—	—	—	—	—	—	—	–1.66*** (–1.76)	–1.88*** (–2.26)
Ratio of income share top to bottom 20% 1960–92	—	—	0.002 (1.19)	—	0.002 (1.01)	—	0.005* (3.02)	—	—
Female primary gross enrollment rate 1965	—	—	—	0.12** (2.59)	0.10*** (1.94)	0.10*** (1.85)	—	0.05 (0.71)	—
Latin America dummy	—	—	—	—	—	—	–0.08** (–2.35)	–0.08*** (–1.98)	–0.07*** (–2.02)
Africa dummy	—	—	—	—	—	—	–0.16* (–4.34)	–0.12** (–2.49)	–0.13* (–3.63)
South Asia dummy	—	—	—	—	—	—	0.003 (0.06)	0.003 (0.50)	0.02 (0.39)
Middle East dummy	—	—	—	—	—	—	–0.09 (–1.01)	–0.07 (–0.67)	–0.09 (–0.97)
Intercept	0.15 (1.51) 41	0.28* (6.09) 76	0.06 (1.17) 41	0.23* (3.36) 54	0.02 (0.51) 38	1.07 (0.68) 38	0.16* (2.92) 41	0.25** (2.08) 38	0.30* (3.59) 41
# of observations	—	—	—	—	—	—	—	—	—
Adj. <i>R</i> -squared	0.38	0.27	0.38	0.26	0.41	0.40	0.59	0.51	0.55

^a *T*-Statistics are given in parentheses.

* Significant at 1%.

** Significant at 5%.

*** Significant at 10%.

Table 2. Chain B—ordinary least squares regressions dependent variable: average real GDP/ln growth 1970–92

Variable	10	11	12	13	14	15	16	17
Log GDP/n 1960	−0.01* (−3.01) ^a	—	−0.01* (−3.04)	−0.01* (−2.87)	−0.01** (−1.87)	−0.009 (−1.42)	−0.01** (−2.38)	−0.01** (−2.55)
Adult literacy rate 1970–72	—	—	—	0.03** (2.45)	—	—	0.03** (2.19)	0.03** (2.21)
Log life expectancy 1967	0.06* (3.79)	0.03** (2.09)	0.09* (3.90)	—	—	—	—	—
Gross domestic investment as a % of GDP 1960–92	0.12* (3.83)	0.14** (2.72)	0.12** (2.37)	0.12*** (1.99)	0.13** (2.26)	0.06 (1.06)	0.12*** (2.07)	0.12** (2.09)
Income share of bottom 40% 1960–70	—	—	0.001 (1.52)	—	0.001*** (1.70)	—	—	0.001** (2.20)
Income share of bottom 20% 1960–70	—	—	—	—	—	—	0.40** (2.18)	—
Ratio of income share of top to bottom quintile 1960–70	—	−0.0007** (−2.17)	—	−0.0007** (−2.06)	—	−2.21 (−0.05)	—	—
HDI* 1970	—	—	—	—	0.06** (2.38)	0.07** (2.58)	—	—
Latin America dummy	—	—	—	—	—	−0.02** (−2.57)	—	—
Africa dummy	—	—	—	—	—	−0.01*** (−1.90)	—	—
South Asia dummy	—	—	—	—	—	−0.003 (−0.31)	—	—
Middle East dummy	—	—	—	—	—	0.01 (0.57)	—	—
Intercept	−0.17* (−3.71)	−0.14** (−2.30)	−0.28* (−3.93)	0.12** (2.74)	0.03 (0.64)	0.04 (1.08)	0.07 (1.46)	0.07 (1.54)
# of observations	73	38	36	24	35	35	24	24
Adj. R-squared	0.34	0.29	0.45	0.37	0.30	0.41	0.38	0.38

Continued next page

Table 2—Continued

Variable	18	19	20	21	22	23
Log life expectancy 1962	0.06 ^c (5.48)	0.07 ^a (3.98)	0.05 ^a (3.04)	0.05 ^{**} (2.65)	0.08 [*] (2.88)	—
Change in the log of life expectancy 1962–82	0.13 [*] (3.81)	0.17 ^{**} (2.48)	0.14 ^{***} (2.01)	0.12 (1.65)	0.14 ^{***} (1.78)	—
Gross domestic investment as a % of GDP (1970–92 average)	—	—	0.12 ^{**} (2.44)	0.13 ^{**} (2.39)	0.06 (1.17)	0.13 ^{**} (2.42)
Income share of bottom 40% 1960–70	—	0.002 [*] (2.83)	0.002 [*] (3.16)	—	—	0.002 [*] (2.96)
Ratio of income share of top to bottom quintile 1960–70	—	—	—	−0.0008 ^{**} (−2.49)	−0.0002 (−0.62)	—
HDI ^a 1960	—	—	—	—	—	−0.0007 (−0.03)
HDI ^a shortfall reduction 1960–80	—	—	—	—	—	0.09 ^{**} (2.08)
Latin America dummy	—	—	—	—	−0.02 ^{**} (−2.71)	—
Africa dummy	—	—	—	—	−0.005 (−0.57)	—
South Asia dummy	—	—	—	—	0.003 (0.29)	—
Middle East dummy	—	—	—	—	0.004 (0.34)	—
Intercept	−0.27 [*] (−5.37)	−0.33 [*] (−3.96)	−0.29 [*] (−3.56)	−0.23 [*] (−2.81)	−0.33 [*] (−2.81)	−0.03 [*] (−3.84)
# of observations	79	39	38	38	38	37
Adj. <i>R</i> -squared	0.27	0.30	0.38	0.32	0.44	0.33

^a *T*-Statistics are given in parentheses.

* Significant at 1%.

** Significant at 5%.

*** Significant at 10%.

(18)–(22) were all highly significant. Adult literacy 1970–72 was significant in equations (13), (16) and (17); and the HDI* for 1970 was significant in equations (14) and (15), all with low coefficients. The change in life expectancy, 1962–82, was positive and significant in all cases but one (see equations (18)–(22)). The change in HDI* shortfall reduction, 1960–80, was significant in equation (23), but the initial level of HDI* was not significant.

The domestic investment rate was always significant except when the regional dummies were included (equations (15) and (22)). The lagged income distribution variables virtually all gave results with the expected sign (i.e. a more equal income distribution is associated with higher economic growth), and were almost always significant—if with very low coefficients—except when the regional dummies were included. Moreover, income distribution is apparently more strongly related to GDP growth when changes as well as levels of human development, however measured, are included. The ratio of income shares of the top to bottom quintiles, 1960–70, showed significance in equations (11), (13) and (21); the share of the bottom 40% was significant in equations (14), (17), (19), (20) and (23), but the lagged income distribution variable was not significant in equations (12), (15) and (22), although the signs were in the “right” direction. Regional dummies for Latin America were significantly negative in both instances when deployed and, in one case, also for Africa. In all equations, except when the regional dummies were introduced (equation (15)), the initial level of GDP per capita was significant, with a negative sign, indicating weak convergence, i.e. with a low coefficient.

In summary, the two chains, taken as a whole, showed a significantly positive effect of economic growth on HD and a significantly positive effect of HD on economic growth. With respect to specific links in each of the chains, our findings broadly confirmed the tested hypotheses, except for income distribution in Chain A. For Chain A, the higher social expenditure, the higher adult literacy, and the higher the female education enrollment for a given level of GNP per capita, the larger the improvement in HD. The most surprising finding, counter to our expectations, was that a more equal distribution of income did not improve HD performance; indeed, in some equations the opposite result obtained. One explanation of this may well be that we

restricted the definition of HD in our Chain A regressions to life expectancy shortfall reduction which is mainly affected by public expenditures on health and education, particularly female, and less by household expenditures. For Chain B, the relationship between HD and economic growth was stronger the higher the investment rate and the more equally distributed the income. The regional dummies were generally negative for both Africa and Latin America in both chains but with small coefficients. Since, on average, Africa experienced a decline in GDP per capita over the period, this indicates that the fall in per capita incomes was not proportionately translated into a slowdown or reversal in HD improvements.⁵⁹

4. VIRTUOUS AND VICIOUS CYCLES AND LOP-SIDED DEVELOPMENT

The existence of two chains linking HD and economic growth is thus strongly supported by both our framework, drawing on micro and macro studies in the literature, and our empirical results. This means that an economy may be on a mutually reinforcing upward spiral, with high levels of HD leading to high growth and high growth in turn further promoting HD. Conversely, weak HD may result in low growth and consequently poor progress toward HD improvement. The strength of the links in the two chains influences the extent of mutual reinforcement between HD and EG, in either direction.

Country performance can therefore be usefully classified into four categories, *virtuous*, *vicious* and two types of *lop-sidedness*, i.e. lopsided with strong HD/weak growth (called HD-lopsided); and lopsided with weak HD/strong growth (EG-lopsided). In the virtuous cycle case, good HD enhances growth, which in turn promotes HD, and so on. In the vicious cycle case, poor performance on HD tends to lead to poor growth performance which in turn depresses HD achievements, and so on. The stronger the linkages in the two chains described above the more pronounced the cycle of economic growth and HD, either in a positive or dampening direction. Where linkages are weak, cases of lop-sided development may occur. On the one hand, good economic growth may not bring about good HD, if, for example, there are such weak linkages as a low social expenditure ratio; on the other hand, good HD performance may not generate good EG if

there is a dearth of complementary resources because of low investment rates. Such cases of lop-sided development are unlikely to persist. Either the weak partner in the cycle eventually acts as a brake on the other partner, leading to a vicious cycle case, or, if the linkages are strengthened, possibly by policy change, a virtuous cycle case results.

One way of classifying countries into the four categories is to compare their performance on HD and EG with the average performance of all developing countries. Figure 2 presents this classification for 1960–92 for all developing countries for which data were available. The vertical and horizontal grid lines represent the average performance for the period, with countries weighted by their populations in 1992. Most developing countries appear as either virtuous (NE quadrant), or vicious (SW quadrant); a significant number showed an HD-lopsided pattern, and very few an EG-lopsided one. A strong regional pattern emerges, with East Asia heavily represented in the virtuous cycle case (seven out of the eight cases are East or South East Asian, the eighth being Botswana). Of the 37 countries in the vicious cycle quadrant, 21 are from sub-Saharan Africa, nine from Latin America. Latin America is also strongly represented in the HD-

lopsided quadrant, i.e. 10 of the 13 are from that region. In the EG-lopsided category there are just four countries—Egypt, Pakistan, Mauritius and Lesotho.

The important issue for policy purposes is how a country may move towards inclusion in the virtuous cycle category. Much can be learned about this by looking at the ways in which countries moved across categories over time. Taking the movements of countries over the three decades 1960–70, 1970–80 and 1980–92 (see Table 3 and Figure 3), we find the following:

—Over half the countries in the vicious-cycle category in 1960–70, i.e. 18 out of 35, remained in that category throughout. Most of these countries were in sub-Saharan Africa, which started with very low levels of HD, handicapping their growth potential; their low growth rates and, subsequently, the debt crisis prevented them from generating the resources necessary for improvements in HD.

—Six countries moved from vicious cycle to EG-lopsided between the 1960s and the 1970s, but four of them fell back to the vicious cycle category in the 1980s. Three moved from vicious to HD-lopsided, including Honduras, Algeria and Madagascar, and only Madagascar returned to the vicious

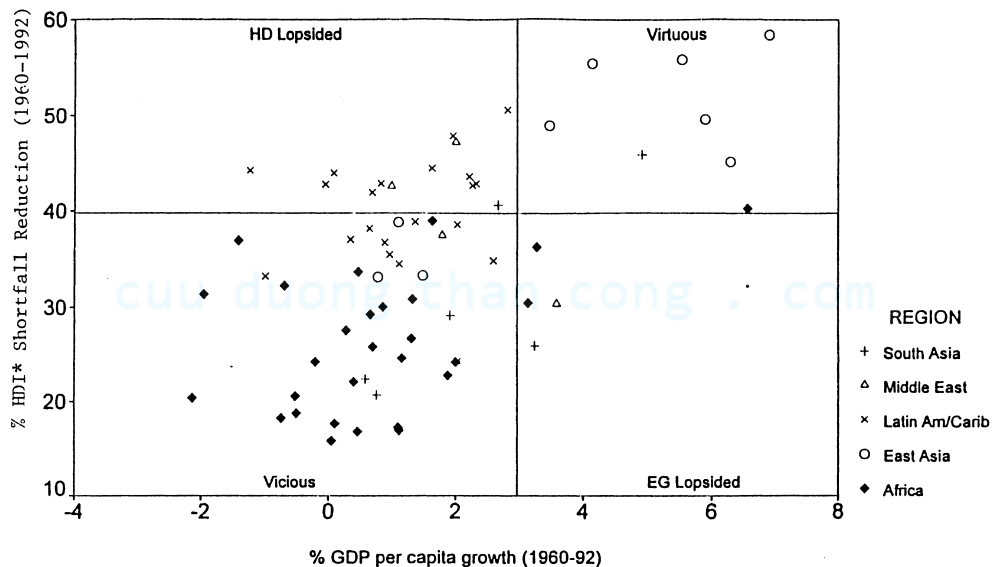


Figure 2. Classification of country performance (1960–92). Note: The horizontal and vertical lines defining the four quadrants represent developing country averages weighted by population.

Table 3. *Virtuous, vicious and lop-sided performance 1960–92*

	1960–70	1970–80	1980–92
<i>Africa</i>			
Benin	Vicious	Vicious	Vicious
Botswana	Vicious	Virtuous	Virtuous
Burkina Faso	Vicious	Vicious	Vicious
Burundi	Vicious	Vicious	Vicious
Cameroon	Vicious	EG lop-sided	Vicious
Central African Republic	Vicious	Vicious	Vicious
Chad	Vicious	Vicious	Vicious
Congo	Vicious	EG lop-sided	Vicious
Côte d'Ivoire	EG lop-sided	Vicious	Vicious
Gabon	EG lop-sided	Vicious	Vicious
Ghana	Vicious	Vicious	Vicious
Kenya	Vicious	Virtuous	Vicious
Lesotho	Virtuous	EG lop-sided	Vicious
Madagascar	Vicious	HD lop-sided	Vicious
Malawi	Vicious	EG lop-sided	Vicious
Mali	Vicious	Vicious	Vicious
Mauritius	HD lop-sided	EG lop-sided	EG lop-sided
Niger	Vicious	Vicious	Vicious
Nigeria	Vicious	Vicious	Vicious
Rwanda	Vicious	Vicious	Vicious
Senegal	Vicious	Vicious	Vicious
Sierra Leone	EG lop-sided	Vicious	Vicious
South Africa	Virtuous	Vicious	Vicious
Sudan	Vicious	Vicious	Vicious
Tanzania	Vicious	Vicious	Vicious
Zaire	Vicious	Vicious	Vicious
Zimbabwe	Vicious	Vicious	Vicious
<i>Latin America & Caribbean</i>			
Argentina	Vicious	Vicious	HD lop-sided
Barbados	Virtuous	HD lop-sided	HD lop-sided
Bolivia	Vicious	Vicious	HD lop-sided
Brazil	EG lop-sided	EG lop-sided	Vicious
Chile	HD lop-sided	HD lop-sided	Virtuous
Colombia	HD lop-sided	Virtuous	HD lop-sided
Costa Rica	HD lop-sided	HD lop-sided	HD lop-sided
Dominican Republic	HD lop-sided	EG lop-sided	Vicious
El Salvador	HD lop-sided	Vicious	HD lop-sided
Guatemala	HD lop-sided	EG lop-sided	Vicious
Haiti	Vicious	Vicious	Vicious
Honduras	Vicious	HD lop-sided	HD lop-sided
Jamaica	Virtuous	Vicious	Vicious
Mexico	Virtuous	Virtuous	HD lop-sided
Nicaragua	Virtuous	Vicious	HD lop-sided
Panama	Virtuous	Virtuous	HD lop-sided
<i>Latin America & Caribbean</i>			
Paraguay	Vicious	EG lop-sided	Vicious
Peru	HD lop-sided	Vicious	HD lop-sided
Togo	EG lop-sided	Vicious	Vicious
Trinidad & Tobago	Vicious	EG lop-sided	HD lop-sided
Uruguay	Vicious	Vicious	HD lop-sided
Venezuela	HD lop-sided	HD lop-sided	Vicious
<i>South Asia</i>			
India	Vicious	Vicious	EG lop-sided
Nepal	Vicious	Vicious	Vicious
Pakistan	EG lop-sided	Vicious	EG lop-sided
Sri Lanka	Vicious	Virtuous	Virtuous
Bangladesh	Vicious	Vicious	Vicious

Continued next page

Table 3—continued

	1960–70	1970–80	1980–92
<i>East Asia</i>			
China	HD lop-sided	Virtuous	Virtuous
Hong Kong	Virtuous	Virtuous	Virtuous
Indonesia	HD lop-sided	Virtuous	Virtuous
Korea Republic	Virtuous	Virtuous	Virtuous
Malaysia	Virtuous	Virtuous	Virtuous
Myanmar	HD lop-sided	Vicious	Vicious
Philippines	HD lop-sided	EG lop-sided	Vicious
Singapore	Virtuous	Virtuous	Virtuous
Thailand	Virtuous	Virtuous	Virtuous
<i>Middle East</i>			
Algeria	Vicious	HD lop-sided	HD lop-sided
Egypt	EG lop-sided	EG lop-sided	Vicious
Morocco	Vicious	EG lop-sided	HD lop-sided
Turkey	Virtuous	HD lop-sided	HD lop-sided

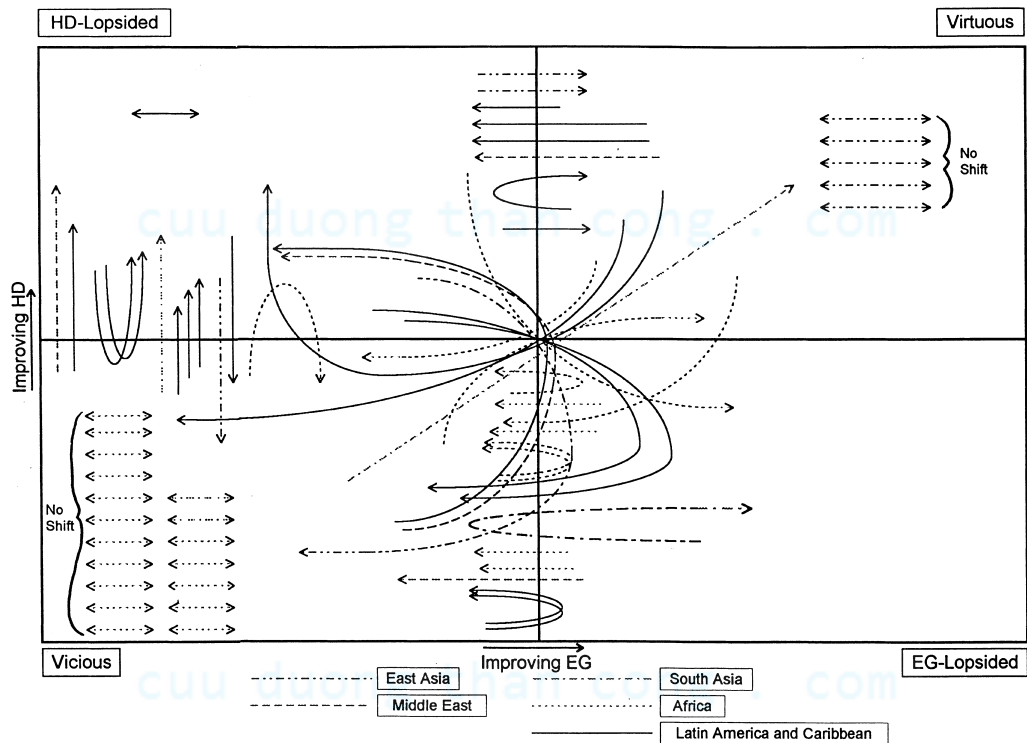


Figure 3. Country HD-EG quadrant changes over three decades. Note: The country movements indicate the quadrants in which countries are placed over the three decades but not their actual location relative to the axes.

cycle category. Kenya, which moved from vicious to virtuous in the 1970s, also subsequently fell back to vicious. Only two countries managed to move from the vicious to virtuous category on a sustained basis—i.e. Sri Lanka and Botswana.

—Of the eight countries which were EG-lopsided in 1960–70, none stayed in that category throughout, but all moved into the vicious category. One—Pakistan—reverted to EG-lopsided in the 1980s. Brazil and Egypt enjoyed relatively fast growth during

the 1960s and 1970s (over 3% in the 1960s and about 6% in the 1970s) but did not utilize this opportunity to improve the levels of HD substantially. In the case of Brazil the highly unequal income distribution (with a Gini of 0.634, one of the worst in the world) was one reason why growth did not translate into HD improvements. In both Pakistan and Egypt, public expenditure on health and education was low, partly due to heavy expenditure on the military, while Pakistan's HD performance suffered especially from discrimination against females.

—Of the 13 HD-lopsided countries in the 1960s, only Costa Rica stayed in that category throughout: four moved into a virtuous cycle—Chile, China, Colombia and Indonesia (Colombia later falling back to HD-lopsided). In these cases, early progress in human development meant that they were able to take advantage of policy reforms for generating growth. Egalitarian income distribution also assisted the movement toward a virtuous cycle. Four moved initially from HD-lopsided into the vicious category (Venezuela, Myanmar, Peru, and El Salvador⁶⁰—the latter two moving back into HD-lopsidedness in the 1980s).⁶¹ Three—Dominican Republic, Guatemala and the Philippines—initially moved to EG-lopsided and subsequently fell back into the vicious category. Among the reasons for the failure to move into high economic growth were the debt situation, poor economic policies and internal disturbances. Consequently, they were unable to maintain the rate of progress in HD because of slow economic growth.

—Thirteen countries were in the virtuous cycle category in the 1960s; five retained this position throughout; and five fell back to the HD-lopsided and three to the vicious category.⁶² Mostly, the countries that fell back were subject to the depressing effects of the 1980s debt crisis on economic growth.

It is important to note that lopsidedness was a temporary condition in all cases except Costa Rica.⁶³ Our most significant finding is that, while HD-lopsidedness permitted movement towards a virtuous cycle (occurring in about a third of the cases), *in the case of EG-lopsidedness, all the cases reverted to a vicious cycle*. Very few countries managed to go directly from vicious to virtuous; but some succeeded in moving to HD-lopsided, from where it was possible to move into the virtuous category.

Our analysis suggests that it is not possible to move to virtuous via EG-lopsidedness, as this proved a dead end.

Hence the process we need to examine more closely is that leading to a movement from vicious to HD-lopsided, from HD-lopsided to virtuous, or the very unusual case, undoubtedly difficult, of taking the direct route from vicious to virtuous.

Our earlier review of the links in the two chains suggests that to move from vicious to HD-lopsided one needs to strengthen the links in Chain A, which may be achieved by adopting some of the following policies:

- those leading to a shift in resource allocation toward education and health services, especially those serving the majority of the people, as apparently occurred in Argentina with enhanced decentralization.

- those generating a more equitable income distribution (for example, through land and tax reform or a move toward a more employment-intensive pattern of output). Algeria is an example, with land reform in the 1960s and some large-scale employment programs in the 1970s.⁶⁴

- those providing extensive opportunities for the unemployed, for example Bolivia's Social Fund in the 1980s, which received substantial support from donors.

Movement from the HD-lopsided to the virtuous category requires strengthening the links in Chain B by, for example:

- taking advantage of an improved HD to promote economic growth through policy reform;

- increasing the investment rate, possibly assisted from the outside;

- improving the distribution of income.

Chile is an example where strong economic reforms, combined with a high level of HD, accounted for improved economic growth. Relatively good income distribution in China, along with policy reform and very high investment rates, led to accelerated economic growth. In Indonesia, a similar process was heavily supported by external capital flows.

We do not wish to argue here that any particular set of policies would achieve a particular movement across categories; rather we want to emphasize an important conclusion about the sequencing of policy change, i.e. that HD must be strengthened *before* a virtuous cycle can be attained. Policy reforms which focus only on economic growth are unlikely to succeed. Countries in a virtuous cycle category

may well slip back into HD-lopsidedness, if, for some reason, growth slows down, but as long as HD stays high such cases have a good chance of resuming their virtuous cycle pattern.

Whenever either or both chains appear to be weak, leading to lop-sided or vicious cycles, it is important to identify where the weak links are and what the appropriate policies might be to strengthen such links. These policies must, moreover, be viewed in an evolutionary context. Even countries initially successful in both HD and EG will need to change their policies as development proceeds in order to sustain their success. In an early phase, for example, priority should be given to primary education and some comprehensive health interventions, both from the perspective of improving HD and that of increasing economic growth. At a later stage, the roles of science and technology institutions and higher education become more important for strengthening Chain B, while, along Chain A, hospitals assume a greater role than before.

In summary, we have demonstrated the existence of an iterative process between the ultimate objective—improvements in HD—and economic growth as a necessary but not sufficient condition for achieving such improvements. Moreover, by investigating the relative importance of various links connecting HD and EG we have identified the direction policy might take to strengthen such links. One important conclusion concerns the desirable phasing of policy change. Economic and social policy has tended to focus priority on getting the economic fundamentals “right” as a necessary precondition for economic growth, while arguing that HD improvement must await such economic growth. Our findings do not deny the importance of economic reforms, but emphasize that a focus on HD must be included from the beginning of any reform program. Economic growth itself will not be sustained unless preceded or accompanied by improvements in HD.

NOTES

1. See especially the UNDP's *Human Development Reports*, starting in 1990.
2. See, e.g., Sen (1984); Streeten, Burki, ul Haq, Hicks and Stewart (1981); Fei, Ranis and Stewart (1985).
3. The first UNDP *Human Development Report* stated that: “The basic objective of development is to create an enabling environment for people to enjoy long, healthy and creative lives” (UNDP, 1990, p. 9), and defined human development as “a process of enlarging people's choices” (p. 10).
4. One notable exception is Adelman and Morris (1973) who argued that educational investment should be given sequencing priority.
5. E.g. Fields (1989); Deininger and Squire (1996).
6. Bruno, Ravallion and Squire (1995), for example, in a study of 20 developing countries, show that a 10% increase in average income per capita, 1984–93, was associated with a 20% fall in the proportion of people living on less than \$1 a day. See also Ravallion and Datt (1991).
7. Lipton (1977); Ranis (1979); Stewart (1977); Lipton and Ravallion (1995).
8. Strauss and Thomas (1995). Of 38 studies in different countries one-third indicate that at least one-half of additional income is spent in this way. See also Bouis and Haddad (1992).
9. E.g., Alderman, Behrman, Khan, Ross and Sabot (1995, 1996a); Behrman and Wolfe (1987a,b); Birdsall (1985); Deolalikar (1993); King and Lillard (1987).
10. Williamson (1993).
11. Birdsall, Ross and Sabot (1995).
12. Blau (1986); Harbert and Scandizzo (1982); Thomas, Strauss and Hanriques (1990, 1991); Thomas, Lavy and Strauss (1992).
13. Gertler, Locay and Sanderson (1987).
14. von Braun (1988).
15. Garcia (1990).
16. Hoddinott and Haddad (1991).
17. See UNDP (1991).
18. See UNDP (1991) Chapter 3, and UNDP (1996) Chapter 3.

19. Decentralization of publicly provided services recently has been introduced in a wide range of countries. Tentative conclusions about their effectiveness are mixed, with apparent relative success in promoting efficiency and contributing to HD in Indonesia, Malaysia, Chile and Karnataka in India, but less so in Argentina, Bangladesh and Brazil. Mostly, local governments have been severely constrained in their ability to raise taxes as well as in the freedom of allocative decision-making, and full democratic devolution has been rare. See Behrman (1995b); Prud'homme (1995); Klugman (1995); Ranis and Stewart (1994); Tanzi (1995).
20. UNDP (1996, p. 71). These calculations adopt a narrow definition of social priority expenditure, including pre-primary and first-level education plus primary health care only.
21. Riddell, Robinson deConinck, Muir and White (1995).
22. See, e.g., the review by Strauss and Thomas (1995).
23. See e.g., Rosenzweig and Schultz (1982); Wolfe and Behrman (1987); Barrera (1990).
24. Thomas (1990).
25. Lavy, Strauss, Thomas, deVreyer (1995).
26. A term used broadly to describe civil society networks—see Coleman (1988); North (1990) and Helliwell and Putnam (1995) for the development of the concept and some empirical evidence. Tendler and Freedheim (1994) provide evidence.
27. This clearly does not detract from the intrinsic value of improving the lives of the unemployable, who may account for a significant proportion of the population.
28. See surveys in Behrman (1990a,b,c, 1995a); Behrman and Deolalikar (1988); King and Hill (1993); King and Bellew (1988); Psacharopoulos (1994); Schultz (1988, 1993a,b); Strauss and Thomas (1995).
29. Following the work of Psacharopoulos, the conclusion that the returns to education are highest for primary education has become part of the accepted wisdom; but in fact this is by no means always the case—see, e.g., Schultz (1993a,b). However, since secondary education necessarily requires prior attendance at primary school, the usual measures of returns to primary education which do not allow for this may understate the total returns.
30. Boissiere, Knight and Sabot (1985); Alderman, Behrman, Khan, Ross and Sabot (1996b).
31. Schultz (1975); Welch (1970); Rosenzweig (1995); Foster and Rosenzweig (1994); Behrman, Rosenzweig and Vashishtha (1995).
32. Birdsall (1993).
33. Jamison and Mook (1984). A similar level of education was estimated to increase farm productivity by 10% or more, according to studies in India and Pakistan (Azher, 1991; Butt, 1984; Duraisamy, 1992). Studies in Malaysia, Ghana and Peru show that, on average, an extra year of schooling of a farmer is associated with an annual increase in output of 2–5% (Birdsall, 1993). Examination of the early stages of India's Green Revolution indicates that the benefits from schooling arose more from conferring on farmers the capacity for learning from their own experience or from those of others, rather than from providing them with an initial information advantage (Foster & Rosenzweig, 1995).
34. Deraniyagala (1995).
35. See Behrman and Deolalikar (1987) and surveys in Behrman (1993, 1996).
36. See Cornia and Stewart (1995).
37. Strauss (1986); Immink and Viteri (1981); Wolgemuth, Latham, Hall and Crompton (1982).
38. Behrman and Deolalikar (1989); Behrman and Lavy (1995); Deolalikar (1988); Foster and Rosenzweig (1993); Haddad and Bouis (1991); Pitt, Rosenzweig and Hassan (1990); Sahn and Alderman (1988); Strauss and Thomas (1996).
39. Selowsky and Taylor (1973).
40. Selowsky (1981).
41. Schultz and Tansel (1993).
42. Perotti (1993).
43. See Romer (1990); Grossman and Helpman (1991); Gemmell (1995).

44. E.g., Barro (1991); Barro and Lee (1993, 1994).
45. Wood (1994); Owens and Wood (1995).
46. See Kenen (1965); Keesing (1966); Pack and Westphal (1986); Leamer (1993).
47. E.g. Michaely (1977); Krueger (1978); Ram (1985); Rana (1988); Edwards (1993).
48. Psacharopolous, Morley, Fiszbein, Lee and Wood (1992, p. 48).
49. Bourguignon and Morrisson (1990).
50. Bourguignon (1995).
51. See Birdsall, Ross and Sabot (1995); Jayaraman (1995); Strauss and Thomas (1995); Thomas, Strauss and Henriques (1991); Behrman and Wolfe (1987a).
52. Ainsworth, Beegle and Nyamete (1995).
53. OECD/DAC (1995); World Bank (1995a).
54. Alesina and Rodrik (1994); Alesina and Perotti (1994); Persson and Tabellini (1994); Birdsall *et al.* (1995).
55. Alesina and Rodrik (1994).
56. As incorporated in the Human Development Index—see UNDP (1995). We also tried regressions with changes in adult literacy rates and a combined, equally weighted, measure of the two. The results were similar but the number of observations more limited.
57. HDI* is a modified version of the Human Development Index of UNDP, including only the nonincome components, i.e. educational attainment as measured by a combination of adult literacy (2/3 weight), mean years of schooling (1/3 weight), and longevity as measured by life expectancy at birth.
58. When changes over time were introduced, the dates of the initial level of HD were also changed, so that log life expectancy was for 1962 and HDI* for 1960.
59. One explanation is that there were important specific interventions (notably immunization) that affected HD positively throughout the world in the 1970s and 1980s. In a sense these weakened the links in Chain A by rendering HD improvements more independent of incomes. In Africa, this would translate into a reduced negative impact on HD of falling incomes.
60. Iraq made the same move between the 1960s and 1970s, but data are not available for the later period, when conflict is likely to have damaged both HD and growth.
61. The Philippines moved from HD-lopsided to EG-lopsided and then returned to HD-lopsided in the 1980s.
62. Lesotho moved from virtuous to vicious by way of EG-lopsided.
63. One of the explanations of why Costa Rica was able to sustain HD achievements despite low economic growth resides in its early, strong and sustained commitment to HD, exemplified by abolition of its army in 1948 and its heavy investment (at 10% of GDP) on health and education during 1970–92.
64. El-Ghonemy (1990).

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